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Mathematical model used in substantiating optimal contract

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Abstract. *The theory of optimal contracts refers to the market state, in which the bidders, the participants in the execution of transactions, have a certain number of certain information higher or lower. Normally, anyone who concludes a contract, regardless of its nature and we refer to the business environment, seeks to place himself on an optimal solution, i.e. one that according to the Latin principle "aurea mediocritas" gives him a chance to average, but protects him the realization of a contract subject to many risks. Normally, the conclusion of any contract is based on an interest, which starting from the principle of the free market, based on the ratio between supply and demand, may end up in the situation of concluding one or another of the contracts.*
In the literature the problem of optimal contracts is not so new, only that there is less information and materials published by specialists on this topic. In principle, in the capital market, those operating in the capital market must consider the possibility of concluding a contract on optimal terms.
Nowadays, when we are in the Big Data era, in which databases are enormous, it is essential that companies or agencies that mediate business know very clearly the information that underlies the transaction to be concluded. As always, there is a clear enough difference between the level of information held by one or another of the customers.
In this article we started the theoretical problem in very synthetic terms, because it is known and we tried to substantiate a model that could be the basis for renting optimal contracts. It should be noted that it started from the utility function, in the sense of von Neumann-Morgenstern, as well as the Lagrange function and last but not least from the Kuhn-Tucker multiplier, often used in microeconomic analyzes based on consistent models.
In this article we started from the estimation of the multiplier between two equations to obtain an optimal result. The optimal contract for an agent, best placed, is a solution given by a system of two

equations that lead to Pareto optimality, or if you will to Pareto efficiency. On the other hand, the optimal contract in the situation of asymmetric information for the interested agent is the optimal Pareto or Pareto-optimal. In this situation, in this article we took a numerical case, from whose analysis it is clear how the study should be based in the perspective of substantiating the decisions to conclude an optimal contract.

Finally, the mathematical model is concretely formulated, imposing some participation restrictions or compatibility restrictions that must always be taken into account by the one who enters the market and wants to conclude an optimal contract. It follows that the model can be simplified, in order to remove some restrictions or to establish that some of them can be satisfied by using the Kuhn-Tucker multiplier. Thus, if a second agent or another market participant signs the contract, he assumes some risks. There are a lot of solutions in the market study, however, and then it must be borne in mind that these contracts are satisfactory if we take into account the conditions of the mathematical model we talked about.

In this article we started from the theoretical elements, analyzing them in the mathematical-economic sense, in order to reach the relationship that the conditions for concluding an optimal contract imply.

Keywords: optimal contract, models, functions, multiplier, agents, capital market.

JEL Classification: C02, E22, G11.

Introduction

In this article, the authors started from the essence offered by the free market, in the sense that any transaction must be based on a certain substrate of anticipated efficiency of profitability for the one who enters into this contract. Discussing these market elements, we followed starting from the Kuhn-Tucker method of nonlinear optimization, as well as from the von Neumann-Morgenstern utility function and we arrived through the mathematical logic at establishing an optimal contract.

In the article on the λ multiplier we issued some opinions, materialized in proven sentences, which lead to the fact that this optimal contract in a symmetric information situation for an agent is of the Pareto-optimal type. From here we developed the mathematical model, represented and graphically to be more suggestive, so as to reach a precise relationship that is based on how the market should be studied, using the proposed mathematical model.

We also took two numerical examples that we introduced and subjected to calculations and analyzes, examples that give the possibility to establish that the model used has certain limits and through the demonstration we provided those interested the opportunity to use it when they want to substantiate an optimal contract. Of course, the topic is very broad, but we tried to synthesize it as much as possible, so that mathematical relationships, deriving from each other based on certain logical criteria, lead us to the end of an efficient and usable mathematical model. Of course, this mathematical model can be used not only in negotiating and concluding optimal contracts, but also to establish optimal correlations and proportions at the macroeconomic level. It is simple to just replace the terms of this model with the ones we are interested in and the results will be satisfactory. We also mention this in the sense that a macroeconomic forecast must always be based on macroeconomic correlations and proportions that ensure macrostability and in this way the plans of measures or strategies of national economic development are in close accordance with the realities that may materialize at some point.

In the article, we have carefully tried to ensure that the notations used are compliant, consistent and easily identified through subsequent transformations based on the offer that the literature makes available to those interested.

The article also used some graphical representations precisely to solve and give logical meaning to the interpretation of the successive stages and led to the substantiation of this mathematical model that can be used mainly in optimal contracts.

Literature review

Anghelache Constantin, Anghel Mădălina Gabriela (2018, 2019), they address in their works various problems related to economic modeling and statistical-econometric analyzes applied to various economic phenomena. Anghelache Constantin (2009), addresses some methods and models for measuring financial-banking risks. Also, Anghelache Constantin (2019) presents in his paper some considerations on the effect of financial-monetary measures on the business environment. Cotfas Mihai, Andrei Anca, Roman Mihai, Marin Dumitru, Stancu Stelian, Patrașcu Nicolae (1995) addresses in their work problems related

to the theory of general equilibrium. Marin Dumitru, Galupa Angela (2001), addresses theoretical issues related to externalities and public goods. Marin Dumitru, Manole Sorin, Turmacu Mihaela (2004) are concerned with the applicability of mathematics in economics. Marin Dumitru, Emanuel Lazăr, Pătrașcu Neculai (1998), addresses the theoretical aspects of capital market contracts. Marinescu Daniela, Marin Dumitru (2011a) addresses the analysis of certain economic phenomena at the microeconomic level. Marinescu Daniela, Marin Dumitru (2011b) analyzes an adverse selection model with three states of nature, in which both the director and the agent are risk neutral.

Methodologies, data, results and discussions

Adverse selection patterns occur when one of the two participants in *the principal-agent* model, namely *the principal (the decision-maker)*, has less information than the *agent*. In other words, the principal does not know the type of *agent*.

A trader does not know how big the buyer's budget is or an insurance company (as a decision maker) does not know how carefully the one who wants to insure drives, etc.

In [1] it is shown that the optimal for the principal (the one proposing the contract) is to propose a menu of contracts one for each type of agent and to build the model in such a way that each *agent* chooses his intended contract.

We will first analyze the case with two types of agents and how the reward changes in relation to the type of *agent*, in a situation of symmetrical information. If an agent chooses the action which from a lot of given shares we will assume that the gross profit of *the principal* is *P(a),* where $P'(a) > 0$ and $P''(a) < 0$.

Then the net profit is:

$$P(a) - s, \tag{1}$$

where *s* is represented the salary (reward) or transfer of the principal to the *agent.*

We assume that the principal recognizes the two types of agents denoted 1 and 2 as it is better placed or not.

The difference between the two agents is materialized depending on the utility. For the first *agent* the utility function is:

$$U(s^1, a^1) = U(s^1) - V(a^1) \tag{2}$$

where $U(\cdot)$ represents the utility function in the von Neumann-Morgenstern sense (in relation to gain s^1);

$V(a^1)$ represents the cost function of the effort following the agent's decision to choose the action $\hat{a}$.

In general the function $U(\cdot)$ has the properties: $U'(\cdot) > 0$ and $U''(\cdot) \leq 0$ (that is, the agent is either risk aversion or risk neutral). The cost function of the effort $V(\cdot)$ has the usual properties namely: $V'(\cdot) > 0$ and $V''(\cdot) \geq 0$.

The greater the effort, the greater the optimality of the agent. The optimal contract for the type 1 agent is determined by solving the nonlinear optimization program (using the Kuhn-Tucker method).

$$\underset{a^1,s^1}{\text{Max}}[P(a^1) - s^1] \tag{3}$$

s.r. $U(s^1) - V(a^1) \geq \underline{U}$ (the condition of participation in the contract)

$s^1 \geq 0, a^1 \geq 0$

where $\underline{U}$ is the minimum market threshold reserved for Agent 1.

The associated Lagrange function is:

$$L(s^1, a^1, \lambda) = P(a^1) - s^1 + \lambda[U(s^1) - V(a^1) - \underline{U}] \tag{4}$$

where $\lambda \geq 0$ is the Kuhn-Tucker multiplier.

The first order conditions that are both necessary and sufficient (given the properties of the *U* and *V*) become:

$$\frac{\partial L}{\partial s^1} \leq 0,\ s^1 \geq 0 \text{ and } s^1 \cdot \frac{\partial L}{\partial s^1} = 0 \tag{5}$$

$$\frac{\partial L}{\partial a^1} \leq 0,\ a^1 \geq 0 \text{ and } a^1 \cdot \frac{\partial L}{\partial a^1} = 0 \tag{6}$$

$$\frac{\partial L}{\partial \lambda} \leq 0,\ \lambda \geq 0 \text{ and } \lambda \cdot \frac{\partial L}{\partial \lambda} = 0 \tag{7}$$

or rewritten:

$$-1 + \lambda U'(s^1) \leq 0, s^1 \geq 0 \text{ şi } s^1[-1 + \lambda U'(s^1)] = 0 \tag{8}$$

$$P'(a^1) + \lambda V'(a^1) \leq 0, a^1 \geq 0 \text{ şi } a[P'(a^1) + \lambda V'(a^1)] = 0 \tag{9}$$

It follows from relation (5) that $\lambda > 0$, otherwise $P'(a^1) \leq 0$ contrary to the assumption of the function of profit.

Then the group of relations (3) is equivalent to $\frac{\partial L}{\partial \lambda} = 0$, well:

$$U(s^1) - V(a^1) - \underline{U} = 0 \text{ sau } U(s^1) - V(a^1) = \underline{U} \tag{10}$$

that is, the participation restriction is saturated. If the agent accepts the contract, he receives exactly the minimum threshold reserved by the market as a utility level.

It follows from relation (6) $s^1 > 0$, and from (4) we have the equation $-1 + \lambda U'(s^1) = 0$, and from (5) $P'(a^1) + \lambda V'(a^1) = 0$

We eliminate the multiplier λ between the last two equations and obtain the following result:

Proposition 1: The optimal contract for agent 1 (better placed) is the solution of the system given by the following two equations:

$$\begin{cases} P'(a^1) = \frac{V'(a^1)}{U'(s^1)} \\ U(s^1) - V(a^1) = \underline{U} \end{cases} \quad (11)$$

The first equation characterizes the Pareto optimality (efficiency) of the contract, i.e. the gross marginal profit equals the marginal rate of substitution of the reward by the level of action (the level of effort made).

The second equation shows the maximum level of satisfaction obtained by the *agent*.

For the second type of *agent*, the satisfaction function is given by the relationship:

$$U(s^2) - (k + f(\varepsilon))V(a^2) \geq \underline{U} \quad (12)$$

where it is fixed $k > 1$, and $f(\varepsilon)$ is a strictly ascending function with $f(0) = 0$,

and so$f(\varepsilon) \in (1 - k, \infty)$.

We also assume that $f(\cdot)$it is derivable, therefore $f'(\varepsilon) > 0$

The mathematical model, in this case, is written:

$$\underset{a^2, s^2}{\text{Max}}[P(a^2) - s^2]$$

$$\text{s.r. } U(s^2) - [k + f(\varepsilon)]V(a^2) \geq \underline{U}, \;\; s^2 \geq 0, \;\; a^2 \geq 0 \quad (13)$$

Applying the Kuhn-Tucker method again, we obtain the following system:

$$\begin{cases} P'(s^2) = \frac{[k+f(\varepsilon)]V(a^2)}{U'(s^2)} \\ U'(s^2) - [k + f(\varepsilon)]V(a^2) = \underline{U} \end{cases} \quad (14)$$

Coefficient $k + f(\varepsilon)$ fneedles the difference between the two types of agents namely: at the same level of action *a*, the usefulness of agent 2 is greater than that of agent 1.

From the second equation we get the reward $\tilde{s}^2$ for a level of effort $\tilde{a}^2$, according to the relationship:

$$\tilde{s}^2 = U^{-1}\{[k + f(\varepsilon)]V(\tilde{a}^2) + \underline{U}\} \quad (15)$$

Proposition 2: The optimal contract in symmetric information situation for the type 2 agent is PARETO-optimal.

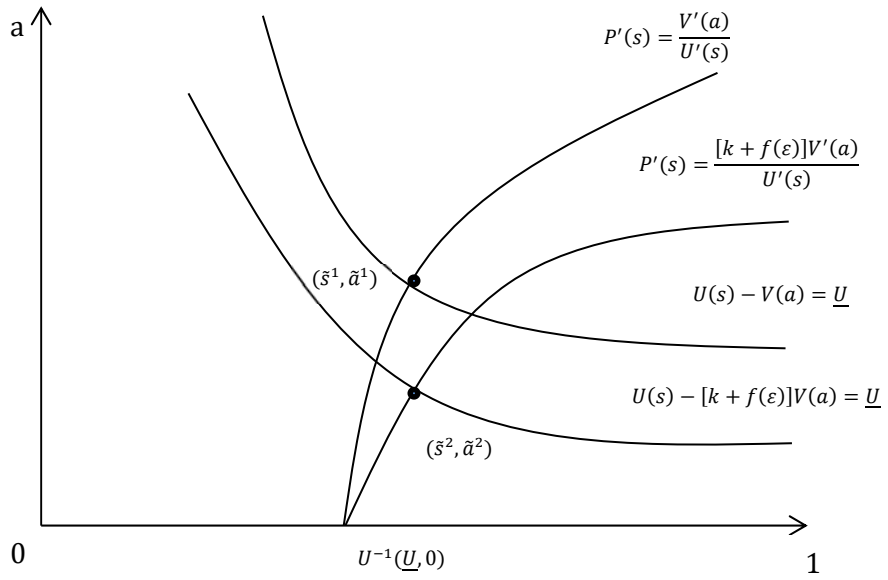
The reward depends on the parameter ε and is given by the formula:

$$\frac{\partial s^1}{\partial \varepsilon} = U^{-1}\{[k + f(\varepsilon)]V(\tilde{a}^2) + \underline{U}\} \quad (16)$$

It turns out that as the difference between the two types increases and the reward for the better placed type increases.

A graphical analysis of the two contracts will allow us to compare the two levels of action $\tilde{a}^1$ and $\tilde{a}^2$, such as rank I rewards.

Graph 1. *Evolution of the two contracts*



Curves $U(s) - V(a) = \underline{U}$ and $P'(s) = \frac{V'(a)}{U'(s)}$ characterizes the optimal contract for the type 1 agent, and the equilibrium point is $(\tilde{s}^1, \tilde{a}^1)$.

For type 2 agent, i.e. curves $P'(s) = \frac{[k+f(\varepsilon)]V'(a)}{U'(s)}$ and $U(s) - [k + f(\varepsilon)]V(a) = \underline{U}$, the optimal contract is on point $(\tilde{s}^2, \tilde{a}^2)$.

Is it necessary to justify the position of the four curves?

The graph shows that $\tilde{s}^1 > \tilde{s}^2$, in other words, the better placed agent will be required to make a greater effort.

Regarding the rewards, nothing can be said about the relationship between them. There are two effects, namely: the type 1 agent, exerting a greater effort, the principal will transfer a larger amount. On the other hand, the type 2 agent, due to the coefficient $k + f(\varepsilon) > 1$, it will have a higher cost-effectiveness (disuse) function and will consequently claim a higher reward.

The composition of the two opposite effects will also result in the relationship (inequality) between the two rewards. The higher the parameter ε, the further away from the type 2 agent.

Particular case:

Whether $(a) = 600a$, $U(s) = \sqrt{s}$ and $V(a) = a^2$, and $f(\varepsilon) = 10 \cdot \varepsilon + 1$. We assume that $\underline{U} = 0$ and $k = 2$. For agent 1, the optimal contract results from solving the system:

$$\begin{cases} P'(a) = \frac{V'(a)}{U'(s)} \\ U(s) - V(a) = \underline{U} \end{cases}, \text{ so } 600 = \frac{2a}{\frac{1}{2\sqrt{s}}} => 600 = 4a\sqrt{s}$$

The second equation becomes $\sqrt{s} = a^2$ and so $600 = 4a^3 => a^3 = 125$, $\tilde{a}^1 = 5$

Then $\tilde{s}^1 = 625$

For agent 2, we get:

$$\begin{cases} 600 = \frac{(3+\varepsilon)\cdot 2a}{\frac{1}{2\sqrt{s}}} \\ \sqrt{s} - (3+\varepsilon)\cdot a^2 = 0 \end{cases} \text{ or } \begin{cases} 600 = 4\cdot(3+\varepsilon)\cdot a\sqrt{s} \\ \sqrt{s} = (3+\varepsilon)\cdot a^2 \end{cases} =>$$

$=> 125 = (3+\varepsilon)^2 \cdot a^3$,

where from $\tilde{a}^2 = \frac{5}{\sqrt[3]{(3+\varepsilon)^2}}$,

and $\tilde{s}^2 = (3+\varepsilon)^2 \cdot (\tilde{a}^2)^4 = (3+\varepsilon)^2 \cdot \frac{5}{\sqrt[3]{(3+\varepsilon)^2}} = 5\cdot(3+\varepsilon)^{8/3}$.

It is observed that as ε increases, the second agent (the inefficient one) will be required to exert less effort.

Next we will analyze the P-A model in an asymmetric information situation, respectively if *the principal* does not recognize the type of agent.

We will assume, however, that P believes that A is type 1 (efficient) with a probability *p*. These probabilities can be established on objective basis, possibly using the past experience of economic or subjective agents (Bayesian type). The decision maker will in this case propose two contracts, one for each agent and will build the mathematical model in such a way that each agent chooses his intended contract (if the contract is signed).

The mathematical model will contain the objective function which consists in maximizing the net profit expected for the decision maker and the actual restrictions. These are of two kinds:

- Participation restrictions, one for each agent;
- Incentive compatibility restrictions (with the type of agent), i.e. the restrictions by which each agent is encouraged to choose (if he signs) even his intended contract.

Whether (a^1, s^1) and respectively (a^2, s^2) contracts for the two agents, efficiently and effectively. The difference between the two types of agents is given by the cost function of the effort, namely:

i) for the agent (efficient) 1, $V(a)$ with the usual properties: $V'(a) \geq o$ and $V''(a) \geq 0$;
ii) for the agent (inefficient) 2, $[k + f(\varepsilon)]V(a)$ where *k* is a fixed parameter$k > 1$, and the function $f: [0, \infty) \to (1-k, \infty)$ it is derivable and strictly ascending.

Given the above, the mathematical model is thus formalized:

$$\text{I)} \underset{\substack{(a^1,s^1)\\(a^2,s^2)}}{\text{Max}} \{p[P(a^1) - s^1] + (1-p)[P(a^2) - s^2]\} \quad (17)$$

$$\text{s.r. II)}\ U(s^1) - V(a^1) \geq \underline{U} \quad (18)$$

$$U(s^2) - [k + f(\varepsilon)]V(a^2) \geq \underline{U} \quad (19)$$

$$U(s^1) - V(a^1) \geq U(s^2) - V(a^2) \quad (20)$$

$$U(s^2) - [k + f(\varepsilon)]V(a^2) \geq U(s^1) - [k + f(\varepsilon)]V(a^1) \quad (21)$$

III) a^1, s^1, a^2, s^2 positive

Restrictions (18) and (19) are participation restrictions, and (20) and (21) are incentive compatibility restrictions by which agents are motivated to choose their intended contract.

The model can be simplified in order to remove some restrictions or to establish that some restrictions (in case of admissible solutions) can be satisfied or not with implications on the values of Kuhn-Tucker multipliers.

Proposition 1: If restrictions (19) and (20) are verified, then restriction (18) is also verified.

Demonstration: In other words, if the second agent, the worst placed, signs the contract, the more agent 1 signs the contract.

Indeed from (20) and taking into account the range of values of the function $f(\varepsilon)$, get:

$U(s^1) - V(a^1) \geq U(s^2) - V(a^2) \geq U(s^2) - [k + f(\varepsilon)]V(a^2) \geq \underline{U}$

So $U(s^1) - V(a^1) \geq \underline{U}$, that is, the constraint (18) is redundant and can be omitted.

Proposition 2: If the set of admissible solutions is empty, then $a^1 \geq a^2$

Demonstration: Indeed, assuming that there is at least one pair of contracts (a^1, s^1), (a^2, s^2), one for each participant and adding the restrictions (20) and (21), get:

$-V(a^1) - [k + f(\varepsilon)]V(a^2) \geq -V(a^2) - [k + f(\varepsilon)]V(a^1)$

(after a convenient reduction in the useful life of the reward)

We group and we get:

$$[V(a^1) - V(a^2)][1 - k - f(\varepsilon)] \leq 0 \quad (22)$$

How $f(\varepsilon) > 1 - k$, results from (22), $V(a^1) - V(a^2) \geq 0$,and from the monotony of function $V(\cdot)$, $a^1 \geq a^2$ the condition of enforceability of the contract requires that the better placed (efficient) agent be required to submit a higher level of action.

We will solve the problem using the Kuhn-Tucker method and consequently rewrite the remaining constraints, respectively (19), (20) and (21) after removing the constraint (18), and the Kuhn-Tucker multipliers $\lambda_1, \lambda_2, \lambda_3$ they are positive.

The Lagrange function is written:

$$L(a^1, s^1, a^2, s^2, \lambda_1, \lambda_2, \lambda_3) = p[P(a^1) - s^1] + (1 - p)[P(a^2) - s^2] +$$

$$+ \lambda_1\{U(s^2) - [k + f(\varepsilon)]V(a^2) - \underline{U}\} + \lambda_2[U(s^1) - V(a^1) - U(s^2) + V(a^2)] +$$

$$+\lambda_3\{U(s^2) - [k + f(\varepsilon)]V(a^2) - U(s^1) - [k + f(\varepsilon)]V(a^1)\} \quad (23)$$

We will analyze, without restricting the generality of the problem, an optimal interior (with all the strictly positive components).

Then from the relationship group $\frac{\partial L}{\partial x} \leq 0,\ x \geq 0$ and $x \cdot \frac{\partial L}{\partial x} = 0$, where $x \in \{a^1, s^1, a^2, s^2\}$ we get, if $x > 0, \frac{\partial L}{\partial x} = 0$. For $x = a^1$ results $\frac{\partial L}{\partial a^1} = 0$, where from:

$$pP'(a^1) - \lambda_2 V'(a^1) + \lambda_3[k + f(\varepsilon)]V'(a^1) = 0$$

or

$$\frac{pP'(a^1)}{V'(a^1)} = \lambda_2 - \lambda_3[k + f(\varepsilon)]. \quad (24)$$

Analogous to the other variables:

$\frac{\partial L}{\partial s^1} = 0, \text{deci} - p + \lambda_2 U'(s^1) - \lambda_3 U'(s^1) = 0$, so:

$$\frac{p}{U'(s^1)} = \lambda_2 - \lambda_3 \quad (25)$$

$\frac{\partial L}{\partial a^2} = 0, (1-p)P'(a^2) - \lambda_1[k + f(\varepsilon)]V'(a^2) + \lambda_2 V'(a^2) - \lambda_3[k + f(\varepsilon)]V'(a^2) = 0$
where from:

$$(1-p)\frac{P'(a^2)}{V'(a^2)} = \lambda_1[k + f(\varepsilon)] - \lambda_2 + \lambda_3[k + f(\varepsilon)] \quad (26)$$

$$\frac{\partial L}{\partial s^2} = 0, -(1-p) + \lambda_1 U'(s^2) - \lambda_2 U'(s^2) + \lambda_3 U'(s^2) = 0$$

$$\frac{(1-p)}{U'(s^2)} = \lambda_1 - \lambda_2 + \lambda_3. \quad (27)$$

From relations (24) and (26), respectively (25) and (27) by assembly we obtain:

$$\frac{pP'(a^1)}{V'(a^1)} + (1-p)\frac{P'(a^2)}{V'(a^2)} = \lambda_1[k + f(\varepsilon)] \quad (28)$$

and

$$\frac{p}{U'(s^1)} + \frac{1-p}{U'(s^2)} = \lambda_1. \quad (29)$$

From both relations it follows that the multiplier λ_1 it is strictly positive.

From the first-order Kuhn-Tucker conditions it follows that $\frac{\partial L}{\partial \lambda_1} = 0$, well:

$$U(s^2) - [k + f(\varepsilon)]V(a^2) - \underline{U} = 0$$

At the optimum point, agent 2 obtains exactly the minimum threshold reserved by the market, i.e.:

$$U(s^2) - [k + f(\varepsilon)]V(a^2) = \underline{U} \quad (30)$$

The higher the parameter ε, the greater the difference between the two types and at the same time the inefficiency of the inefficient agent.

Analyzing equation (25) and taking into account the property of the function $U(\cdot)$ it turns out that $\lambda_2 > 0$ and $\frac{\partial L}{\partial \lambda_2} = 0$, well:

$$U(s^1) - V(a^1) = U(s^2) - V(a^2) \quad (31)$$

By processing this equation we obtain the second characteristic of the contract:

$$U(s^1) - V(a^1) = U(s^2) - [k + f(\varepsilon)]V(a^2) + [k + f(\varepsilon)]V(a^2) - V(a^2) =$$

$$= \underline{U} + [k - 1 + f(\varepsilon)]V(a^2) \quad (32)$$

The term $[k - 1 + f(\varepsilon)]V(a^2)$, also called conformational rent, it represents the utility increase obtained by agent 1 due to the fact that it is better placed.

I showed above that $a^1 \geq a^2$ (Proposition 2)

Proposition 3: At the optimum point $a^1 > a^2$

Demonstration: We assume the opposite, namely that $a^1 = a^2 = a$. Then it follows from the equality (31) that and $s^1 = s^2 = s$. Relationships (24), (25), (26) and (27) become:

$$\frac{pP'(a)}{V'(a)} = \lambda_2 - \lambda_3[k + f(\varepsilon)]$$

$$\frac{(1-p)P'(a)}{V'(a)} = \lambda_1[k + f(\varepsilon)] - \lambda_2 + \lambda_3[k + f(\varepsilon)] \quad (33)$$

and

$$\frac{p}{U'(s)} = \lambda_2 - \lambda_3$$

$$\frac{1-p}{U'(s)} = \lambda_1 - \lambda_2 + \lambda_3 \quad (34)$$

Eliminating multipliers λ_2 and λ_3 it turns out that $\lambda_2 = 0$, in contradiction with (25). So $a^1 > a^2$. Using this inequality and the restrictions (10) and (11) we obtain $\lambda_3 = 0$. Then from (24) and (25) we obtain the third characteristic of the optimal contract, namely:

$$P'(a^1) = \frac{V'(a^1)}{U'(s^1)} \quad (35)$$

The optimal contract for agent 1 is also Pareto-optimal.

Application

Either the particular case where $P(a) = 10a,\ p = \frac{1}{2},\ U(s) = s,\ V(a) = (a)^2,\ \underline{U} = 0,$ $k = 2$ and $f(\varepsilon) = 4\varepsilon + 1,\ \varepsilon > -\frac{1}{2}$.

The optimal contract is determined as a solution of the nonlinear optimization program:

$$\underset{\substack{s^1,a^1 \\ s^2,a^2}}{\text{Max}} \left[\frac{1}{2}(10a^1 - s^1) + \frac{1}{2}(10a^2 - s^2)\right]$$

s.r. $s^1 - (a^1)^2 \geq 0$

$s^2 - (3+4\varepsilon)(a^2)^2 \geq 0$

$s^1 - (a^1)^2 \geq s^2 - (a^2)^2$

$s^2 - (3+4\varepsilon)(a^2)^2 \geq s^1 - (3+4\varepsilon)(a^1)^2$

$s^1 \geq 0, a^1 \geq 0, s^2 \geq 0, a^2 \geq 0$

We note with: $R^1 = s^1 - (a^1)^2$ şi $R^2 = s^2 - (3+4\varepsilon)(a^2)^2$

Then the mathematical model becomes:

$$\underset{\substack{R^1,a^1\\R^2,a^2}}{Max}\left\{\frac{1}{2}[(10a^1 - (a^1)^2] + \frac{1}{2}[10a^2 - (3+4\varepsilon)(a^2)^2] + \left[\frac{1}{2}R^1 + \frac{1}{2}R^2\right]\right\}$$

The first two restrictions are reduced to sign conditions $R^1 \geq 0,\ R^2 \geq 0$, and the last two restrictions become:

$R^1 \geq R^2 + 2(1+2\varepsilon)(a^2)^2$

and

$R^2 \geq R^1 - 2(1+2\varepsilon)(a^2)^2$

It is known that at the optimum point $R^1 = R^2 + 2(1+2\varepsilon)(a^2)^2$, and $R^2 = 0$.

The problem comes down to optimizing a function of two variables, namely:

$$\underset{a^1,a^2}{Max}\, F(a^1, a^2)$$

where: $F(a^1, a^2) = \frac{1}{2}[(10a^1 - (a^1)^2] + \frac{1}{2}[10a^2 - (3+4\varepsilon)(a^2)^2] - (1+2\varepsilon)(a^2)^2$

The first order conditions are:

$\frac{\partial L}{\partial a^1} = 0 => 10 - 2a^1 = 0, \text{where from } \tilde{a}^1 = 5$

$\frac{\partial L}{\partial a^2} = 0 => \frac{1}{2}[10 - 2(3+4\varepsilon)a^2] - 2(1+2\varepsilon)a^2 = 0 => 5 - (3+4\varepsilon)a^2 - 2(1+2\varepsilon)a^2 = 0, \text{where from } \tilde{a}^2 = \frac{5}{5+8\varepsilon}$

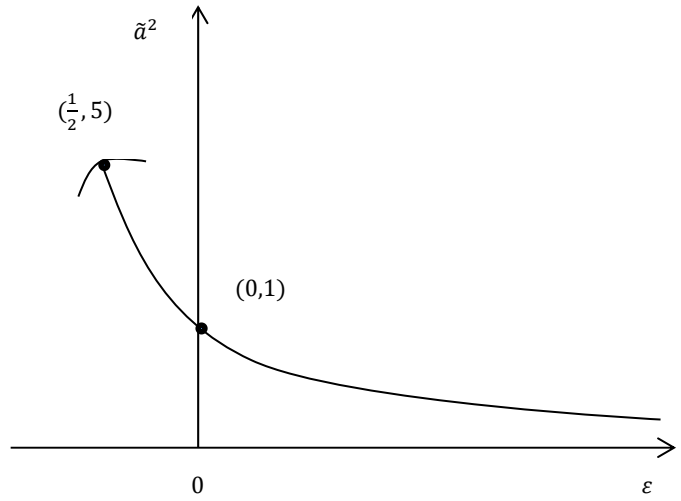
The optimal contract is written:

$\tilde{a}^1 = 5,\ \tilde{s}^1 = 25 + \frac{50(1+2\varepsilon)}{(5+8\varepsilon)^2}$

$\tilde{a}^2 = \frac{5}{5+8\varepsilon},\ \tilde{s}^2 = \frac{25(3+4\varepsilon)}{(5+8\varepsilon)^2}.$

It is observed that for agent 1, the contract is Pareto-optimal. For the second agent the effort level decreases with increasing parameter ε.

Graph 2. *Optimal contract*



The analysis can be extended to salaries, profit and information income.

Conclusions

The study of the literature, primarily mathematical and economic, on which this article is based leads to some theoretical and practical conclusions. Thus, first of all, these contracts, which are concluded in the free market, must offer the participant at least optimal, if not high, efficiency.

The free market offers different options and those who intend to achieve optimal contracts must rely on a number of information. This is a second conclusion that an optimal contract can only be realized on the basis of market dominance and in this sense the relevant information that gives meaning to the contractual transaction that is performed.

The study considered two entities (economic agents) that had a different volume of information. Starting from the grounded theories of Kuhn-Tucker, von Neumann-Morgenstern and the Pareto model, we went step by step to substantiate a tested mathematical model, which would ensure the realization of contracts in optimal conditions.

Another conclusion is that in the conditions of Big Data, the era we are currently going through, there is a huge volume of information, which can be used but with discernment to substantiate the conditions under which an optimal contract is concluded. At the same time, the Blockchain theory acquires an increasingly important place in the context of Big Data, which responds to the study concerns in order to conclude an optimal contract.

Although the article is very mathematical, it aimed to substantiate and explain the model that the authors propose as one that helps to substantiate and rent optimal contracts.

A final conclusion is that this model can be extended, it can be resistematized, so as to meet all the requirements regarding the substantiation and negotiation of optimal contracts.

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Examining the drivers of business cycle divergence between Euro Area and Romania

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Abstract. *This research aims to provide an explanatory analyses of the business cycles divergence between Euro Area and Romania, respectively its drivers, since the synchronisation of output-gaps is one of the most important topic in the context of a potential EMU accession. According to the estimates, output-gaps synchronisation entered on a downward path in the subperiod 2010-2017, compared to 2002-2009. The paper demonstrates there is a negative relationship between business cycles divergence and three factors (economic structure convergence, wage structure convergence and economic openness), but also a positive relationship between it and its autoregressive term, respectively the GDP per capita convergence.*

Keywords: output-gap, business cycles, divergence, Euro Area, Romania.

JEL Classification: C32, O47, F44, F45, L16.

1. Introduction

One of the fundamental reasons for establishing single currencies is related to the political actions aimed at the depreciation of the national currency, which were frequently used by the national governments to enhance the economic growth rate. However, such a strategy was not beneficial, as it encouraged a similar political reaction from other neighboring countries, leading to a general competitive devaluation on medium and long-run. Euro currency was the response of the European Union to this and other challenges. However, the process of adopting euro is quite difficult and, apart from meeting the nominal convergence criteria set out within the Maastricht Treaty before ERM II accession, and maintaining appropriate economic evolutions in line with these for at least two years (EA accession also needs the support of the ECOFIN Council), it also requires achieving an optimum level of real and structural convergence.

After adopting euro, the Member States lose the independence of the national monetary policy which lowers the number of instruments that the country have at disposal for stimulating economic growth. Following the loss of monetary policy independence, the decision to change the interest rate remains at the discretion of the European Central Bank, depending on the evolution of the euro area economy. In this context, if the euro area economy registers a positive output-gap, while one member of it experiences a recessionary output-gap, the ECB's decision will not be in the benefit of the mentioned country, since raising the interest rate will have a negative effect on this economy (the example remains valid even when the roles are reversed). Therefore, the creation of a common destiny is encouraged by increasing business cycles (output-gaps) convergence. This is also in line with the explanation provided by Mundell (1961) regarding the importance of business cycles synchronisation in ensuring an Optimum Currency Area.

The motivation for choosing this thematic area consists in the important role of the output-gaps convergence with the Euro Area, in the preparation of the euro adoption process. Although business cycles convergence is a major topic of interest for researchers, some results are evasive and do not threat, in a comprehensive manner the full implications of the drivers of the business cycles convergence. In addition, most of the studies provide a general view at European Union/Euro Area level and do not focus on individual cases.

The general objective of this paper is to identify the factors that could enhance/reduce the business cycle convergence/divergence between the Romanian economy and Euro Area and its associated effects, this being achieved by reaching the following specific objectives:

- examining the link between the economic structure convergence and business cycles divergence between Romania and Euro Area;
- identifying the impact of economic openness on the business cycles divergence between Romania and Euro Area;
- examining the link between the wage structure convergence and business cycles divergence between Romania and Euro Area;
- identifying the impact of Romanian GDP per capita convergence towards the Euro Area average on the business cycles divergence between the parts reviewed.

2. Literature review

Business cycles synchronisation concept was first introduced in the economic literature by Burns and Mitchel (1946) who considered this as a proxy for economic activities volatilities – catched by the dynamic of GDP. Following that, many economists focused their attention on studying business cycles convergence/synchronisation determinants at European Union level. However, the results depends on the methodology and data used. Catching business cycles convergence/divergence or synchronisation may be difficult, since this indicator is based on output-gap estimates which are extremely volatile depending on the period used, but there are several studies proposing different methodologies. Business cycles estimates are generally influenced by the detrending methods applied, Hodrick-Prescott (1980), Baxter-King (1995) and Christiano-Fitzgerald (2003) filters being the most ones used. According to Artis and Zhang (1995), the simplest way to calculate the synchronisation of business cycles consists in the GDP detrending, followed by the computation of the bilateral cross-correlations using Spearman correlation coefficient. There are other options too, such as the Pearson correlation on periods and subperiods (Flood and Rose, 2010), but this paper analyses the divergence between business cycles as the absolute differences between these output-gaps, as this approach is more suitable to the objective of the study – taking also into consideration its limits, since even close business cycles can be in different phases.

Frankel and Rose (1998) analysed the endogeneity of the Optimum Currency Area and argued that there is a causal relationship in terms of trade integration and business cycles convergence. According to the theory of endogeneity, the two authors showed that the differences between countries are smaller the higher is the level of integration. Their research highlights a positive reaction of the symmetrical shocks across the Euro Area to increasing economic integration.

Other authors demonstrated the positive influence of increasing trade intensity on business cycle synchronization for industrialised countries (Fatás, 1997; Clark and van Wincoop, 2001; Imbs, 2004; Calderon et al., 2007). The importance of trade in driving business cycles convergence was also confirmed by other authors (Böwer and Guillemineau, 2006; Garcia-Herrero and Ruiz, 2008; Lee, 2010; Dées and Zorell, 2011). However, Marinaș (2006) stated that increasing the degree of economic openness is not enough for a country as Romania and, in this context, great attention should also be paid to the similarity with the Euro Area in terms of the structure of exports. Fidrmuc (2004) investigated the determinants of business cycle synchronisation between Visegrád Group countries (Czech Republic, Poland, Slovakia and Hungary) and found that the parameter of the bilateral trade intensity index changes its value and statistical significance in case of insertion of other variables (there were only one variable that remained significant in all cases – intra-industrial trade).

The statistical significance of both trade and economic specialisation was also confirmed by Trăistaru (2004). Imbs (2004) identified a positive relationship between economic structure convergence and business cycles synchronisation. According to the results of the paper, countries response to shocks may converge if the economic structures of the states are similar. This evidence was also supported by other authors (Calderon et al., 2007; Beck,

2013, Kalemli-Ozcan et al., 2001, Siedschlag, 2010), while other authors (Baxter and Kouparitsas, 2005; Inklaar, Jong-A-Pin and de Haan, 2008) have come to a different conclusion which highlights the ambiguity of this relationship, but the most opinions support a positive relationship between these variables. On the other hand, cyclical similarity has proven to be a function in response to the evolution of other variables, such as: fiscal similarity, membership in the customs union, the absolute difference in the long-term interest rate.

From another point of view, some researchers (Massmann and Mitchell, 2004; Cancelo, 2012; Gogas, 2013) demonstrated that business cycles synchronisation could be driven by the EMU accession, while others did not support this hypothesis (Camacho et al., 2006; Mink et al., 2007). Other studies (Kose et al., 2003; Cerqueira and Martins, 2009) have shown that financial openness is another significant factor.

3. Methodology

This section describes the main econometric tools and methods used to analyse the drivers of business cycles divergence between Romania and Euro Area over the period 2002-2017. In this context, it worth to be mentioned that I have used Eurostat data with quarterly frequency in order to increase the number of observations, implicitly the robustness of the analysis.

The analysis was performed using Eviews 9.0 software, respectively the Least Squares method in time series window. However, having in mind the risk for heteroskedasticity, I opted for a logarithmic transformation for all statistical data used before applying the estimation method on the following equation:

$$\log(OGdiv)_t = \alpha_0 + \beta_0 \log(OGdiv)_{t-1} + \beta_1 \log(ecstructureconv)_t +$$
$$+ \beta_2 \log(openness)_t + \beta_3 \log(wagestructureconv)_t +$$
$$+ \beta_4 log(realgdpcapconv)_t + \varepsilon_t \quad (1)$$

where:

- *OGdiv* represents the business cycle divergence calculated as the absolute difference between the output-gap (the share of the difference between the real and potential GDP expressed in million euros in the potential GDP) registered by Romania and the one of Euro Area. Even if most of the papers use multiple correlations between countries, this approach cannot be used in time-series data when studying the link between business cycles convergence and its determinants as a consequence of the low number of observations. Therefore, I calculated the absolute difference between the cycles as a proxy for the business cycles divergence. First, the estimation of the OG was performed using the seasonally and calendar adjusted data for the real GDP having 2010 as base year. Further, I have applied the Hodrick-Prescott filter for supporting the decomposition of the data into a non-stationary trend and a stationary cyclical component. In order to strengthen the efficiency of the estimation, I set the lambda value to 1600, its role being to counteract the acceleration of the trend relative to the cyclical component of the Gross Domestic Product.

A negative value of the business cycle captures the existence of a recessionary output-gap, while a positive value records an expansionary phase of it. Hodrick-Prescott filter is based on minimising a function that captures the deviations of the Gross Domestic Product from the potential level and the changes of the growth rate of the trend, this being calculated according to the following formula:

$$\mathrm{HP} = \min_{y_t^*}\left\{\sum_{t=1}^{T}(y_t - y_t^*)^2 + \lambda\sum_{t=1}^{T}[(y_t^* - y_{t-1}^*) - (y_{t-1}^* - y_{t-2}^*)]^2\right\} \quad (2)$$

where $(y_t - y_t^*)$ is the business cycle of the Y country and λ represent the lambda coefficient.

However, I have added the autoregressive term, since the variables proved to be stationary at I(0) and I(1) according to the results provided by the Augmented Dickey-Fuller test, its corresponding lag being selected using the Schwarz Information Criterion.

- *ecstructureconv* is the convergence between the economic structure of the Romanian economy and that of the Euro Area, calculated using the methodological guidance provided by Krugman (1993), as follows:

$$ecstructureconv = 1 - \left(\sum_{z=1}^{Z} abs\,(GVA_{RO} - GVA_{EA})\right) \quad (3)$$

where Z represents all number of economic sectors analysed = 11 (z being one of these) and GVA is the share of the Gross Value Added generated by the sector z in the total.

- *openness* is the degree of the economic openness calculated using the following formula:

$$openness = \left(\frac{imports + exports}{GDP}\right) x\ 100 \quad (4)$$

- *wagestructureconv* represents the convergence between the wage structure of the Romanian economy and that of the Euro Area, its calculation being adapted to the Krugman index presented above.

$$wagestructureconv = 1 - \left(\sum_{z=1}^{Z} abs\,(W_{RO} - W_{EA})\right) \quad (5)$$

where W represents the share of the wages provided in the sector z in total wages per economy.

- *realgdpcapconv* is the share of the Romanian real GDP per capita (expressed in euros) in the one registered by the Euro Area. Since the data for this indicator were not available in its seasonally adjusted form, I used the Tramo-Seats tool in order to increase the feasibility of the data by excluding the seasonal influence.

In addition, I have also used Pearson correlation to examine the business cycle synchronisation between Romania and Euro Area by subperiods (pre-crisis period: 2002-2009 and post-crisis period: 2010-2017), as well as throughout the analysed period.

$$Pearson_{(RO,EA)} = \frac{cov(RO, EA)}{\sigma_{RO}\sigma_{EA}} \quad (6)$$

where *cov(RO, EA)* represents the covariance between the cycles of Romania and Euro Area, and σ is the standard deviation.

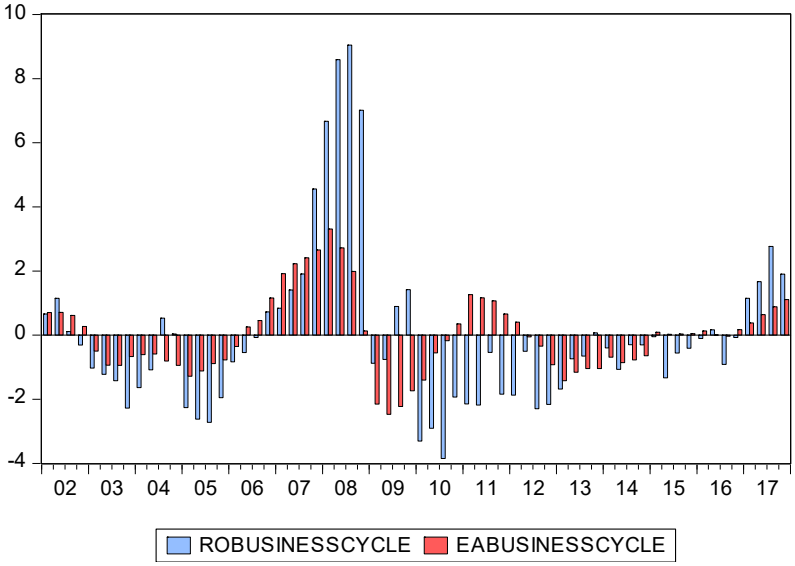
Further, the reliability of the estimations was checked by testing the following hypothesis: (i) statistical validity of the model – Fisher test; (ii) normal distribution of the residuals – Jarque-Bera test; (iii) autocorrelation of the residuals – Breusch-Godfrey test; (iv) homoskedasticity – Breusch-Pagan-Godfrey; (v) stability of the model – CUSUM test; (vi) existence of the multicollinearity – Variance Inflation Factors test. I used this approach, since these are the main conditions identified by Gauss-Markov for confirming the maximum verisimilitude of the estimators.

4. Results and interpretations

This section analyses the main results of the computed estimation. First, I have estimated the output-gap (% of potential GDP) at the level of Romania and Euro Area covering the period 2002-2017. The data evidences that Romania have registered a higher volatility in terms of its specific business cycle, this being quite pronounced in the period 2008-2009. As it can be seen in Figure 1, the Romanian economy had followed an overheating trend in 2007-2008, succeeded by a severe recessionary output-gap. However, this evolution had been also followed by the euro area economy, but the magnitude of overheating was higher in Romania as a consequence of the pro-cyclical policies and the lack of building fiscal buffers. In the period 2010-2017, Romania has entered on a downward path in terms of business cycle synchronisation with Euro Area which is also reflected in Table 1. Following the computation of the Pearson correlation between EA business cycle and the one of Romania, I have found a correlation of 59.09% over the full period analysed (2002-2017). Nevertheless, the data shows a higher correlation of the cycles in the period 2002-2009 (67.1%) then the one calculated for the period 2010-2017 (30.1%). One reason is that there was a gap between the starting point of the crisis in Romania and the one of Euro Area since the linkages between Member States using euro currency are stronger through investment and trade channels. In the third and fourth quarter of 2009, the fall of the potential GDP was higher than the one of the real GDP in Romania, which led to a positive output-gap in these period even if the real GDP dropped with 6.2% in 2009Q3 and 4.0% in 2009Q4. This is also close the AMECO reported data for this indicator, which estimated an output-gap of -0.2% of potential GDP in 2009. The crisis effects in Romania have not been addressed through preventive measures and the corrective ones were strictly oriented to several cuts in government spending which have stifled the economy even more, while EA Member States have responded to the crisis momentum in an integrated and coordinated manner. However, when Euro Area economy started to redress, its cyclical

position had been affected by the debt crisis. There was a mix between heterogeneous government actions, different crisis starting point and effects which changed the upward path of the business cycle synchronisation between Romania and Euro Area into a downward one.

Figure 1. *Business cycles comparison between Romania and Euro Area*



Source: Own calculations using Eviews 9.0.

Table 1. *Pearson correlation*

Pearson correlation	Period		
	2002Q1-2009Q4	2010Q1-2017Q4	2002Q1-2017Q4
RO-EA	67.10%	30.10%	59.09%

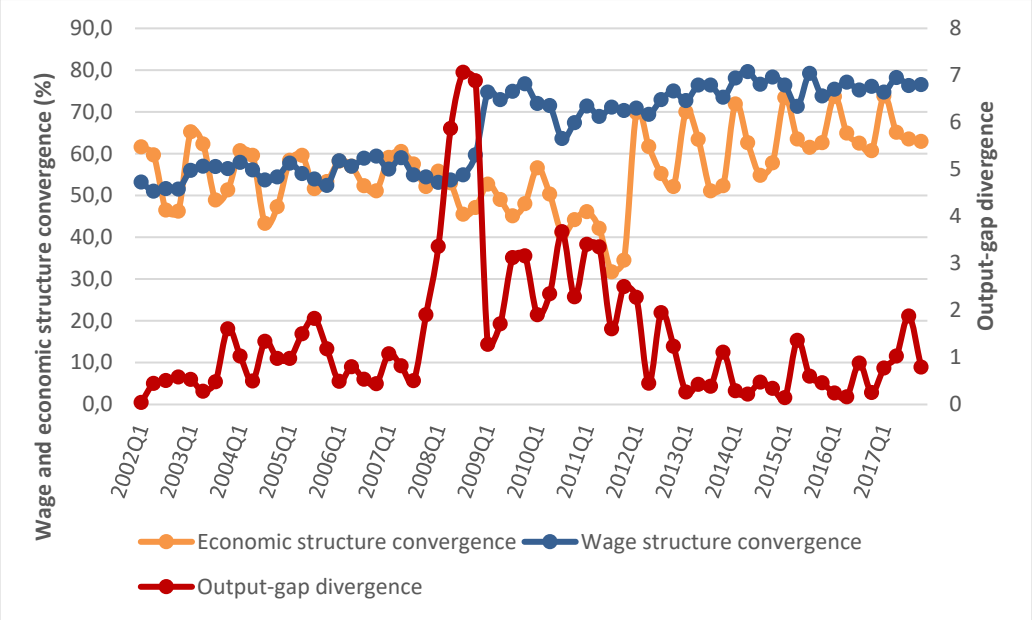
Source: Own calculations using Eviews 9.0.

Anyway, business cycle synchronisation cannot be used in a time-series model, since it is calculated based on the correlation on a given period, which significantly reduce the number of observations. This argued the need to estimate an indicator that provide an usable value for each quarter of the analysed period. In this context, I have used the absolute difference between the output-gaps in order to catch the estimated values for business cycles divergence.

Figure 2 indicates a stronger inverse relationship between economic structure convergence and business cycles divergence which also support the hypothesis that the first mentioned variable is one the most important driver of the output-gaps convergence. However, this discussion is very tricky since Euro Area economy is more dependent on the service sector and Romania have a higher share of Gross Value Added from the industrial sector in GDP (23.7% of GDP in Romania – 2017, compared to 17.8% of GDP at EA level). Practically, an economy with a high share of the industrial sector could be more resilient in a crisis momentum, while an economy based on the service sector may reflect more economic opportunities and higher profitability. In sum, both examples have their own benefits. Nevertheless, when starting the reform to adopt euro, a country government should start

stimulate the economic activity of the competitive sectors, taking also into consideration the economic structure of the Euro Area.

Figure 2. *The evolution of business cycles divergence, economic structure convergence and wage structure convergence (RO-EA)*



Source: Own calculations using Eviews 9.0 and Microsoft Office Excel 2016.

The second studied relationship is that between wage structure convergence and output-gaps divergence which may seen also negative, but lower than the one presented above as a result of the constant evolution of the wage structure convergence which is mainly driven by the wage rigidities. An important evidence is reflected by the results of the statistical correlation between these variables, which indicates a higher negative correlation between business cycles divergence and economic structure convergence (-48.44%) than the one between business cycles divergence and wage structure convergence (-15.65%).

The second phase of the research focuses on estimating the impact of the factors mentioned in methodology on the natural logarithm of output-gaps divergence. In this respect, I found that an increase with 1% in the output-gaps divergence lagged by one quarter (defined in the methodology) led to a rise in the actual business cycles divergence with 0.26%. This can be explained by the facts presented above regarding the different behaviour of the Member States in applying preventive or corrective measures in the starting phases of the crisis and the following ones, when Euro Area have faced with the debt crisis.

Regarding the economic structure convergence between EA and RO, I demonstrated that an increase in its dynamics with 1% generated a fall of output-gaps divergence with 2.18%, which actually represents an increase in business cycles convergence. The main argument supporting this evidence consists in the fact that countries based on kindred economic activities also respond similarly to shocks. Next, I have also identified a negative relationship between the degree of openness and output-gaps divergence, since trade and

investment channels creates solid dependent networks, but also exposures between economic players. In fact, according to the estimation, an increase in the degree of openness with 1% have a negative impact on output-gaps divergence of 2.21%.

With a view to the wage structure convergence, I have found that an increase in its dynamics with 1% have led to a fall in the output-gaps divergence of 3.04%. Lastly, I have identified a positive relationship between the real GDP per capita convergence (as it had been defined in the methodology) and output-gaps divergence, since the catching-up process its faster when some EA countries are registering unfavourable developments of potential GDP and Romania reach its peak – which actually places the regions review in different phases of the economic cycles. Therefore, in some cases, this effect may limit the business cycles synchronisation since Romania is a country that need to converge to the EA/EU average in terms of economic development, but prioritisation of the competitive economic activities, respectively the improvement of foreign direct investments level and of the institutions quality could facilitate a balance development favourable to both indicators. Bodislav recommended several actions to promote a sustainable catching-up process, as follows: (i) supporting the increase GDP per capita; (ii) diversifying the structure of the production sectors; (iii) increasing trade and financial openness; (iv) increasing the competitiveness of labour force.

Figure 3. *Results of the model*

Dependent Variable: LOG(OGDIV)
Method: Least Squares
Date: 04/28/20 Time: 22:19
Sample (adjusted): 2002Q2 2017Q4
Included observations: 63 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(OGDIV(-1))	0.260254	0.095813	2.716263	0.0087
LOG(ECSTRUCTURECONV)	-2.183034	0.517614	-4.217490	0.0001
LOG(OPENNESS)	-2.217883	0.931531	-2.380901	0.0206
LOG(WAGESTRUCTURECONV)	-3.049311	0.946083	-3.223091	0.0021
LOG(REALGDPCAPCONV)	3.071194	0.905555	3.391507	0.0013
C	21.73555	4.341481	5.006483	0.0000

R-squared	0.621560	Mean dependent var	-0.047655
Adjusted R-squared	0.588364	S.D. dependent var	0.933847
S.E. of regression	0.599146	Akaike info criterion	1.903769
Sum squared resid	20.46161	Schwarz criterion	2.107877
Log likelihood	-53.96873	Hannan-Quinn criter.	1.984046
F-statistic	18.72369	Durbin-Watson stat	2.161318
Prob(F-statistic)	0.000000		

Source: Own calculations using Eviews 9.0.

As can be seen in Figure 3, five estimators are significant at a threshold of 1%, while the coefficient of economic openness is significant at 5%. The selected independent variables explains the evolution of the business cycles divergence between Romania and Euro Area in a proportion of 62.15% according to the estimated value of R-squared. In addition, the probability of Fisher test confirms the statistical validity of the model, but the confirmation of the maximum verisimilitude of the estimators also imply the need to check the residuals, stability of the model and the existence of multicollinearity. Table 2 provide the main

results of the tests used to investigate the residuals features. Thus, the probability of Jarque-Bera confirmed the normal distribution of the residuals, this being an important assumption of the Gauss-Markov theorem. Moreover, the absence of the autocorrelation between residuals was validated by the Breusch-Godfrey test, while Breusch-Pagan-Godfrey confirmed the hypothesis of homoskedasticity.

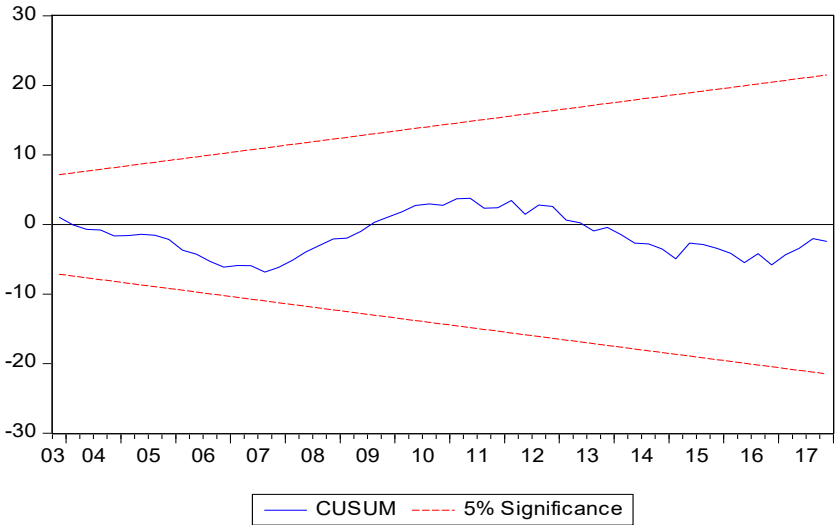
Table 2. *Statistical data series used*

Hypothesis checked – test peformed	Probability
Normal distribution of the residuals - Jarque-Bera test	0.669
Autocorrelation of the residuals - Breusch-Godfrey test (2 lags included)	0.604
Homoskedasticity - Breusch-Pagan-Godfrey	0.181

Source: Own calculations using Eviews 9.0.

The stability of the model was also confirmed according to the Figure 4, since CUSUM test provides a result significant at 5%. Lastly, I performed the Variance Inflation Factors test (Figure 5) in order to check the existence of multicollinearity. The test provided adequate results given that centered variance inflation factors are lower than 4, this being the accepted threshold for the existence of this issue in the economic community. However, in certain conditions multicollinearity can be accepted if variance inflation factors are higher than 4 and lower than 10, but the values exceeding 10 confirmed the hypothesis of a severe multicollinearity. Taking into consideration all hypothesis analysed, I confirmed that the model provides accurate estimators and there is not any open issues that can affect the reliability of the estimation.

Figure 4. *Stability of the model – CUSUM test*



Source: Own calculations using Eviews 9.0.

Figure 5. *Multicollinearity test – Variance Inflation Factors*

Variance Inflation Factors
Date: 04/28/20 Time: 22:30
Sample: 2002Q1 2017Q4
Included observations: 63

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
LOG(OGDIV(-1))	0.009180	1.647412	1.632927
LOG(ECSTRUCTUR...	0.267925	756.5723	1.379748
LOG(OPENNESS)	0.867750	2869.413	1.451064
LOG(WAGESTRUCT...	0.895072	2749.195	3.488934
LOG(REALGDPCAPC...	0.820029	1341.467	3.727275
C	18.84846	3307.892	NA

Source: Own calculations using Eviews 9.0.

5. Conclusions

This paper analyses the evolution of the business cycles divergence between Romania and Euro Area, respectively the effects of its driving forces. According to the results, the correlation of the business cycles entered on a downward trend in the period 2010-2017 (30.10%), compared to the first subperiod analysed (2002-2009, 67.10%) which indicates a fall in the output-gaps convergence between Romania and Euro Area. Generally, this was the result of the different magnitude of the crisis and of the heterogeneity in government' actions. The business cycles synchronisation still stands at a modest level (2002-2017, 59.09%) and confirms that Romania is not prepared to adopt Euro currency in the near future. Of course, with some significant efforts, this process could be achieved in the upcoming years, but with higher costs than benefits.

The results also indicates a negative relationship between three exogenous factors (economic and wage structure convergence, as well as economic openness) and the dependent variable. Moreover, the output-gaps divergence between the parts reviewed is positively driven by the autoregressive term and the share of the Romanian real GDP per capita in the one registered by the Euro Area. However, we should not look at this estimate as a need to make a trade-off between the catching-up process and business cycles synchronisation. The government should monitor at granular level the driving forces of these variables and try to identify a relevant list of factors that can improve both types of convergence (output-gaps convergence and GDP per capita convergence), such as competitive economic sectors, quality of institutions, foreign direct investments and so on.

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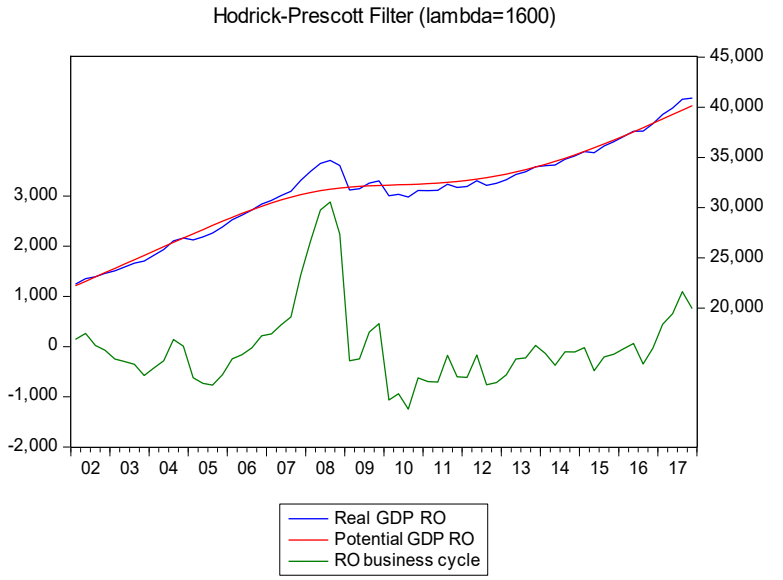
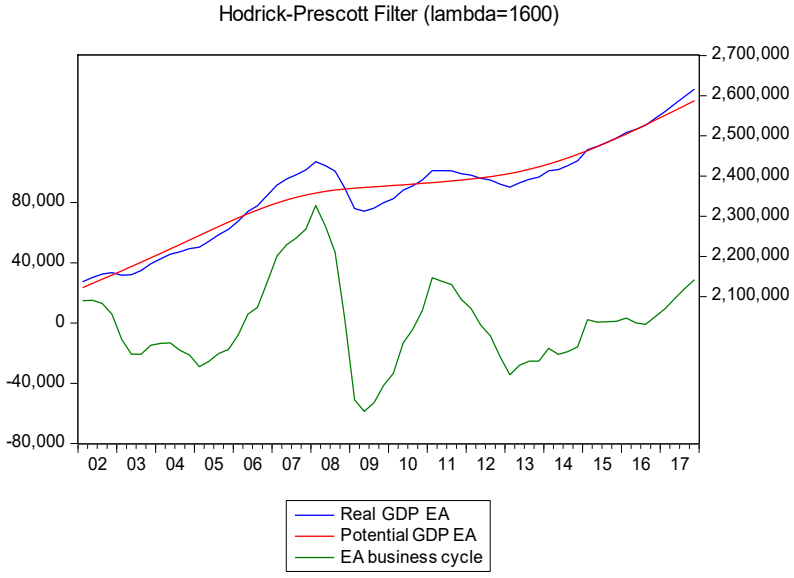
Annex 1. *Real GDP, Potential GDP and Output-gap calculation (Romania and Euro Area)*





Source: Own calculations using Eviews 9.0.

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Migration, economic causes and decisions

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Abstract. *Migration is most often generated by dramas lived by a population in a particular area. It also provokes other dramas in the chosen destination area. Economic imbalances, intercultural problems and different levels of education can cause long-term or short-term conflicts. The time required to adapt to new living conditions may vary according to the strength of the accepting society and the malleability of requesting groups. Smoothing the differences may take several generations. Population mutations can bring benefits to applicants and host population, but can also provide exported crime samples. Leaders are the ones who will make the difference and those who will manage to print the general picture of phenomenon.*

Keywords: migration, labor insertion, economy, vulnerable groups, management, unemployment rate, legislation, social exclusion, asylum.

JEL Classification: J110, J61, R23.

1. Introduction

We all know migration is a phenomenon that has always existed, since the great Greek colonization and Roman conquests, the Roman Empire, the great migrations of the nineteenth and early twentieth century and continuing today, being a challenge that requires integrated management of all countries of the world.

Migration is a reality that will continue to exist as long as there are disparities in terms of wealth/welfare and development among different parts of the world. This can be a chance because it is a factor of human and economic exchanges, also because it allows people to achieve their aspirations.

Throughout history, migration has transformed itself from a regional process, determined by economic, social, natural and political factors into a global phenomenon and can now be seen in approximately 3% of the total population. Although important migration flows are encountered in a relatively limited number of states, no country is outside the international migration flows, as they are either places of origin, transit, or destination, or in some cases, all these simultaneously.

For the European area, the movement of individuals and labor is of particular importance, as successive waves of EU enlargement, the aging of population of (Western) European countries at an accelerated pace, and the economic reasons are the main incentives for increased movement of people and workforce. The information used in the article is real. Some of them can be found on dedicated sites (e.g. Eurostat, NBS etc.), the data regarding Romania being officially obtained from Ministry of Internal Affairs, General Inspectorate of the Romanian Border Police (see Adresa nr. 528.120 din 27.11.2017, Ministerul Afacerilor Interne, Inspectoratul General al Poliției de Frontieră and Adresa nr. IP 550 011 din 12.03.2019, Ministerul Afacerilor Interne, Inspectoratul General al Poliției de Frontieră).

2. Basic concepts of migration

Migration is the movement of population or an individual from one region to another, in order to settle there. In the relevant terminology of migration, to emigrate means the action of leaving one's country in order to settle down in another. The immigration is the activity through which one enters a country other than one's own, in order to settle there. In this sense, the term “foreigner” should not be mistaken with “immigrant”, as it often happens.

Currently, there are three categories of emigrants, namely:

- emigrants expressing their desire to change their native country and travel to another with a particular purpose, and finally accede to a new nationality;
- displaced persons (expelled, returned, transferred) driven away from their country of origin;
- refugees who have been forced to leave their countries.

International migration (voluntary or forced) became an important part of global existence. Thus, it can be said that efficient administration of migration can play an important role in

development and reducing poverty. It is all about creating a safe area where individual protection of citizens, respect for fundamental rights and their free movement is ensured. It is about an area where the safety of citizens and their collective protection must be ensured through appropriate measures. It is an environment where legal decisions can circulate freely and people can have easier access to justice. Finally, it is an area requiring concerted management of immigration and asylum.

3. The international context

Migration is increasingly mentioned in EU policy documents and strategies, being considered one of the essential elements of the Union's development, on medium and long term. An important role in these policies and strategies is given to cooperation at any level it is exercised – between states, inter-governments, institutions or agencies.

Europe's fundamental objectives have not changed: a strong commitment to harmonious societies, based on cohesion and inclusion which respects the fundamental rights of citizens within solid market economies, giving citizens an area of freedom, security and justice without internal borders.

The experience developed by the EU member states has shown that efficiency in managing immigration is ensured by a specialized structure in the issue of migration and asylum. Thus, 88% of the member states have strict specialized structures in the field. At the same time, they ensure compatibility and interoperability in the implementation of common European policies (Eurostat, Available online: http://ec.europa.eu/eurostat/data/database).

Regarding to immigration flows (Eurostat, Statistics Explained, Available online: http://ec.europa.eu/eurostat/statistics-explained/index.php/Migration_and_migrant_population_statistics/ro), a total of 4,7 million people immigrated in 2015 in to one of the EU member states and, according to reports, at least of 2,8 million emigrants have left an EU member state. These figures do not represent migration flows to/from the EU as a whole, as they also include flows between different EU Member States.

Out of a total of 4,7 million immigrants registered in 2015, about 2,4 million were third-country citizens and 1,4 million were citizens of another EU member state than the country of destination; about 860.000 were citizens of the EU member state of destination (e.g. “returning home” or foreign-born) and about 19.000 were stateless.

If we are to do a 2015 ranking of the EU member states, we will find that Germany reported a total of 1.543.800 immigrants, followed by the United Kingdom with 631.500 migrants, followed by France with 363.900 migrants, Spain (342.100) and Italy (280.100). Germany reported the largest number of emigrants in 2015 (347.200), followed by Spain (343.900), the United Kingdom (299.200), France (298.000), and Poland (258.800), 17 of the EU member states reported a higher share of immigration than emigration in 2015. However, in Bulgaria, Ireland, Greece, Spain, Croatia, Cyprus, Poland, Portugal, Romania, Latvia and Lithuania, the number of emigrants exceeded the number immigrants.

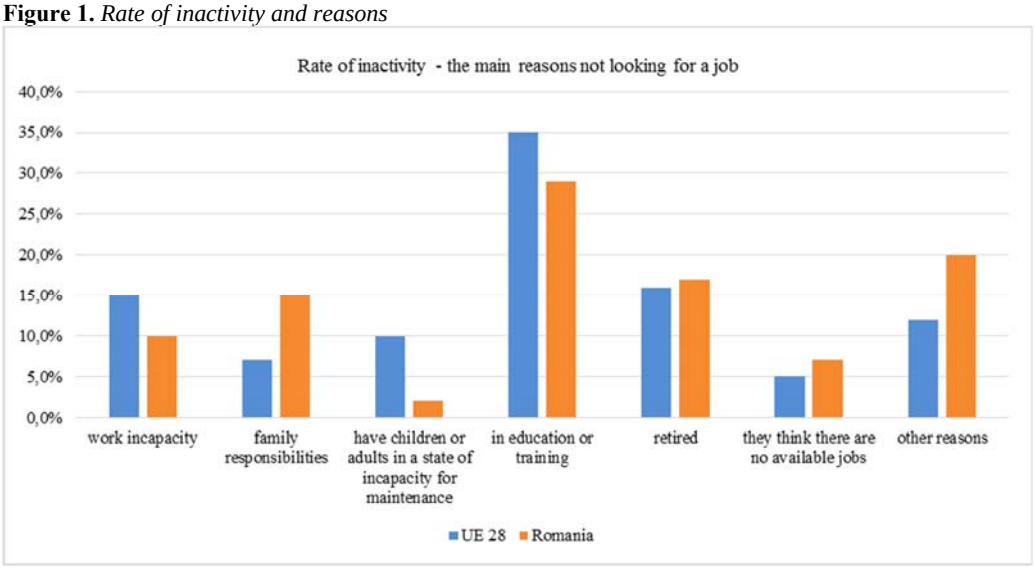
If we rank in relation to the size of the resident population, we will find that Luxembourg has recorded the highest immigration rates in 2015 (42 immigrants per 1.000 natives), followed by Malta (30 immigrants per 1.000), Austria and Germany (both registering 19 immigrants per 1.000 natives). The highest emigration rates in 2015 were reported for Luxembourg (22 migrants per 1.000 persons), Cyprus (20 migrants to 1.000 people) and Malta (20 emigrants per 1.000 people).

If we make a 2015 analysis, we will see that the relative share of nationals immigrant, i.e. immigrants with EU citizenship of destination, from the total number of immigrants was the highest in Romania (87% of all immigrants), followed by Lithuania (83%), Hungary (56%), Croatia (55%), Latvia (52%), Estonia (52%) and Portugal (50%).

The estimated number of immigrants from third countries to the EU area was 2.7 million in 2015. In addition, 1.9 million people who had previously residency in an EU member state migrated to another member state. An analysis based on the previous residence shows that Luxembourg reported the largest share of immigrants from another EU member state (91% of the total number of immigrants in 2015), followed by Slovakia (80%) and Romania (71%); relatively low proportions were reported by Italy (26% of all immigrants), as well as by Bulgaria, Slovenia and Sweden (each reporting a proportion of 28%).

There was a slightly prevalence of men among women (56% versus 44%) within gender distribution of immigrants from EU member states in 2015. Germany reported the largest proportion of male immigrants (63%). In contrast, Cyprus reported the largest proportion of female immigrants (57%). Immigrants from the EU member states were, on average, much younger than the total population already resident in their country of destination in 2015. On 1st January 2016, the average age of the EU population was 42.6 years. In contrast, the average age of migrants in the EU was 27.5 years in 2015.

Figure 1. *Rate of inactivity and reasons*



Source: Eurostat, Available online: http://ec.europa.eu/eurostat/data/database

In connection with the economic inactivity, a basic problem for the EU states is migrants' integration arrived inside their countries. How could these persons be integrated in order to become a specialized work source? Is it really necessary to integrate these migrants to fulfill work forces? Are there any inactive people like part of the work force inside the destination countries?

According to Eurostat Statistics, at the European level, there is a share of 30-35% for inactive population. Italy comes first with a 35.1% inactive population, on the second place is Croatia with 34.4%, Belgium and Romania come the third with 32.4%, while Greece has 31.8%. On the opposite side, Sweden comes with the least percentage – 17.9%, while Netherlands has 20.3% and Denmark has 20%. To conclude, 89 million of the people aged between 15 and 64 years are inactive work force inside European Union (Eurostat, Statistics Explained, Available online: http://ec.europa.eu/eurostat/statistics-explained/index.php/Migration_and_migrant_population_statistics/ro).

If we make an analysis of the involvement of women and men, we will notice that at EU level the female inactivity rate is higher than for men. As an example, in Romania the rate of economic inactivity in the case of women's is 76% higher than men.

First of all, over 20% of Romanian inactive persons explain their situation from strictly personalized reason, compared to the EU where the percentage is 10%; secondly, 10% of the inactive population are disabled individuals, which label them as unable to work; thirdly, 14,8% due to family duties, 2,8% have adults or children in care; next 29% find themselves in an educational or professional process; 15,9% are retired, while 6.8% consider that there are not available jobs for them. Agerpress – Romanian Press Institution – provides the figures needed to explain the inactive Romanian population: 35% educating persons, 16% out-of-work, 16% unable to work, 10% caregivers (e.g. baby-sitters or adult supporters) ((Eurostat, Available online: http://ec.europa.eu/eurostat/data/database).

Moving to the European framework, we see that 60% of those inactive are women, while 8 from 10 do not work. Another 78% declared not willing a job and that's why they did not look for a job (Eurostat, Available online: http://ec.europa.eu/eurostat/data/database).

According to Eurostat statistics, on 1st January 2016, 35.1 million people born outside the EU lived in an EU member state and 19.3 million were born in another EU member state than the one in which they had residency. If we add the number of people born in other EU member states existing in Hungary, Ireland, Luxembourg, Slovakia and Cyprus, this figure is higher than the number of persons born outside the EU. Regarding the number of third-country nationals living in the EU on 1st January 2016, we will find 20.7 million, which accounted for 4.1% of the EU-28 population. On 1st January 2016, 16 million people living in one of the EU member states had the nationality of another EU member states (Eurostat, Statistics Explained, Available online: http://ec.europa.eu/eurostat/statistics-explained/index.php/Migration_and_migrant_population_statistics/ro).

Regarding to the origin countries, Syria, Afghanistan and Iraq were countries that lost the largest number of citizens between 2014 and 2016. Eurostat underlined the increasing number of asylum seekers as a form of international protection. If in 2014 only 562.700 persons were asylum seekers, their number rose to 1.257.000 in 2015 and stopped at

1.204.300 in 2016. Syria lost 334.800 citizens, Afghanistan 183.000 and Iraq 127.000 (Eurostat, Available online: http://ec.europa.eu/eurostat/data/database).

Regarding the destination countries, Germany seems to be top destination country for migrants. 772.300 asylum applications were registered only in Germany in 2016, representing 60% from the total registered in EU. Italy comes after Germany with 121.200 applicants (10% from the total). France ranks third with 70.000 applications (6% from the total), Greece goes further with 49.900 requests (4% from the total), Austria registered 39.900 applications (3%) and UK 38.800 (3%). There are some important changes within European countries if we compare the last three years. Hence, Hungary faced a huge flow of immigrants in 2014 coming on the Balkan route. In 2016, as a result of anti-migration polities and strictly secured borders, the number of the asylum applications diminished by 84%, compared to 2015 (Eurostat, Available online: http://ec.europa.eu/eurostat/data/database).

Regarding the protection of asylum seekers, before we talk about guaranteeing protection of asylum seekers, we need to clarify what the term asylum law means. Asylum law means the right conferred by a sovereign state to a person who is accused in the State of origin of political, scientific or religious reasons to settle in its territory (http://www.notiunidedrept.ro/drept-de-azil/). The asylum seeker term is quite often confused with the refugee term because, very often, an asylum seeker is a person who declares that he is a refugee and seeks international protection against persecution or serious dangers in his own country. Every refugee is in the first instance an asylum seeker, but not every asylum seeker will eventually be recognized as a refugee. During the time that this person expects the application to be accepted or rejected, he/she is called an asylum seeker. The term asylum seeker does not contain any presumption of any kind, it merely describes that a person has lodged an asylum application. National asylum systems are the ones that decide which asylum seeker qualifies for such international protection. Those who do not meet the legal requirements to receive refugee status or another form of international protection may be sent back to their home countries (The UN Refugee Agency, Available online: http://www.unhcr.org/ro/pe-cine-ajutam/solicitanti-de-azil).

An asylum seeker can apply for a first time in a particular country and then go through the same process as an applicant by filing a new application in any other country. If the applicant submits after another time an application in the same country, he is no longer considered to be the applicant for the first time. The acquisition datasets of citizenship are collected by Eurostat according to article 3 paragraph (1) letter (d) of (EC) Regulation No. 862/2007, which states that: “Member states must provide statistics to the (Eurostat) Commission with the number of persons (...) who have their habitual residence in the territory of the member state and who, in the reference year, obtained the nationality of the member state (...) distincted (...) depending on the previous nationality or stateless status of the persons concerned” (Eurostat, Statistics Explained, Available online: http://ec.europa.eu/eurostat/statistics-explained/index.php/Migration_and_migrant_population_statistics/ro).

The EU guaranteed 710.400 asylum protection in 2016 within its 28 states. Most of them come from Syria – 405.600, representing 57% of the total, Iraq – 65.800, representing 9%

of the total, followed by Afghanistan with 61.800, representing 9% of the total, Eritrea – 5%, Somalia – 2% and others with 14%.

4. The Romanian national context

The Ministry of Internal Affairs, through its specialized structures, ensures respect of the Romanian state border regime, of the foreigners' regime in Romania, manages the records of people who have been granted the right to stay in Romania (the Management Information System of Foreigners), implements the national refugee policy, organizes and coordinates the issuance and general evidence of identity and travel documents. Within the Ministry of Internal Affairs, institutions acting in the sphere of migration are the following: the Romanian Border Police, the General Passports Directorate and the General Inspectorate for Immigrations.

The implementation of common immigration and asylum policy, by providing international protection, effective management of migration flows (admission, stay, departure, integration), prevention and fight against illegal migration, are carried out by the General Inspectorate for Immigration.

According to art. II. par. (1) of the Immigration Act no. 118/2012, the General Inspectorate for Immigrations is organized and operates as a specialized structure of the central public administration, a public institution with legal personality, subordinated to the Ministry of Internal Affairs, which carries the attributes given to it by law for the implementation of the Romanian policies in the areas of migration, asylum and integration of foreigners, as well as of the relevant applicable legislation in these areas.

The central role of the General Inspectorate for Immigrations in managing national immigration is reinforced by the position conferred to this structure by the Governmental Decision no. 498/2011, approving the National Strategy on Immigration (NSI), the institution coordinating the implementation and monitoring the objectives and targets in this field. In this context, we mention that, through the General Inspectorate, the General Inspectorate for Immigrations holds the position of vice-president of the Inter-institutional Group for the implementation of the SNI and provides the technical secretariat for this group through its own specialists.

The current legislation in which regulates the regime of foreigners in Romania, of the European Union citizens, the regime of the European Economic Area, and the rules of law governing asylum, is mainly given by:

- The Emergency Ordinance of the Government no. 194/2002 on the regime of foreigners in Romania, republished, with the subsequent amendments – a law which regulates the entry, stay and exit of foreigners in Romania, their rights and obligations, as well as the specific measures to control migration, in accordance with the obligations assumed by Romania through the international documents to which it is party.
- Law no. 122/2006 on asylum in Romania, with the subsequent amendments – a law compliant with the Community acquis, adapted to the social and political realities of Romania and the world.

- The Emergency Ordinance of the Government no. 102/2005 on the free movement on the territory of Romania of the citizens of the member states of the European Union and European Economic Area, as amended and supplemented.
- The Emergency Ordinance of the Government no. 56/2007 on the employment and deployment of foreigners in Romania.
- The Emergency Ordinance of the Government no. 44/2004 on the social integration of foreigners who were granted a form of protection or a right to stay in Romania – aimed at facilitating the social integration of the foreigners who were granted a form of protection in Romania.

Romania's accession to the European Union has led, in recent years, to substantial changes to the rules of law governing the regime of foreigners in Romania, of the European Union and of the European Economic Area citizens, as well as the rules of law governing asylum in Romania, in order to insure compliance with relevant Community legislation and with other international legal instruments to which the Romanian State is a party.

This complex process of regulatory harmonization is still ongoing, in order to identify viable solutions for the transposition of the acquis in the field.

At the same time, amendments of the national legislation within the areas mentioned above seek permanent elimination of failures occurring in the implementation of the legislative framework for foreigners.

After 1990's, continuous efforts gradually contributed to the institutional maturation necessary to this structure, which was reformed to the level of individual attitudes. We can say that today, the immigration officers are true professionals, both in the work carried out internally and externally, where they proved that they can work and can team up with foreign partners in some of the hottest areas of globe.

In terms of immigration, throughout history, Romania was and still is intersected by segments of known South-North and East-West routes across Europe. Given the country's geographical location, Romania is at the confluence of migratory routes that have as their starting point the southern parts of the globe (African continent countries) as well as the Asian and Southeast Asian countries. However, migratory flows affecting the territory of Romania have as their starting point different areas for legal and illegal immigration. Thus, it can be concluded from their analysis that legal immigration flows come from countries which Romania has developed and counts to develop cooperative relations. In this context, it can be stated that, since 2005, countries such as Moldova, China and Turkey represented the largest share of foreigners who have chosen to reside temporarily or permanently in Romania.

The intensity of legal immigration flows has been influenced over time by economic and social factors, both in the country of origin and in Romania. Thus, during the 90's, Romania was an attractive market and foreigners enjoyed certain facilities regarding their entrance, staying, or performing commercial activities, which made the residence of a large number of foreigners at that time in Romania, especially for the purpose of carrying out commercial activities.

Over time, progress in terms of applicable legal rules, both in terms of development of economic activities in the country, employment, and those setting for legal status of foreigners and harmonization process with the rules of European law, made the intensity of legal immigration flow to remain at an average level.

A milestone in terms of legal immigration in Romania was the appearance/starting and persistence of economic crisis, which has led to a decrease in the intensity of legal immigration flow, especially regarding economic immigration – commercial activities or employment.

In the same way, the illegal immigration flows are affected by social and economic situation in the origin countries, by Romania's geographical position on illegal immigration routes whose destination are the countries in the West of European continent, as well by the changes that occurred in migration routes, due to measures taken by the authorities of the countries they cross.

A characteristic of illegal immigration in Romania is bipolarity. Thus, on the one hand, we can speak about the illegal immigration of mostly foreigners coming from countries with the highest weight in respect with legal immigration (Moldova, Turkey and China). This category is characterized by a certain continuity and "conventional" ways of illegal immigration, such as exceeding the term of stay granted by the visa or residence permit.

Figure 2. *The main origin countries of legal immigrants in Romania*

Source: The General Inspectorate for Immigration, Newsletter "Migration and Asylum".

On the other hand, we can speak of temporary illegal immigration flows caused by socio-economic events in the native countries, which represented "new waves" for each period. Thus, for the 90's, we can mention the illegal immigration flows of foreigners from East Asia, particularly Bangladesh and Pakistan, who, in order to get to Western European countries, used the route through Russia, Moldova or Ukraine, Romania, with continuation to Hungary. In the early 2000's, due to the conflict in Iraq, there appears the illegal immigration of citizens of that state, who travelled on the route Turkey – Bulgaria – Romania and with continuation to the Western European states.

The war in Syria was another cause that kept up the migration route mentioned above.

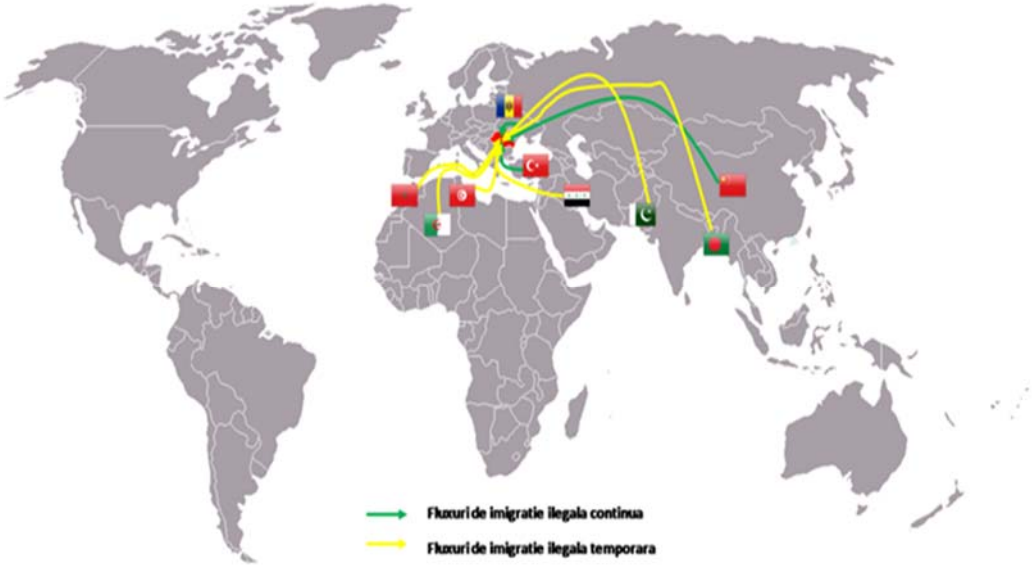
A special situation has been observed starting with the second half of 2011, in the context of Arabian Spring and of the social movements in countries of Northern Africa. Thus, for that period, we can notice a massive foreigner's influx from Algeria, Morocco, Tunisia and Syria, who illegally immigrated in Romania.

The increased illegal immigration flow had effects both on the migration system and on the asylum Romania system. This statement is supported by the *modi operandi* involving the violation of the state border regime and foreigners (illegal entry and stay), and abuse of the asylum process – application, abandonment of the procedure and the attempt to illegally leave Romanian territory with Hungary destination.

Timișoara Emergency Transit Center, set up in 2009 and managed by the Romanian Immigration Inspectorate, is the first such center in the world, being considered by the international community as a model for the evacuation and protection of refugees. During these years of operation, the center ensured a high degree of visibility of Romania, and for the first time at international level, the concept of emergency evacuation of refugees in danger of being returned from the first country of asylum in the country where they are exposed to persecution, inhuman treatment or danger. Timișoara Transit Center was used as a model for other centers in the Philippines and Slovakia.

In 2017, following state border surveillance and control missions, border guards detected 5.846 foreign nationals trying to cross the border illegally, of which 2.840 on the entry and 3.006 on the leaving way.

Figure 3. *The main origin countries of illegal immigrants in Romania*



Source: The General Inspectorate for Immigration, Newsletter "Migration and Asylum".

Of these, at the border with Serbia, more than 1.500 people have been found to have attempted to enter illegally in Romania, and on the border with Hungary border, guards

have detected more than 2.700 foreign citizens planning to leave the country illegally, most of them being asylum seekers in Romania. 738 migrant groups and 239 guides/carriers, Romanian and foreign citizens, were involved in helping migrants attempt to cross the border illegally. 4.706 were detected by illegally acting on the green border, 683 of the identified migrants attempted to illegally cross the frontier hidden in the means of transport and the other 457 people were detected trying to cross illegally using other methods (false travel documents and visas, substitution of person, avoidance of border control etc.). 1.600 persons applied for asylum status at the border police structures, being handed over to the representatives of the General Inspectorate for Immigration for the undertaking of the legal measures.

We are trying to present a situation of the first three positions occupied by certain criteria in September of 2017:

- In the situation of foreign citizens with the right of residence on the territory of Romania according to the country criterion the first place was occupied by the Republic of Moldova (10.487) followed by Turkey (8.969) and China (7.890).
- In the case of EU/EEA/Swiss nationals with the right of residence in the territory Romania according to the country of origin criterion was occupied by Italy (14.194), followed by Germany (5.781) and France (5.558).
- In the case of foreign nationals found illegally staying the first place was occupied by Iraq (948) followed by the Republic of Moldova (273) and Syria (253).
- In the case of the foreign citizens on whose behalf the return decisions were issued first place was occupied by Morocco (175) followed by Turkey (151) and Moldova (148).
- In the situation of the persons who were removed under escort from the territory of Romania first place was occupied by Pakistan (88) followed by Iraq (43 and Turkey (31).
- In the case of asylum applications, the first place was occupied by Iraq (88) followed by Syria (43 and Pakistan (31).

In 2018, 2.986 foreign citizens attempted to cross the border illegally, of which 1.649 on the entry into the country and 1.337 on exit. There were identified 425 migrant groups and 170 facilitators, Romanian and foreign citizens, involved in supporting migrants in the attempt to cross illegally the border. 1.620 people were trapped illegally on the green border, 1.078 of the identified migrants attempted to illegally cross the border hidden in the means of transport and the other 288 people were detected trying to cross illegally using other methods (false travel documents and visas, substitution of person, avoidance of border control, etc.). 847 persons applied for asylum status at the border police structures, being handed over to the representatives of the General Inspectorate for Immigration for the undertaking of the legal measures. Also, in 2018, in about 400 cases, it intervened to prevent the illegal entry of more than 2.700 people at the Romanian-Serbian border. Regarding the nationality of the people found in the attempt to cross the border illegally, most citizens come from the following countries: Iraq, Iran, Syria, Turkey, Afghanistan, Albania, Pakistan, Vietnam and Palestine.

Compared to 2017, in 2018 there is an increase in the number of detected migrants hidden in the means of transport, both in the sense of exit and in the sense of entering the country,

in the conditions of a 52.9% decrease in the flow of migrants at the green border and the total lack of shipping cases of Black Sea craft.

We will briefly present Romania's National Strategy on Immigration for 2015-2018. The document provides for the next years to effectively manage immigration in all its aspects by addressing specific skills gaps and attracting highly skilled workers, a more robust approach to illegal immigration and readmission, including better cooperation with third countries, protecting those who need help through a firm asylum policy. The national strategy purpose is to create a flexible and efficient system of citizens admission from countries with migration potential. Considering the migration of the Romanian labor force to other states, the strategy also aims to cover the existing deficit on the labor market, this target being achieved by attracting highly qualified persons but with the condition of protecting Romanian citizens. Changing national legislation in the way to remove inaccuracies and creating a legal framework favorable to admission, including through the transposition of European directives in the field, will create optimal conditions for institutions to implement the objectives of strategy.

Regarding the asylum component, the strategy seeks to ensure better access to asylum for people who need protection, a better quality of reception conditions and faster and more credible asylum decisions. Taking into account the experience gained by the EU member states between 2012 and 2015, the strategy aims at a unitary and coherent management of the situations caused by the possible occurrence of an influx of illegal immigrants into Romania, caused by crisis situations of nature political, social, economic or military.

Because immigration and asylum are largely influenced by events occurring globally, the following issues have been identified that can influence the operational situation in the area of competence in the medium and long term:

- Maintaining state conflict in Syria and adjacent areas.
- Reactivating the armed conflict in Iraq and Afghanistan.
- Maintaining unstable situation in areas bordering Romania (Ukraine, Transnistria).
- Perpetuation and intensification of the Israeli-Palestinian armed conflict.
- Continuing illegal migration from Turkey, which has become the main transit country for illegal migration from the Middle East or Africa to Romania, Istanbul being the main hub on the way to the West.

The National Immigration Strategy 2015-2020 were established following general policy objectives:

- Promoting legal migration for the benefit of all parties: Romanian society, immigrants and their countries of origin.
- Strengthening legality staying third-country nationals in Romania and proper enforcement of removal and restrictive measures.
- Improvement of the national asylum system in order to streamline and ensure compliance with applicable national, European and international legal standards.
- Romania's active participation in the efforts of the international community and the Member States of the EU in identifying sustainable solutions for people in need of international protection and the social integration of third-country nationals.

In this sense, the social integration policy of third-country nationals is aimed at enabling persons who are resident or domiciled in Romania have minimum knowledge and skills baggage, mainly through Romanian language classes, cultural orientation programs and counseling guidance to enable them to access the services and social policies in the same conditions as for Romanian citizens (Inspectoratul General pentru Imigrări, Strategia Națională privind Imigrația, Available online: https://www.google.ro/search?q=politica+romaniei+privind+imigratia&ie=utf-8&oe=utf-8&client=firefox-b&gws_rd=cr&dcr=0&ei=Q1nbWf20I9DJwAKW8Jt4).

The National Immigration Strategy for 2015-2018 includes the following specific objectives relevant to the transposition and implementation of the overall strategic objectives:

- Facilitating the access to Romanian territory of third-party citizens that meet the needs of labor employment (creating the legal framework for attracting and retaining the workforce according to identified needs).
- Facilitating the access of third-country nationals to Romanian higher education institutions for fields and professions identified as deficient.
- Facilitating the admission and residence of third-country nationals for the development/progress business in Romania in line with the national economic interest.
- Providing better information to citizens of third countries on the possibilities and conditions for legal immigration.
- Permanent information on the risks of illegal migration and undeclared work, as well as the sanctions and restrictive measures that may be applied.
- Streamlining legality third-country nationals reside and work in Romania.
- Strengthening cooperation between the competent Romanian authorities to combat illegal immigration and undeclared work of third-country nationals.
- Implementing measures to return illegal immigrants to European Union standards;
- Continue to ensure access to the asylum procedure and comply with the principle of non-refoulement.
- Processing asylum applications effectively and in accordance with applicable national, European, and international legal standards.
- Effective combating abuse to the asylum procedure.
- Ensuring a dignified standard of living for asylum seekers in accordance with applicable national, European and international legal standards.
- Ensuring compatibility and interoperability with other asylum systems in the Member States, coordination with the European Asylum Support Office as well as strengthening and increasing the quality of the asylum procedure and measures to integrate people with some form of international protection from third countries.
- Unified and coherent management of the situations caused by the occurrence of an influx of illegal immigrants into Romania, generated by political, social, economic or military crisis situations.
- Social integration of people who were granted a form of protection in Romania and those with legal residence.
- Incorporate integration issues into all other relevant policy areas.
- Creating an environment that facilitates the integration of third-country nationals.

- Assuming Romania's obligations as a state of refugees resettlement.
- Continuation of the operations through the Timişoara Emergency.

Relocation Center under the Agreement between the Romanian Government and the United Nations High Commissioner for Refugees and the International Organization for Migration concerning the temporary evacuation in Romania of persons in urgent need of international protection and their subsequent relocation, signed in Bucharest on May 8, 2008, ratified by Law no. 291/2008 (Decision no. 780/2015 for the approval of the National Immigration Strategy for the period 2015-2018 and the Action Plan for 2015 for the implementation of the National Immigration Strategy for the period 2015-2018).

Regarding to institutional cooperation in 2012, The General Inspectorate for Immigrations (I.G.I.) gave great importance to improving inter-agency cooperation with other competent authorities in the field of public order and safety. Thus, I.G.I. coordinated the national implementation of two large operations in fighting against illegal immigration in Europe (Balder – under the Danish Presidency and Aphrodite – under the Cypriot presidency) that registered notable results.

The concept of foreigner, no matter that is merchant, employee, student, applicant for asylum, illegal resident, prosecuted, sentenced or undesirable, is intrinsically linked to the regulation of the General Inspectorate for Immigration.

In order to increase the operative capacity in the area of competence during the year 2017 national measures were progressively disposed, which showed the inter-institutional cooperation:

- To strengthen the state border surveillance device, based on a plan were carried out joint actions of the Ministry of Internal Affairs (Police, Gendarmerie, General Aviation Inspectorate) in various areas under the jurisdiction of the Romanian Border Police located on the south and southwestern border of Romania.
- The staff was supplemented with personnel from the central operational structures and territorial units to act progressively in the border area; measures have been taken to strengthen the state border surveillance device at The Black Sea, the Romanian Border Police, through the Coast Guard, having features and capabilities to ensure naval patrols and interventions at sea.
- The head of the Romanian Border Police has had bilateral meetings with all heads of the institutions manages the border of neighboring states in order to develop cooperative relations with the border authorities of these states and to put in place common measures to combat cross-border crime and ensure a high level of state border surveillance and control.

Also, during 2018, to manage the migration phenomenon to Romania's borders, the following measures were ordered:

- At the border with Serbia, the action measures carried out with the participating forces within the Ministry of Internal Affairs and the staff relocation and patrol and surveillance techniques were maintained, with air surveillance missions being carried out with the support of the General Aviation Inspectorate of the Ministry of Internal Interior.

- At the border with the Republic of Bulgaria, since June, measures have been adopted to strengthen border surveillance and control, including the relocation of personnel and equipment from the Giurgiu Territorial Inspectorate – Giurgiu Border Police for the reinforcement of identified risk areas.

Which are the perspectives of immigration in Romania? According to the continuous analysis, we can say that Romania faces no major problems in 2017 with immigrants or refugees. This applies in comparison with developed countries, which have been and will always be the favorite destination of such migration flows. In terms of outlook, we can say that the legal and illegal migration phenomenon in Romania will be influenced both by domestic and international factors.

From the internal factors that will influence the phenomenon, we can mention:
- Economic growth: an economic growth of Romania will lead to attracting foreign investment and increasing the import foreign labor force.
- The development of the social security system will make Romania more attractive to foreigners that establish their residence on the Romanian territory and to asylum seekers and refugees who receive social assistance in other European countries.
- The evolution of the domestic legal framework enforced against these categories of people, which will make Romania more or less attractive to immigrants, both legal and illegal.

From the point of view of international factors, we can mention:
- Romania's accession to the Schengen area (in conjunction with the Bulgaria's accession), which will create a safe passage from the Eastern and Southern borders of the European Union to the Western and Northern European states that are a favorite target of immigrants.
- The development of social and military conflicts in the world, which will put their stamp on immigration and asylum in Romania.
- The end of the global economic crisis and the recovery of the national economies could lead to an increase in economic immigrants, including Romania.

Completion of the transition period imposed by some member states of UE to Romanian workers until 01.01.2014, which had led to increase of exported labor force and to the needed to cover national labor market requirements.

5. Discussion

Migration and its social, economic or political effects have been discussed quite a lot in different contexts and it will be discussed further, depending on the evolution of events at international level. However, one of the future research directions proposes to tackle a slightly more delicate topic – export, import or transfer of criminality, and all the effects introduced by. We can analyze domestic crime, organized crime (mobile organized crime groups or syndicates), terrorism, money laundering and especially, cybercrime. Invisible borders are subject to major changes from those established by law and may in certain situations endanger the security of the state of law. We want to draw attention to

cybercrime, in general and "cybercrime regarding financial transfers", in particular, because the effects can be felt by the society in the short, medium and long term, at all levels.

6. Conclusions

Economical migration is first of all generated by social background: poverty, unemployment, low quality of life, badly paid work places and so on. Origin countries spreading emigration because of economic reasons are those from Africa, Asia and South America. There poor people are living a miserable life because of insecurity and lack of any social protection. That's why they choose to leave their native places and migrate to other parts of the world to a better life. Speaking about destination countries, those leaving South America choose United States or Canada, while those from Asia or Africa emmigrate to the West European societies.

Migration implies dysfunctional work force structure – both qualified and unqualified type. This is followed by serious changes especially inside origin immigration countries where human resources diminish under-developed countries suffer the most (https://newsint.ro/business/migratia-economica-pierdere-sau-beneficiu-pentru-tara-de-origine/Priscilla Oltean) because of qualified work force decreasing. The lack of high technology as well as the difficult production of added value is responsible for low living standards and low wages in the origin countries. The number of those with relatively large salaries is reduced in these societies. In the destination country, a worker gets a higher salary for the same work/job because there is a higher demand for labour while the supply is limited.

Another factor plays an essential role in fostering economic migration: sometimes, natives refuse certain work places considering their under-educated or poorly paid status. Inside destination countries, generally well-developed states, immigrants accept to work for less wages and this facts determines a decrease in salary paying at the level of entire country available for the same kind of work done by immigrants and contribute to the work force numerical growth (https://newsint.ro/business/migratia-economica-pierdere-sau-beneficiu-pentru-tara-de-origine/Priscilla Oltean). If the native countries were to raise wages, they would increase welfare globally and trigger a process of salary balancing. There they succeed in saving money and send it to the origin countries. Money transfer is seen as a special way (sure and stable) of external financing, a permanent income source, used to increase internal consume. Thus, reducing poverty and facilitating a higher living standard (https://newsint.ro/business/migratia-economica-pierdere-sau-beneficiu-pentru-tara-de-origine/Priscilla Oltean). A good example would be given by Romanians who work in Spain, Italy and England. They save a lot and send almost everything to Romania. They are not interested in future investments in the destination country.

The emigration of highly skilled labor force to more developed countries only contributes to the export of intelligence from countries where living standards and wages are lower than in developed countries. The effect is easy to understand. Educational systems in home countries invest in the training of specialists; after completing their studies, due to the high

number of graduates, they do not find a job in the field and chose to go to destination countries. Highly-qualified workforce emigration is a human potential loss for the native country, because it can't benefit from its own specialists prepared by. This migration of specialists leads to a significant drop in revenue, slowing growth and economic growth, falling productivity, and a reduction in foreign investment in the native country. Thinking about specialists, one important question comes to mind: "Will they come back, will they invest in the origin country as qualified or non-qualified work force or will they contribute to facilities growth for the ones left at home by improving the internal work market?" (https://newsint.ro/business/migratia-economica-pierdere-sau-beneficiu-pentru-tara-de-origine/Priscilla Oltean).

In some cases, the economic migration of labor can indirectly cause economic growth in the country of origin through the transfers of money and goods, not necessarily through investment, but stimulating domestic consumption and raising the standard of living.

Conclusions on migration are difficult to formulate as the phenomenon may change according to economic, political and military developments. That's why we can only try to present some statistics valid for a limited time. History is a good teacher and the elements of similarity are useful in situations where certain aspects can lead to similar conclusions. We can say that the assumptions about the root causes of migration are correct, the economic motivation being one of the most important elements. Migration routes change, state actors are changing, people's modal shift changes, but motivations remain roughly the same. Proper management of migration can eliminate potential conflicts from the outset and generate added value for all parties involved: home country, migrant population and destination country.

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The voluntary pension funds – a viable solution to supplement the pensioners' incomes

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Abstract. *The voluntary pensions, known as Pillar III, are a part of the pension system in Romania and aim to ensure a separate private pension, which supplements the pension provided by the public system and, where available, the privately managed pension. In fact, the voluntary pension is a long-term savings product, the participant and/or employer for its employees may choose to contribute to the individual account with an amount between a minimum amount, established by each voluntary pension fund prospectus and a maximum of 15% of the gross monthly salary income or of the income assimilated to it. At any time, the participant has the possibility to stop paying the contributions, keeping all his rights, according to the rules of the voluntary pension scheme. When he wants, he will be able to resume paying the contributions to the same fund or he can opt for another one. The participant also has the right to change the level of contributions at any time, provided that this level is included in the specified range.*

Keywords: voluntary pension, participant, fund, contribution, personal assets.

JEL Classification: C40, J32.

Introduction

The Law no. 204/2006 represents the legal framework that regulates Pillar III on voluntary pensions, with subsequent amendments and completions. Compared to the privately managed pension system, which imposes certain age restrictions on the payment of personal assets, in the case of voluntary pensions they are eliminated. Specifically, the right to a voluntary pension is opened, at the participant's request, when the following conditions are cumulatively met: the participant reaches the age of 60 and the payment of at least 90 monthly contributions. These monthly contributions may or may not be consecutive. Participants or beneficiaries (in the case of deceased participants) will be paid the amount accumulated in the personal account in the form of a single or installment payment, in equal monthly installments, with a value of at least 500 lei, for a maximum period of 5 years (except for the last installment which will be a residual rate).

Literature review

Alserda, Dellaert, Swinkels and van der Lecq (2019) stated that group pension plans must demonstrate that participants' risk-taking attitudes are properly reflected in the plan's asset allocations. Anghel and Hașegan (2019) analyzed the main aspects regarding the profitability of pension funds in Romania. Anghelache and Anghel (2019) highlighted the importance of using statistical methods and models in economic studies. Anghelache (2008) is a reference work in the field of economic analysis. Barr and Diamond (2009) established a set of principles for the design of multi-objective pension systems and the analysis of the pension system as a whole, as well as the fact that different systems share risks differently and have different effects depending on generation and gender. Beetsma, Romp and Vos (2012) analyzed the feasibility and welfare consequences of a voluntary funded pension system and the sharing of risk between generations. Bouchet, Marchiori and Pierrard (2017) used an OLG model to propose a pension reform capable of supporting an entire retirement system, given the profound demographic changes. Cagetti (2003) addressed a number of issues related to accumulation and saving over a lifetime. Casey and Dostal (2013) sought to identify whether the participation of low-income people in voluntary pension schemes is justified. Chen, Beetsma, Ponds and Romp (2016) investigated the benefits of intergenerational risk sharing through privately funded pensions and public debt. Coile and Gruber (2007) used data from a survey to examine the impact of social security incentives on retirement behavior. Creedy and Guest (2008) provided a general equilibrium analysis applied to several alternative tax regimes for private pensions, their analysis focusing on the implications of this pension tax regime, but also of others, for intergenerational equity, the national level of living, labor supply, saving and social welfare. Draper, Westerhout and Nibbelink (2017) showed that the gain in welfare due to the division of risks between generations is higher than the cost of labor market distortions. An interesting topic is addressed by Foster (2015) on the elderly who do not have private pensions and the role of the state in providing pensions. Hairault, Langot and Sopraseuth (2010) presented empirical and theoretical evidence in favor of the view that the decision on the standard retirement age affects the employment of older workers in the period before retirement. Hașegan (2019) conducted a comprehensive

analysis of the Second Pillar of pensions in Romania. Iacob (2019a) analyzed the way and the extent to which the activity of economic entities is influenced by physical phenomena and processes. Iacob (2019b) applied statistical instrumentation in economic studies. Manchester (2010) referred to the impact of the type of pension plan on retirement age. Naczyk and Domonkos (2015) analyzed the main aspects that characterize existing private pensions in Eastern Europe. Novy-Marx and Rauh (2011) conducted a study in which they calculated the current value of pension debts of employees in the public system, using discount rates that reflect the risk of payment from the taxpayer's perspective. Thomas and Spataro (2016) analyzed the correlation between pension funds, the labor market and economic growth. Zandberg and Spierdijk (2010) sought to identify the extent to which pension funding and economic growth are correlated.

Data, results and discussions

In this article we analyzed the main indicators that characterize Pillar III of pensions (number of participants, depending on other criteria, market share, total asset value, net asset value), by using tables, graphs and statistical and econometrical methods., such as dynamic series and the index method.

According to the legal provisions in force, the participant in a voluntary pension fund is:

- the employee, the civil servant or the person authorized to carry out an independent activity;
- the person who carries out his activity in elective positions or who is appointed within the executive, legislative or judicial authority, during the mandate;
- member of a cooperative society, according to Law no. 1/2005 regarding the organization and functioning of the cooperation;
- another person who earns income from professional or agricultural activities.

Regarding the number of participants in voluntary pension funds in Romania, at the end of 2019 there were 501,123 people registered, increasing by 6.13% compared to the previous year.

Table 1. *Number of participants in voluntary pension funds in Romania, in the period 2007-2019*

Year*	No. of participants	Change y-o-y (%)**
2007	50,887	-
2008	150,745	196.23
2009	187,172	24.16
2010	221,605	18.40
2011	260,379	17.50
2012	292,146	12.20
2013	313,348	7.26
2014	346,452	10.56
2015	382,318	10.35
2016	410,241	7.30
2017	446,131	8.75
2018	472,167	5.84
2019	501,123	6.13

Source: Financial Supervisory Authority, accessed April 21, 2020, own systematization.
*End of December values.
**Own calculations.

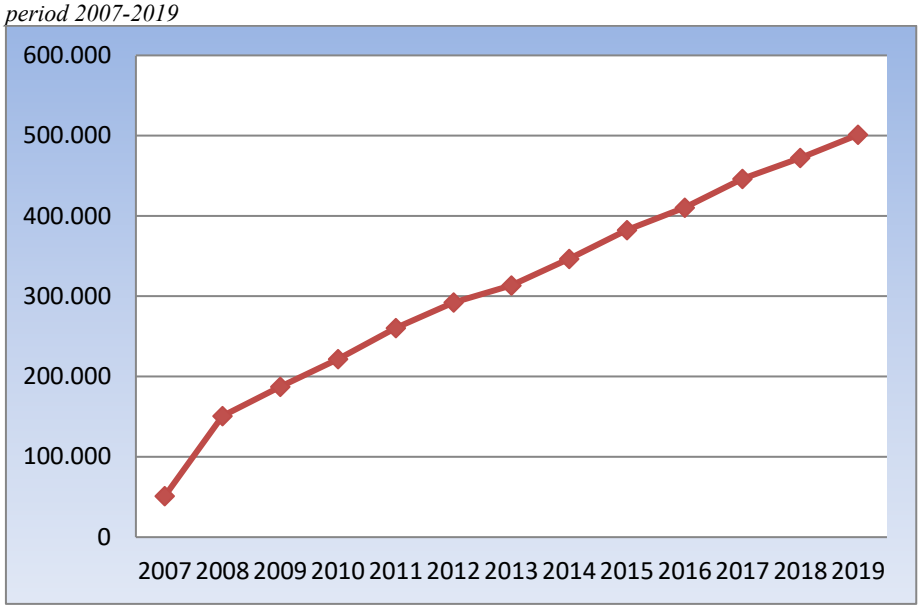
The number of participants in Pillar III has registered a continuous increase since the beginning of the operation of the system until now. The most significant increase compared to the previous year was recorded in 2008, i.e. an increase of 196% compared to 2007, but it should be noted that in 2007 the number of participants is only for seven months, taking into account that the beginning of the collection of contributions to the voluntary pension scheme was launched in June 2007.

Starting with 2009, the increases were, at the beginning, higher, after which, since 2012, the pace of the change has been slower, decreasing from one year to another. The exception is 2013, when the reduction was much steeper, of approx. 5 percentage points compared to the previous year. Since 2014, growth has continued, but at a slower pace. The declining trend of the growth rate is based on the lack of interest of certain categories potential participants, as well as their modest financial resources. However, in 2019, there were over half a million participants in voluntary pension funds, which represents about 10% of the total number of employees in the economy.

Analyzing the data from 2019 compared to 2007, there is an increase in the number of participants by 450,236 people, representing a rate of change of 884.78%. This significant increase is determined by the active promotion of Pillar III pensions, a context in which more and more people are convinced of the advantages that this system offers to increase incomes after retirement.

The graphical representation of the evolution of the number of participants in voluntary pension funds in Romania is highlighted in Figure 1.

Figure 1. *The evolution of the number of participants in the voluntary pension funds in Romania, in the period 2007-2019*



Source: Own representation based on data published by the Financial Supervisory Authority.

For a relevant analysis of the voluntary pension system, it is important not only the total number of participants, but also especially the profile of the participant, thus this aspect will be studied from the point of view of gender and age group.

Regarding the distribution by gender of the participants in the voluntary pension funds in Romania, throughout the period under analysis, it is found that the share of females is predominant. Exceptions are the years 2008 and 2009, specific to the period of the economic and financial crisis, when a number of jobs were lost, especially by women, thus the share of men marking a slight superiority.

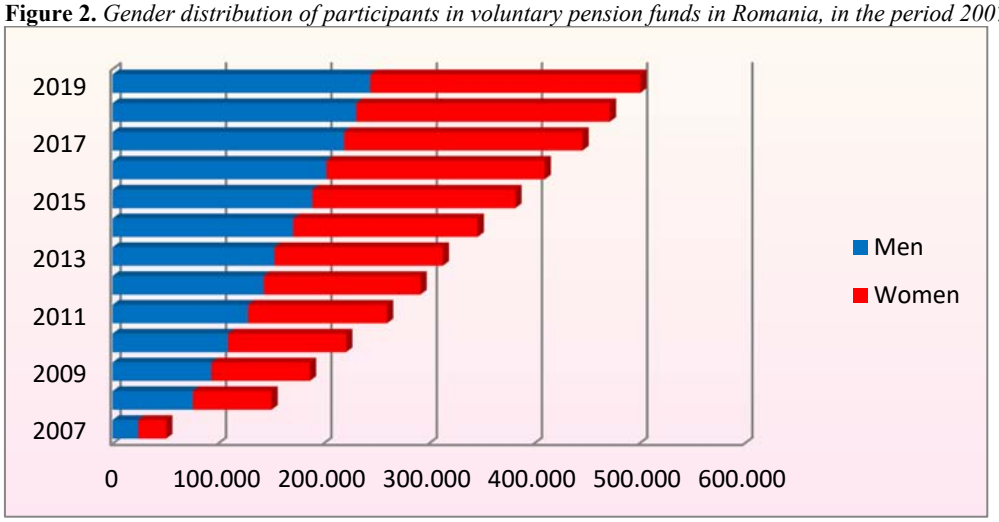
Table 2. *Gender distribution of participants in voluntary pension funds in Romania, in the period 2007-2019*

Year*	Women		Men	
	No. of participants	Share** (%)	No. of participants	Share** (%)
2007	26,520	52.12	24,367	47.88
2008	74,574	49.47	76,171	50.53
2009	93,503	49.96	93,669	50.04
2010	112,084	50.58	109,521	49.42
2011	131,891	50.65	128,488	49.35
2012	148,788	50.93	143,358	49.07
2013	159,730	50.98	153,618	49.02
2014	175,095	50.54	171,357	49.46
2015	192,817	50.43	189,501	49.57
2016	207,225	50.51	203,016	49.49
2017	226,498	50.77	219,633	49.23
2018	241,023	51.05	231,144	48.95
2019	256,711	51.23	244,412	48.77

Source: Financial Supervisory Authority, accessed April 21, 2020, own systematization.
*End of December values;
**Own calculations.

There is a balanced situation, the differences between the two genders being less than 1%, aspects highlighted in the graphical representation of the data in Figure 2.

Figure 2. *Gender distribution of participants in voluntary pension funds in Romania, in the period 2007-2019*



Source: Own representation based on data published by the Financial Supervisory Authority.

Regarding the distribution by age groups of the participants, in the whole analysed interval, the age group 16-29 years was the weakest represented. Regarding the other two groups, until 2013 inclusive, the age group 30-44 years registered the most participants in voluntary pension funds. The situation has changed starting with 2014, due to the fact that the new members were older, but also to the fact that after seven years, the active participants moved from the second group to the third. Thus, in the period 2014-2019, most participants are part of the group over 45 years, which records increases from one year to another. It should be noted that, in 2019, the number of participants in the third group reached 266,156, more than half of the total number registered at system level.

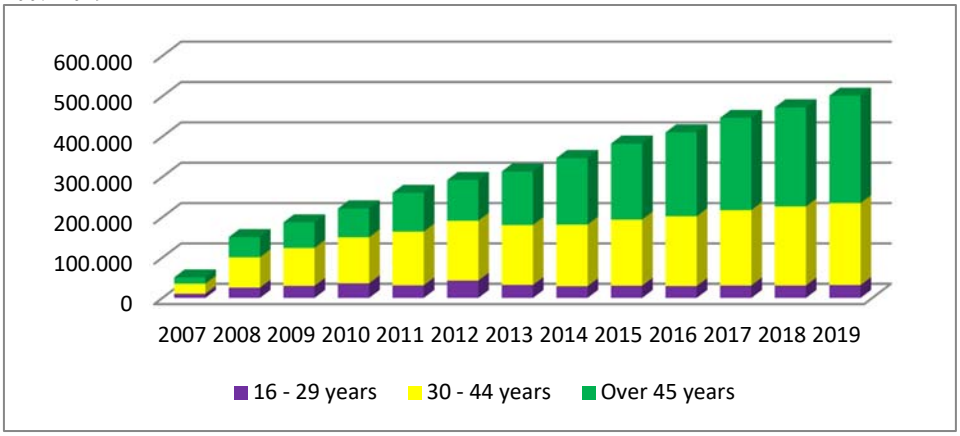
Table 3. *Distribution by age groups of participants in voluntary pension funds in Romania, in the period 2007-2019*

Year*	Age groups		
	16-29 years	30-44 years	Over 45 years
2007	10,247	25,103	15,537
2008	25,496	75,302	49,947
2009	29,842	93,982	63,348
2010	36,295	114,036	71,274
2011	31,183	133,129	96,067
2012	42,880	148,557	100,709
2013	32,117	148,564	132,667
2014	28,917	152,678	164,857
2015	30,293	163,867	188,158
2016	29,354	173,077	207,810
2017	30,769	186,834	228,528
2018	30,780	195,811	245,576
2019	31,710	203,257	266,156

*End of December values.
Source: Financial Supervisory Authority, accessed April 21, 2020, own systematization.

For a better understanding of the evolution of the distribution by age groups of the participants in the voluntary pension funds in Romania, from the beginning of the operation of the system until now, the data are presented graphically in Figure 3.

Figure 3. *Distribution by age groups of participants in voluntary pension funds in Romania, in the period 2007-2019*

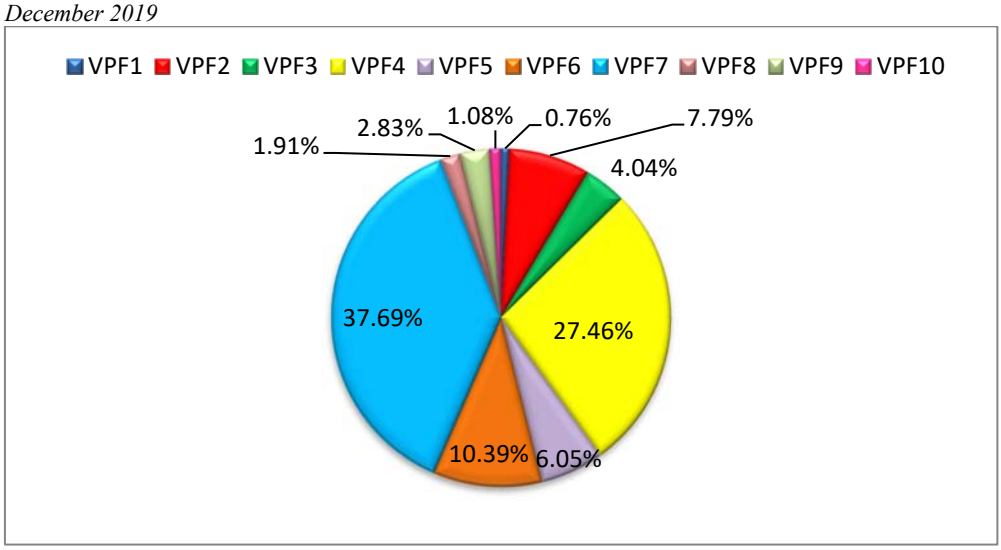


Source: Own representation based on data published by the Financial Supervisory Authority.

There are currently ten voluntary pension funds operating, of which eight are included in the medium risk category and two are characterized by a high degree of risk.

Regarding the market share of voluntary pension funds according to the number of participants, at the end of 2019, there is an inhomogeneous structure, two funds holding together a share of over 65%. These are followed by three funds with shares in the range of 6-10%, the remaining five funds having market shares below 5%. The data are represented graphically in Figure 4

Figure 4. *Market share according to the number of participants in voluntary pension funds in Romania, in December 2019*



Note: The voluntary pension funds are coded by authors with numbers from 1 to 10.
Source: Own representation based on data published by the Financial Supervisory Authority.

Regarding the allocation of resources by different asset classes, at the end of December 2019, the highest shares are related to government securities (56.42%), stocks (25.60%) and corporate bonds (8.39%). Investments in bank deposits, in December 2019 represented only 2.50% of total assets.

The assets of Pillar III were invested, in a proportion of over three thirds in Romania, while the difference in the European Union and the European Economic Area. Thus, fund managers invest in Romanian financial instruments such as government securities, bonds, deposits and Undertakings for the Collective Investment in Transferable Securities (UCITS). The foreign assets in which the pension management invests are financial instruments of issuers from the USA, the Netherlands, Germany, Luxembourg, Ireland, France and the United Kingdom or of the type of bonds issued by the EBRD, the EIB, etc. Of all foreign currency investments, the largest share is held by the euro, followed by the US dollar.

In accordance with the legal provisions in force, the administrator of the voluntary pension fund invests in the types of financial instruments presented in Table 4.

Table 4. *Types of the financial instruments and the maximum percentage in which they can be invested from the total value of the assets of the voluntary pension fund*

Type of the financial instrument	Maximum percentage that can be invested from the total value of the assets of the voluntary pension fund (%)
Money market instruments, including accounts and deposits in lei at a bank	20
Government securities issued by the Romanian Ministry of Public Finance, issued by member states of the European Union or belonging to the European Economic Area	70
Bonds and other securities issued by local public administration authorities in Romania or in EU Member States or belonging to the EEA	30
Securities traded on regulated and supervised markets in Romania, EU Member States or EEA	50
Government securities and other securities issued by third countries	15
Bonds and other securities traded on regulated and supervised markets, issued by local government authorities in third countries	10
Bonds and other securities of foreign non-governmental organizations, if these instruments are listed on authorized stock exchanges and meet the rating requirements	5
Participation certificates issued by collective investment undertakings in securities from Romania or from other countries	5

Source: Law no. 204/2006 on voluntary pensions, with subsequent amendments and completions; own systematization.

To these forms of investment are added others which are provided for by the rules adopted by the supervisory authority. The legislator also established the maximum percentages that are allowed to be invested in the assets of a voluntary pension fund, depending on the type of issuer of financial instruments, i.e. the administrator of an voluntary pension fund has the right to invest a maximum of 5% in a single company or in each of its assets, respectively a maximum of 10% of the assets of a voluntary pension fund may be invested in the assets of a group of issuers and their affiliates.

An indicator that needs to be analyzed is the total value of the assets of an optional pension fund, which is determined by summing the value of all the assets in its portfolio. These assets can be financial and cash instruments, resulting from the investment of the personal assets of the participants. By subtracting the obligations of the voluntary pension fund from the total value of its assets, the net value of the assets of the respective voluntary pension fund is obtained, according to the following calculation formula:

$$VAN_{(i)} = VAT_{(i)} - VO_{(i)}$$

where:
$VAN_{(i)}$ – the net assets value of the voluntary pension fund "i";
$VAT_{(i)}$ – the total assets value of the voluntary pension fund "i";
$VO_{(i)}$ – the value of the obligations of the voluntary pension fund "i".

The data registered by the voluntary pension system in Romania regarding the evolution of the value of the total asset and that of the net asset can be found in Table 5.

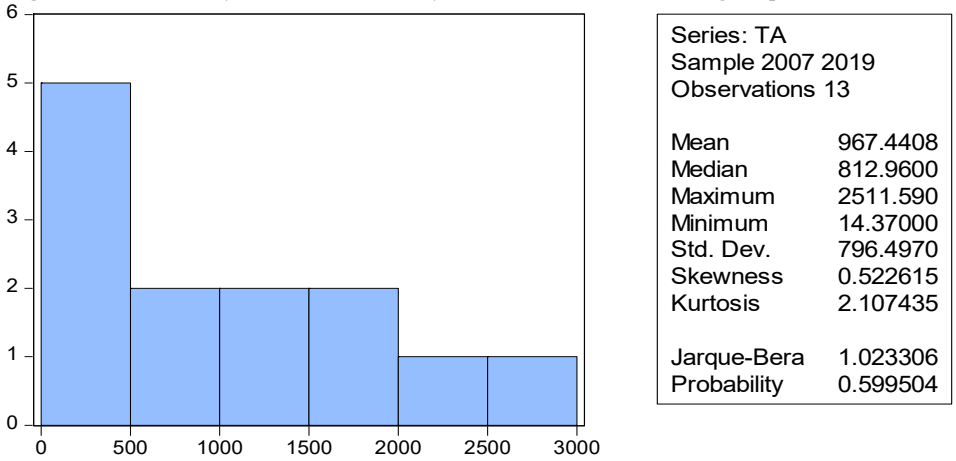
Table 5. *The value of the total assets and the value of the net assets related to the Pillar III of pensions in Romania, during the period 2007-2019*

Year *	Total assets (million lei)	Net assets (million lei)
2007	14.37	14.32
2008	84.42	84.29
2009	204.40	204.04
2010	328.61	328.0
2011	436.41	435.65
2012	599.97	598.92
2013	812.96	811.61
2014	1,041.52	1,039.79
2015	1,254.32	1,252.22
2016	1,504.07	1,501.66
2017	1,783.30	1,780.58
2018	2,000.79	1,997.47
2019	2,511.59	2,507.42

Source: Financial Supervisory Authority, accessed April 21, 2020, own systematization.
*End of December values.

The statistical tests applied for the data series regarding the evolution of total assets in the period under analysis reflected the fact that its average value is 967.44 lei. It can also be seen that the distribution of this data series does not correspond exactly to the normal distribution, a situation that cannot be considered to be very serious because it is specific to most data series in the financial field. The data are highlighted in Figure 5.

Figure 5. *The results of the statistical tests of the total assets series, during the period 2007-2019*



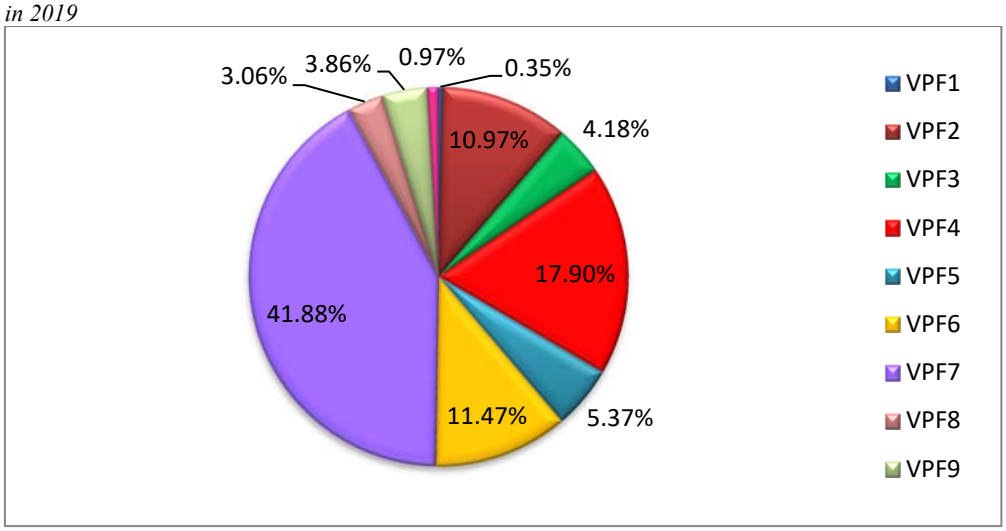
The statistics of the series show that the value of the total assets at the level of the voluntary pension system oscillated between a minimum of 14.37 million lei and a maximum of 2511.59 million lei. For the analyzed interval, the median value is 812.96 million lei.

The shape of a distribution is characterized by the flattening index (Kurtosis) and the asymmetry index (Skewness). The asymmetry index is positive or negative, as the distribution is asymmetric to the right or left. In the present situation, the analyzed series is characterized by positive asymmetry, as the Skewness index is positive, as a result the distribution is asymmetric to the right. Also, the positive value recorded by the Kurtosis index, but different from its reference level (3) shows that the series does not follow a

normal distribution, being leptokurtic, which implies a wide deviation of the extreme values from the average of the considered population.

The market share of voluntary pension funds in 2019 depending on the value of the net asset is presented in figure no. 6. As in the case of the market share according to the number of participants analyzed above, in this situation there is an inhomogeneous structure, the evolution being relatively similar, the same two funds above (7 and 4) holding together a share of about 60%. Five funds had market shares below 5%, and one fund had a very close share, respectively 5.37%. The other two funds had shares of about 11%.

Figure 6. *Market share of the voluntary pension funds according to the value of net assets in Romania, in 2019*



Note: The voluntary pension funds are coded by authors with numbers from VPF1 to VPF10.
Source: Own representation based on data published by the Financial Supervisory Authority.

Another important indicator that characterizes the activity of the voluntary pension system is the unit value of the net asset, which is calculated based on the calculation ratio below:

$$VUAN_{(t)} = \frac{VAN_{(t)}}{n_{u\,(t)}}$$

where:
$VUAN_{(t)}$ – the unit value of net assets on day "t";
$VAN_{(t)}$ – the net value of the fund's assets on day "t";
$N_{u(t)}$ – the number of the fund units on day "t".

In Table 6 are presented the data registered, in the period 2007-2019, by the ten voluntary pension funds that were active at the end of 2019. We mention that, over time, four more voluntary pension funds have been present and operated on the market, but they no longer work. Of these, one fund operated only two, respectively in 2009 and 2010, another fund operated in the period 2008-2012, the third fund operated for six years, in the period 2009-2014, and the second the fourth fund has been active for four years, since the beginning of the system's operation, respectively in the period 2007-2010.

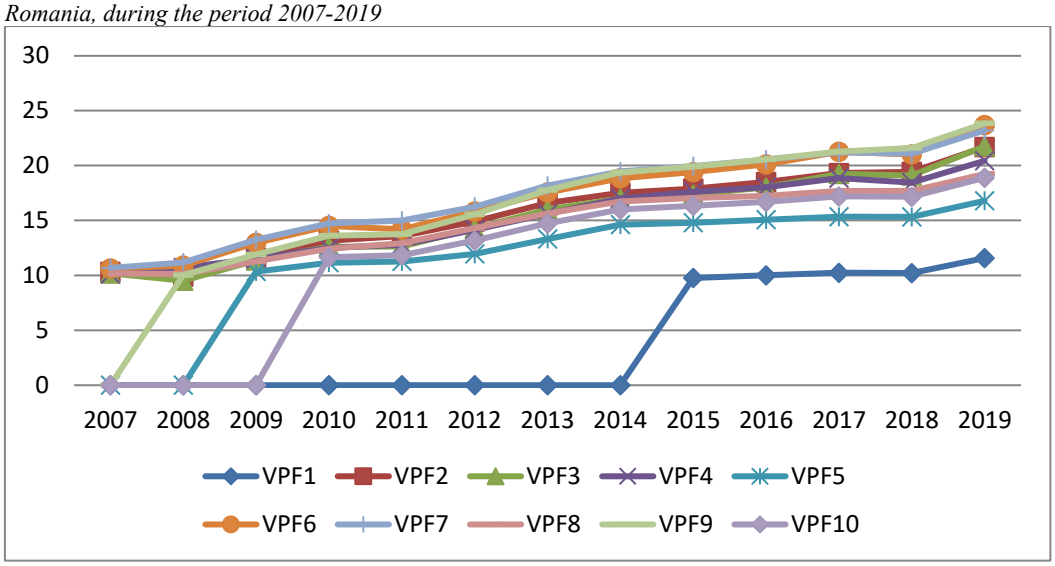
Table 6. *The unit value of net assets recorded by voluntary pension funds in the period 2007-2019 (lei)*

Year	VPF1	VPF 2	VPF3	VPF4	VPF5	VPF6	VPF7	VPF8	VPF9	VPF10
2007	0	10.3213	10.1817	10.1400	0	10.6300	10.6800	10.1678	0	0
2008	0	9.8958	9.5224	10.7104	0	10.8885	11.1692	10.1298	10.0218	0
2009	0	11.6064	11.3611	11.5216	10.3489	12.9631	13.2447	11.2748	11.9031	0.0000
2010	0	13.1625	12.6015	12.4956	11.1480	14.5023	14.7264	12.4264	13.6129	11.6495
2011	0	13.5844	12.6339	12.7935	11.2672	14.1857	14.9895	12.9240	13.7499	11.8344
2012	0	14.9085	14.2581	14.1510	11.9528	15.8129	16.2504	14.3020	15.5532	13.1648
2013	0	16.5809	15.9939	15.5936	13.3064	17.5494	18.1643	15.6303	17.7582	14.7249
2014	0	17.5145	16.9863	17.0080	14.6181	18.8455	19.4635	16.7241	19.3689	16.0049
2015	9.7625	17.8923	17.3522	17.6043	14.7949	19.4036	19.9407	17.0413	19.9089	16.3339
2016	10.0070	18.4979	18.0224	18.0191	15.0688	20.0998	20.5374	17.2340	20.5519	16.6913
2017	10.2360	19.3162	19.2421	18.8485	15.3411	21.2436	21.1984	17.6915	21.2703	17.1877
2018	10.2118	19.4265	19.0879	18.4423	15.3262	21.0142	21.0781	17.6884	21.5917	17.1582
2019	11.571807	21.685602	21.758347	20.432636	16.792615	23.690274	23.207055	19.245100	23.850858	18.885176

Note: The voluntary pension funds are coded by authors with numbers from VPF1 to VPF10; values recorded on the last working day of December.

The study of the presented data shows that each fund analyzed recorded the maximum unit value of net assets in 2019. Of these, three of the funds recorded the highest values at system level, respectively over 23 lei, and three other funds have registered VUAN of over 20 lei. The graphical representation of this indicator in the period 2007-2019 is highlighted in Figure 7.

Figure 7. *The evolution of the unit value of the net asset registered by the voluntary pension funds in Romania, during the period 2007-2019*



Note: The voluntary pension funds are coded by authors with numbers from VPF1 to VPF10.
Source: Own representation based on data published by the Financial Supervisory Authority.

Over the entire time period under analysis, it is found that all funds, with very few exceptions, recorded annual increases in the net asset value.

Until the end of 2019, in Romania, the value of assets paid from voluntary pension funds was 243.4 million lei, structured according to the data in Table 7. Starting with April 2018, participants can request the net asset also in the form of installments.

Table 7. *The value of assets paid from Pillar III funds*

	Single payments	Installment payments	Total
Death	14,279,822	634,175	**14,913,997**
Invalidity	1,395,141	41,846	**1,436,987**
Pension	202,355,518	24,717,806	**227,073,324**
Total	**218,030,481**	**25,393,827**	**243,424,308**

Source: own calculations based on data published by the Financial Supervisory Authority, accessed April 21, 2020, own systematization.

If the participant acquires illnesses that no longer allow the resumption of activity, he will receive a disability pension, in which case he can obtain the amount in his account in the form of a single payment or installments for a maximum of 5 years, if the asset his staff is not at least equal to the amount necessary to obtain the minimum optional pension provided by the legislation in force. We mention that the types and conditions for granting the private pension are included in the provisions of the Draft Law on the organization and functioning of the private pension payment system, which is currently in the process of public debate.

In the case of death of the participant, the law provides for the following situations of payment of the voluntary pension, which are presented below:

- if the death of the participant took place before the application for an optional pension was submitted, then the amount in the account will be paid to the beneficiaries, under the conditions and in the amount established by the individual act of accession and by the act of succession;
- if the participant has died after opening the right to an optional pension, then:
  - the related amounts will be paid to the nominated person or
  - if he has not chosen a type of voluntary pension with the survivor component, the related amounts will be paid to the beneficiaries.

Conclusions

The introduction of voluntary pensions was an important stage in the pension reform in Romania, aiming to reduce the pressure on the public pension system, by ensuring future retirees a private pension, which complements the public one.

The flexibility offered by the voluntary pension system is very high, the participant being the one who decides the pension fund or funds to which he contributes, the level of the contribution, as well as the contribution period. According to the law, the contributions to a voluntary pension fund are withheld and transferred by the employer, at the same time as the compulsory social insurance contributions, or by the participant, monthly, directly to the account of the pension fund specified in the individual act of adhesion.

Another advantage of Pillar III is the tax deductibility, which amounts to 400 euros / year for each employee. For the employer, the deductibility is integral to the calculation of the profit tax, thus constituting an efficient management tool, by offering to the employees a private pension packages for which they benefit from tax deductions.

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*** Law no. 204/2006 on voluntary pensions, with subsequent amendments and completions.

*** Norm of the Financial Supervision Authority no. 28/2017 regarding the use of the net personal assets of the participant in a voluntary pension fund.

*** Norm of the Financial Supervision Authority no. 11/2011 regarding the investing and evaluation of the assets of the private pension funds.

*** www.asfromania.ro – the Financial Supervisory Authority website, Private pension statistics.

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An approach to measuring credit risk in a banking institution from Romania

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Abstract. *Studying the behavior of banking systems both at the macroeconomic level and with the external environment, as well as at the level of financial institutions associated with their dynamic character, in the current context is in the attention of all specialists. Risk quantification is an important aspect in making strategic decisions regarding maintaining financial stability and maintaining a high level of performance of any banking institution. The complexity of current financial systems around the world makes it difficult to create indicators that accurately assess the systemic risk of any institution. This paper has shown that an incorrect credit risk assessment can lead to a decrease in the performance of banking units and can generate a systemic shock that can affect both financial networks and the national or global economy.*

Keywords: credit risk, banking, financial stability, expected credit loss.

JEL Classification: G17, G21, G28, G32.

1. Introduction

In recent years, banking accidents have led to a significant disruption of the financial system around the world. Even the economic crisis of 2008 has shown that we need to better understand financial networks and systemic risk.

The complexity of current financial systems around the world makes it difficult to create indicators that accurately assess the systemic risk of any institution. One of the most important issues that has been highlighted in recent years has been the interconnection of banks in the financial network. This has led to an increase in the likelihood of contagion, a scenario in which small shocks, which initially impact only a part of the institutions in the system, spread throughout the network. Another very important aspect in choosing the decision-making strategies at bank level is the correct quantification of the credit risk. (Nica et al., 2018)

Taking into account recent events in the financial system such as the appreciation of the Swiss franc against the euro and the dollar which has caused great difficulties to the economy, national and international companies, including people, or the phenomenon of "Brexit", studying methods to identify early effects affects an entire system, by diminishing negative events, is very important.

The complexity of current financial systems around the world makes it difficult to create indicators that accurately assess the systemic risk of any institution. One of the most important issues that has been highlighted in recent years has been the interconnection of banks in the financial network. This has led to an increase in the likelihood of contagion, a scenario in which small shocks, which initially impact only a part of the institutions in the system, spread throughout the network. (Nica and Chiriță, 2020)

2. Literature review

The Swedish Central Bank, the first central bank in the world to set up a financial stability department and published its first financial stability report in 1998, defined financial stability as "the safe and efficient operation of the entire payment system" and considered that the most important pillars that ensure balance are:

- A regulatory framework composed of regulations and decrees, complemented by concrete risk assessment actions and inspections on irregularities of individual institutions.
- Another important pillar is the timely monitoring of the central bank on systemic risk.
- Crisis management measures is another important part. All pillars require the division and cooperation of central banks and supervisory departments.

Dexu He, professor from the University of Finance and Economics in China, argues that in the process of developing economic theory, the stability of the financial system has been the focus of economists around the world. Studies on this topic can be divided into two categories: the analysis of the instability of the monetary economy from the Marxist(1) perspective, on the one hand, and the various studies on the financial stability of economists, on the other.

Duisenberg (2001), the first president of the European Central Bank (ECB), believed that although there is no coherent definition of financial stability, there is some common consensus: that under the condition of financial stability, every component of the financial system can its economic function freely.

Padoa-Schioppa (2003), a former member of the executive board of the European Central Bank, considered that financial stability means that the financial system is able to withstand economic shocks, avoid the accumulation of contradictions, continue to mobilize economies to invest in sectors with high efficiency and to achieve payment and settlements.

The financial system in that statement includes financial intermediaries, formal and informal financial markets, payment and settlement systems, technical support platforms, financial laws and regulations and financial regulators. Thus, the systematic study of the stability of the financial system could be carried out through studies on the configuration of savings, disclosure and treatment of information, risk transfer behaviors of brokers, as well as payment and settlement methods.

3. Conceptual dimensions of banking risk

Since the onset of the credit crunch in the United States and Europe in 2006, risk managers have learned valuable lessons about quantifying, assessing, and the importance of properly measuring bank risk. The field of risk management has undergone an enormous change in the last 50 years, and the pace of change is accelerating, largely due to the latest crises and speculative bubbles that have occurred so far. The events of the last decade have also changed the way of thinking, good practices and definitions of risk management. Below I will mention some of the most significant definitions of risk management.

Risk management is a discipline that clearly indicates the risk management and returns of each major strategic decision at both institutional and transactional level. Risk management discipline shows how to change the strategy to align the compensation of long-term and short-term risk profitability in an enterprise. This discipline includes several subdomains that are inseparable and can overlap. We mention some of the most important: credit risk, market risk, asset and liability management, liquidity risk, methodology for calculating and allocating capital, operational risk and performance measurement. (Arianminpathy et al., 2012)

In general, banking risks fall into three main categories: financial, operational and environmental risks. Financial risks are classified into 2 categories: traditional banking risks and treasury risks. Traditional banking risks include balance sheet structure, income statement, credit and solvency risks. These can lead to huge losses for a bank if not managed properly. Treasury risks include currency risks, interest rate risk, market risk and liquidity risk. Financial risks are subject to complex interdependencies, which can significantly increase the bank's overall risk profile. For example, banks that trade foreign currencies against the national currency are subject to currency risk, but also to liquidity and interest rate risk if the bank does not manage open foreign exchange positions well.

Operational risks are related to the bank's general business processes and their potential impact, in compliance with banking policies and procedures, internal systems and technologies, information security, mismanagement measures, fraud identification and interest in business continuity concerns. Another aspect of the description of operational risk includes governance, strategic management planning, and the organizational structure of the bank, internal resource management, product development, and the approach to acquiring new customers.

Environmental risks are analyzed and described in the context of the bank's business environment, including macroeconomic and policy concerns, legal and regulatory factors, and the overall infrastructure of the financial sector and the payment systems of the jurisdictions in which it operates. Environmental risks encompass all classes of exogenous risks that could jeopardize the bank's operations or undermine its ability to continue to operate if they materialized.

The economic literature has used the term systemic risk in the context of financial systems for many years. However, Kaufman, Scott and Taylor argue that there is still no generally accepted definition of the concept of systemic risk. Thus, we will list some proposed definitions for systemic risk.

Kaufman describes systemic risk as the probability that accumulated losses result from an event that triggers a series of successive losses along a network of institutions or markets comprising a system, i.e. systemic risk is the risk of a reaction in such as the domino effect in interconnected domains.

4. Credit risk assessment in a banking institution

The Commercial Bank has been viewed in the past from the perspective of two major functions it held: setting up deposits and granting loans. Meanwhile, the bank has developed quite a lot and offers much more complex services and important roles in an economic system.

In a bank, loans for the individual segment are classified into:

- Unnamed, treasury loans, no mortgage, unsecured: personal needs credit, credit card and overdraft (overdraft).
- Mortgages, guaranteed: mortgages, real estate, mortgage.

The loan is an asset and represents an amount of money that the bank grants to an individual, called a customer. Loans without a mortgage are granted as a loan for a period of time, at least a few months, maximum 5 years.

From the beginning, the bank sets an annual interest rate level, called the APR (annual effective interest rate).

The interest can be fixed for the whole period of the credit agreement or variable. It consists of a fixed bank margin and the reference index for the RON currency, at 3 months, called ROBOR 3M. When the interest rate is fixed, the bank no longer takes into account the evolution of ROBOR and assumes the risk that ROBOR will increase a lot. This risk is

mitigated from the outset by setting a higher than variable fixed interest margin. During the contractual development of the credit line, the bank monitors the monthly payments made by customers.

The most significant risk in this process is the credit risk which means that a customer who has accessed a loan no longer pays the monthly installments. Depending on the default period of the loan, it can be marked as default (in a state of default). Delays in payment are reported to the Credit Bureau.

Probability of default is a key risk parameter used in the context of credit risk management. It is a measure that assigns a numerical value between 0 and 1 to the probability of a properly defined credit event (such as default, bankruptcy), within a specified time horizon. In the internal valuation approach, the probability of default of a counterparty is estimated over a period of one year.

Loss given default (LGD) is the share of an asset that is lost if a debtor defaults. Estimating banks with LGD records is difficult because, fortunately, bank failures are very rare. Moreover, analyzing the actual losses of a bank can be very complicated, because they depend on the chosen time horizon. In fact, the first effect of the counterparty is the immediate imbalance of financial flows that induce the need to rebalance by reducing the issuance of new loans or by selling assets.

In a longer horizon, the default value will be recovered almost partially with the fraction of the residual assets of the unpaid company, and a certain value returns to the bank balance sheet. Because this process takes time, it is not easy to measure the actual effect of the default values, as recovery is usually recognized a few years later than the default, so the effect cannot be directly related to the cause.

Banks determine credit losses by analyzing the loan not repaid definitively. Quantifying losses can be complex and requires an analysis of several variables. As I said, LGD captures the uncertainty about the real loss that will be realized following a credit event. It is calculated as the ratio of the loss to an exposure due to non-payment of a counterparty and the outstanding amount of non-payment.

An organization may use risk-taking, risk avoidance, risk retention, risk transfer, or any other strategy or combination of strategies in order to have proper management of future events. The main objective of risk management is to maximize profitability while maintaining acceptable levels of risk without minimizing losses.

The bank needs to define an acceptable level of risk and must work to maintain it. The concept of reducing risk to zero is like not starting a certain business. Instead, taking unnecessary risks will diminish long-term profitability.

In order to build the framework for the exercise proposed by this case study, I need to present the following general information.

When a customer goes to a bank to make a credit application he is registered in a system and receives several questions to be given a credit simulation. After the simulation, the client receives a score. When accessing the loan, the client is associated with a client rating,

in my case study will be marked with AAA + best rating and C the rating associated with a client in default.

In the table below, I assumed the following information about a credit product, which I called Product A, and simulated a number of customers, probability of default, default loss, gross exposure, and default exposure for each rating in part. The table below contains only the ratings from AAA+ to B-, considered a database with customers who have not yet gone into default, but have a certain associated probability, established based on late payment.

Table 1. *General information on the main risk models*

Product	Rating	LGD	PD	Number of customers	Exposure	EAD
A	BBB+	0.6	0.15%	40,000	1,100,000,000	1,100,000,000
A	BBB	0.6	0.29%	70,000	1,500,000,000	1,500,000,000
A	BBB-	0.6	0.56%	50,000	1,200,000,000	1,200,000,000
A	BB+	0.6	1.08%	20,000	600,000,000	600,000,000
A	BB	0.6	2.04%	18,000	500,000,000	500,000,000
A	BB-	0.6	4.16%	15,000	400,000,000	400,000,000
A	B+	0.6	6.10%	9,000	200,000,000	200,000,000
A	B	0.6	12.10%	4,000	80,000,000	80,000,000
A	B-	0.6	30.49%	6,000	150,000,000	150,000,000

Source: Authors' own research results.

According to the Regulation issued by the European Parliament on 26 June 2013, number 575, the calculation formula for risk-weighted exposure (RW)[2] is as follows:

$$RW = \left[LGD * N * \left(\frac{1}{\sqrt{1-R}} * G(PD) + \sqrt{\frac{R}{1-R}} * G(0{,}999) \right) - LGD * PD \right] * * \frac{1 + (M - 2.5) * b}{1 - 1.5 * b} * 12.5 * 1.06$$

R[3] represents the correlation coefficient and is calculated according to the same regulation 575/2013.

$$R = 0{,}12 * \frac{1-e^{-50*PD}}{1-e^{-50}} + 0{,}24 * (1 - \frac{1-e^{-50*PD}}{1-e^{-50}});$$

b – represents an adjustment coefficient calculated on the basis of the maturity of the credit product according to the following formula:

$b = (0{,}11852 - 0{,}05478 * \ln(\mathrm{PD}))^2$ and M represents the maturity of the asset.

Thus, we obtained the following values for the correlation coefficient corresponding to each rating:

$$R_{BBB+} = 0{,}03 * \frac{1-\exp(-30*0{,}15\%)}{1-\exp(-30)} + 0{,}16 * \left(1 - \frac{1-\exp(-30*0{,}15\%)}{1-\exp(-30)}\right) = 0{,}154;$$

$$R_{BBB} = 0{,}03 * \frac{1-\exp(-30*0{,}29\%)}{1-\exp(-30)} + 0{,}16 * \left(1 - \frac{1-\exp(-30*0{,}29\%)}{1-\exp(-30)}\right) = 0{,}149;$$

$$R_{BBB-} = 0{,}03 * \frac{1-\exp(-30*0{,}56\%)}{1-\exp(-30)} + 0{,}16 * \left(1 - \frac{1-\exp(-30*0{,}56\%)}{1-\exp(-30)}\right) = 0{,}139;$$

$$R_{BB+} = 0{,}03 * \frac{1-\exp(-30*1{,}08\%)}{1-\exp(-30)} + 0{,}16 * \left(1 - \frac{1-\exp(-30*1{,}08\%)}{1-\exp(-30)}\right) = 0{,}124;$$

$$R_{BB} = 0{,}03 * \frac{1-\exp(-30*2{,}04\%)}{1-\exp(-30)} + 0{,}16 * \left(1 - \frac{1-\exp(-30*2{,}04\%)}{1-\exp(-30)}\right) = 0{,}100;$$

$$R_{BB-} = 0{,}03 * \frac{1-\exp(-30*4{,}16\%)}{1-\exp(-30)} + 0{,}16 * \left(1 - \frac{1-\exp(-30*4{,}16\%)}{1-\exp(-30)}\right) = 0{,}067;$$

$$R_{B+} = 0{,}03 * \frac{1-\exp(-30*6{,}10\%)}{1-\exp(-30)} + 0{,}16 * \left(1 - \frac{1-\exp(-30*6{,}10\%)}{1-\exp(-30)}\right) = 0{,}050;$$

$$R_{B} = 0{,}03 * \frac{1-\exp(-30*12{,}10\%)}{1-\exp(-30)} + 0{,}16 * \left(1 - \frac{1-\exp(-30*12{,}10\%)}{1-\exp(-30)}\right) = 0{,}033;$$

$$R_{B-} = 0{,}03 * \frac{1-\exp(-30*30{,}49\%)}{1-\exp(-30)} + 0{,}16 * \left(1 - \frac{1-\exp(-30*30{,}49\%)}{1-\exp(-30)}\right) = 0{,}030.$$

Risk-weighted assets (RWA) are used by a banking institution to determine the minimum amount of capital that the institution must hold so as to reduce the risk of insolvency. Based on the assessment of the risk associated with each banking asset, the minimum capital requirement is determined.

The risk-weighted value of a banking institution is calculated according to the following formula:

$RWA = RW * EAD$, where EAD represent exposure at default.

Table 2. *RWA calculations*

Rating	EAD	RW	RWA (expressed in RON)
BBB+	1,100,000,000	4.483369	4,931,706,099
BBB	1,500,000,000	5.653243	8,479,863,834
BBB-	1,200,000,000	6.794119	8,152,942,899
BB+	600,000,000	7.595417	4,557,249,989
BB	500,000,000	7.684116	3,842,058,086
BB-	400,000,000	6.812735	2,725,094,104
B+	200,000,000	6.124765	1,224,952,936
B	80,000,000	5.333471	426,677,713
B-	150,000,000	5.048754	757,313,033

Source: Authors' own research results.

According to the calculation in the table above, for asset A, I value a total risk-weighted amount of RON 35,097,858,696. This value was calculated following a simulation based on own knowledge gained from banking work experience and may represent the risk-weighted value for a portfolio of a large bank on the Romanian market, from the top 6 banks ranked in terms of asset view.

Below I will calculate the expected value of the loss following asset A, in English Expected Credit Loss (ECL). It is calculated according to the following formula:

$ECL = PD * LGD * EAD$, formula that we rewrite according to a stochastic dynamic system as: $ECL(t) = PD_{t-1,t} * LGD_t * EAD_t$

$ECL_A = ECL_{BBB+} + ECL_{BBB} + \cdots + ECL_{B-} = 68{,}193{,}000\ RON.$

The expected loss over the life of the credit product is calculated according to IFRS9 standards, being a financial calculation tool that replaces the IAS39 standard, emphasizing the depreciation requirements, in addition to those of recognition and measurement. The expected credit loss model applies to debt instruments recorded at amortized cost or fair value through other comprehensive income such as loans, debt securities or financial collateral agreements. Depending on the occurrence of a significant increase in credit risk, banking institutions must forecast and calculate a provision for expected credit losses over 12 months or over the life of the loan.

The IFRS9 financial standard is based on 3 scenarios in the calculation of the ECL value: positive scenario, with an associated weight of 25%, average scenario with a weight of 50% and negative scenario with a weight of 25%.

From a statistical point of view, for the credit risk assessment, risk assessment models are built from the point of view of PD, LGD. In the construction of these models, certain aspects are taken into account, such as the stability of the population, the power of discrimination, the accuracy of the data, etc. Population stability assesses whether there are recent changes in the distribution of asset accounts by rating classes, by comparison with the development sample of the model.

The power of discrimination assesses the model's ability to differentiate exposures in terms of their risk characteristics. Accuracy assesses risk estimates by comparing them with historical observations and analyzes whether the differences between them can be explained by the data scattering property or whether they indicate a systemic underestimation.

Each statistical test performed is verified by the traffic light technique and each color is assigned a value or a range of values in which the test results can be found.

In the case of analyzing an evaluation model such as the Probability of Default model, its statistical testing is performed. The performance of the model (stability and concentration of the population), the power of discrimination and the accuracy of the model are tested. Next, I will present each test area and show how it is applied in a banking model and what statistical tests are used for each assessment tool.

Population stability index is a very important concept in model management. It is crucial to monitor whether the current population has changed from the original population used during the development of a model. For example, the distribution of credit scores may change and the model may still be valid or there may be changes in the population such as changes in the economic environment, political changes, strategic changes in business or even changes in the banking regulatory framework.

Pruitt (2010) affirmed that the Population Stability Index (PSI) is one of the widely used model monitoring values, which measures the difference between the model development sample and the current sample for which the model is used and therefore is implemented in several statistical packages.

PSI can be calculated according to the following formula:

$$PSI_{t,t-a} = \sum_{i=1}^{n} (p_i - q_i) * \ln\left(\frac{p_i}{q_i}\right)$$

Table 3. *PSI Calculations*

1	2	3	4	5	6
Credit score	**Development base**	**Current base**	**(2) - (3)**	**ln ((2) / (3))**	**PSI**
A	0.11	0.09	0.02	0.20	0.0040
B	0.34	0.29	0.05	0.16	0.0080
C	1.21	1.19	0.02	0.02	0.0003
D	3.23	2.96	0.27	0.09	0.0236
E	5.71	5.02	0.69	0.13	0.0889
F	7.15	7.13	0.02	0.003	0.0001
G	9.27	9.19	0.08	0.01	0.0007
H	12.81	12.69	0.12	0.01	0.0011
I	4.72	4.7	0.02	0.004	0.0001

Source: Authors' calculation.

The above values were simulated for each grade and is based on over 30,000 observations/ grade.

$$PSI = 0.02 * 0.2 + 0.05 * 0.16 + 0.02 * 0.02 + 0.27 * 0.09 + 0.69 * 0.13 + 0.02 * 0.003 + 0.08 * 0.01 + 0.12 * 0.01 + 0.02 * 0.004 = 0.1266$$

So $PSI = 12.66\%$

According to the literature (Yurdakul, 2018), the traffic light technique for the population stability index is as follows:

PSI			
	< 10%	(10% - 25%]	>25%

Evaluating the PSI value obtained above, it can be seen that it falls under the scenario related to the color yellow. Certain conditions may be imposed on the existing model and its redevelopment may be required.

The PSI horse method used is the one proposed by Kullback-Liebler. The two distributions p_i and q_i are considered the distributions of a random variable in discrete time, which we can call X. The literature for explaining and analyzing the stability index is not extremely rich, and the calculation formula is called the Kullback-Liebler divergence being noted in the research conducted by Wu and Olson (2010), Yousefi et al. (2016) or Lin (2017).

Another test that can be used to assess population stability is the Herfindahl index. It is defined by the following formula:

$$Herfindahl = \frac{n * \sum_{i=1}^{n} z_i^2 - 1}{n - 1}$$

where n represents the number of bands that include the non-default accounts and z_i - the distribution of the accounts of the model for the investigated year. The specialized literature proposes the following evaluations according to the traffic light technique:

Herfindahl			
	< 10%	(10% - 20%]	>20%

As you can see, for the model that validates according to the statistical results on green it has the same value as the one in the PSI table. The rigor is a bit higher for the next 2 evaluations, everything that is over 20% being framed as a model that needs to be redeveloped urgently. We will calculate the Herfindahl index for the following example:

Table 4. *Herfindahl calculation*

1	**2**			
Credit score	**Number of account (nr_cont)**	z_i	z_i^2	**Herfindahl**
A	11	0.02%	0.000004%	
B	682	1.24%	0.015376%	
C	5730	10.42%	1.085385%	
D	9279	16.87%	2.846276%	
E	10630	19.33%	3.735435%	
F	10571	19.22%	3.694084%	
G	9830	17.87%	3.194344%	
H	6164	11.21%	1.256030%	
I	2103	3.82%	0.146202%	
Total	55000		15,97%	

Source: Authors' calculation.

$$z_i = nr_{cont\,i}/sum(nr\_cont)$$

$$z_A = \frac{11}{55000} = 0{,}02\%$$

$$Herfindahl = \frac{9 * 15{,}97\% - 1}{8} = 5{,}47\%.$$

The value of the Herfindahl index is <10% which means that the model is still valid for the distribution of accounts above. This means that these accounts are well distributed on the scoring bands from A to I.

Another statistically important tool in evaluating a model is the power of discrimination. In the context of credit risk analysis, the power of discrimination is the ability to discriminate ex-ante between default and non-default accounts. The following statistical tests can be used to evaluate this tool:

- Gini index.
- Kendall's Tau.
- Somers'D.

From the point of view of the Basel II agreement, the statistical instruments for measuring the discriminatory power of a credit rating system represent a major quantitative test, as well as the calibration assessment test, which is also necessary to assess the adequacy of capital requirements.

The Gini Index, developed in 1912 by the Italian statistician, ideologue, demographer Gini Corrado, is a statistical measure of distribution, conceived as a gap of economic inequality, measuring the distribution of income among a population. It can take values between 0% and 100%, the extremes expressing either a perfect equality or a perfect inequality for the upper limit. In the case of credit risk assessment, the Gini index measures how good-paying and bad-paying customers are clustered. Thus, I will propose the following portfolio of accounts:

Table 5. *Distribution of the portfolio of accounts*

Credit Score	Good Customers	Bad Customers	Increased cumulative frequency of good customers	Increased cumulative frequency of bad customers	Frequency cumulative share. Good customers	Frequency cumulative share. Bad customers
A	210	128	210	128	1.53%	3.35%
B	304	38	514	166	3.75%	4.35%
C	316	173	830	339	6.06%	8.88%
D	332	90	1162	429	8.48%	11.24%
E	287	48	1449	477	10.58%	12.50%
F	381	43	1830	520	13.36%	13.62%
G	338	38	2168	558	15.83%	14.62%
H	455	31	2623	589	19.15%	15.43%
I	288	22	2911	611	21.25%	16.01%
Total	2911	611	13697	3817	100%	100%

Source: Authors' calculation.

We will name the class of customers who pay their loan installments on time, so there are no delays, in good customers and in bad customers those who are part of the cluster of individuals who have registered various delays in paying debts. I will calculate the Gini index to measure the power of discrimination for each score band according to the following formula:

$$I_{Gini} = 1 - \sum_{i=1}^{n} (CB_i + CB_{i-1}) * (CR_i - CR_{i-1})$$

The above formula is generalized according to the following formula proposed by Yitzhaki (1983) where:

I_{Gini} – represents the Gini index.

CB_i – represents the values of the share of the increasing cumulated frequency of the good customers related to a score band i and CB_{i-1} is related to the previous band.

CR_i – represents the values of the weight of the increasing cumulated frequency of bad customers related to a score band i.

Then:

$$I_{Gini} = 1 - (1{,}53\% * 3{,}35\% + 5{,}29\% * 1\% + 9{,}81\% * 4{,}53\% + 14{,}54\% * 2{,}36\% + 19{,}06\% * 1{,}26\% + 29{,}94\% * 1{,}13\% + 29{,}19\% * 1\% + 34{,}98\% * 0{,}81\% + 40{,}40\% * 0{,}58\%) = 97{,}69\%$$

The value of the Gini index is 97.69%, which expresses the fact that the distribution of accounts tends towards a perfect inequality between good customers and bad customers, which means in terms of credit risk that there is a great power of discrimination for the distribution of accounts on the score bands formed.

5. Conclusions

The expected loss over the life of the credit product is calculated according to IFRS9 standards, being a financial calculation tool that replaces the IAS39 standard, emphasizing the depreciation requirements, in addition to those of recognition and measurement. The expected credit loss model applies to debt instruments recorded at amortized cost or fair value through other comprehensive income such as loans, debt securities or financial collateral agreements. Depending on the occurrence of a significant increase in credit risk, banking institutions must forecast and calculate a provision for expected credit losses over 12 months or over the life of the loan.

From a statistical point of view, for the credit risk assessment, risk assessment models are built from the point of view of PD, LGD. In the construction of these models, certain aspects are taken into account, such as the stability of the population, the power of discrimination, the accuracy of the data, etc. Population stability assesses whether there are recent changes in the distribution of asset accounts by rating classes, by comparison with the development sample of the model. The power of discrimination assesses the model's ability to differentiate exposures in terms of their risk characteristics. Accuracy assesses risk estimates by comparing them with historical observations and analyzes whether the differences between them can be explained by the data scattering property or whether they indicate a systemic underestimation.

In our opinion, credit risk assessment is one of the most sensitive and important issues at the level of a financial institution. An underestimation of the probability of default, the instability of the analyzed population or in general an incorrect assessment of a credit risk model can lead to a significant increase of the portfolio of clients with default status. Therefore, it can become a systemic effect within the bank, but with an impact on other institutions or other banks as well.

Notes

(1) The Marxist perspective represents the fact that certain notions and concepts can be described at a theoretical level, which can be influenced by certain political-economic or legislative practices, having perhaps even totally different meanings. The main founder of Marxism was Karl Max, a German philosopher and economist. The perspective was strengthened by the collaboration of the German economist with Friedrich Engels, together developing the communist theory.

(2) According to Regulation 575/2013, p. 97, available online at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:176:0001:0337:RO:PDF

(3) According to Regulation 575/2013, p. 97, available online at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:176:0001:0337:RO:PDF

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Study on the evolution of tourism and perspectives

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Abstract. *Tourism is one of the important branches of the national economy in most countries, but first of all it is important for Romania. In the process of restructuring and reorganization of the national economy after 1990, unfortunately they did not seek to maintain areas in which Romania had sufficient expertise, experience gained to remain priority areas for us, but also for the European Union or more broadly and it has reached a situation where the industry has been practically destroyed, agriculture is left to chance and moreover, no support is given for the development of certain branches.*
Tourism is the one in which Romania, naturally having a proportional structure and a very important historical past, has possibilities to develop a large-scale tourism. Agrotourism, traditional resorts, privatization in the field of tourism and many more must give a definite perspective for the future evolution of this activity.
When we discuss the situation that happened until December 31, 2019, we have in mind the fact that certain measures have been taken, left-handed is true, but in which tourism continued to be one of the branches that was in full development and had the opportunity to contribute and in the future to a greater extent in the formation of the Gross Domestic Product. Unfortunately, at the time of writing this article, we are in the midst of a pandemic, caused by the coronavirus crisis (COVID 19), in which the perspective of tourism evolution is practically strangled.
We are considering the suspension of this activity altogether, as domestic tourism or external tourism. We are also considering moving to technical unemployment and perhaps from now on, unemployment and other forms of unemployment. Until January 2020, there were increases in most indicators and here we mention arrivals, overnight stays and the number of tourists per structure. The structural analysis of the number of tourists was done monthly or quarterly, as well as a broader analysis attempt. At the same time, the perspective of improving the structure of Romanian tourism, increasing accommodation capacity, quality of life and so on was taken into account.
This article is written at a turning point, between what was until December 31, 2019, if you want until February 29, 2020 in a way, in the evolution of tourism in our country and what is seen in conjunction with this pandemic, after which will follow without a doubt and perhaps a special economic and financial crisis.
The economic and financial crisis has already affected domestic tourism owners and will continue to affect them if they are not supported by government measures. We must also have a point of view regarding the role of the European Union in ensuring the takeover of the activity in this field, which suffers not only Romania, but also in all the member countries of the European Union or its non-members, as well as in terms of world.

Keywords: indicators, internal and external tourism, development, unemployment, jobs.

JEL Classification: H12, J60.

Introduction

In this article, on the study of the evolution of tourism and its prospects in the future, we started from the fact of the study on the evolution of tourism in 2019 and then in January 2020. The study was conducted on the basis of statistical indicators, arrivals, overnight stays, accommodation capacity, average length of stay, net use index of accommodation places, indicator of occupancy of existing places, occupancy of tourist capacities and so on.

The aspects regarding the evolution in 2019 are studied one by one, highlighting indicators that show that in this period there was even the possibility to increase more than it was achieved, but anyway the indicators submitted reveal that this activity could be continued.

The study continues on a structural analysis in connection with the locations from which tourists come to Romania. Also, in terms of Romanian tourism abroad, the locations they reach, there is the possibility to show that until December 2019, even January 2020, there was a positive growth capacity of Romanian tourism.

The article is accompanied by some tables and graphs that are suggestive and give essence and argumentation to the conclusions or points of view that the author said in this article.

The analysis is subject to the author's magnifying glass and in terms of the possibility to find out what are the prospects, only that, among the perspectives that emerge from the analysis until January 31, 2020 is one, and the analysis that is put further, in connection with the perspective of tourism Romania, after the current pandemic, the coronavirus crisis (COVID 19), is far from it.

In this regard, the article concludes with a spectral analysis of the evolution of the number of tourists arriving in accommodation units between November 2013 and March 2020.

It is not the purpose of the article to advance the evolution of tourism in Romania in 2020 and in the coming years, but a point of view must be expressed in the sense that, certainly, this activity will be greatly affected, given that in activities in this field are currently suspended, and it is difficult to assume that there are immediate prospects for this activity to be unblocked. It remains to be established, perhaps for a future analysis we will focus on determining the role of measures that can be taken by the Romanian government to support the resumption and development of tourism, but at the same time what is the role of the European Union that must get involved and allocates funds to resume this activity, which is not only for Romania, but for the entire European Union.

Literature review

Anghelache Constantin and Anghel Mădălina Gabriela (2019a) addresses issues related to the collection and systematization of statistical data for the analysis of economic phenomena. Anghelache Constantin and Anghel Mădălina Gabriela (2019b), addresses

and solves various theoretical and practical problems of economic modeling. Also, Anghelache Constantin and Anghel Mădălina Gabriela (2018a) addresses various models and methods for analyzing the quality of life in Romania. Anghelache Constantin and Anghel Mădălina Gabriela (2018b) analyzes in their paper the correlations between the employed population, unemployment and vacancies. Bran, F., Dinu, M. and Simon, T. (1998) are concerned in their work with environmental issues and their impact on tourism development. Cristureanu C. (1992) addresses theoretical issues related to international tourism. Farole T., Rodinguez-Pose, A. and Storper, M. (2011) addresses issues related to cohesion policy in the European Union in terms of economic growth. Iacob Ștefan Virgil (2018, 2019, 2020) addresses various models of statistical-econometric analysis of simple, multiple linear regression and spectral analysis in researching the evolution of various economic phenomena, both micro and macroeconomic. Leea, J.W. and Brahmasreneb, T. (2013) research in their work the influence of tourism on economic growth. Manacorda, M., Manning, A. and Wadsworth, J. (2012), studies the impact of immigration on the wage structure in the UK. Silva, J. and Toledo, M. (2009), address in their paper the issues related to the cyclical behavior of vacancies and unemployment.

Some methodological clarifications

The analysis refers to a series of indicators, context in which we selected from the methodology used by the National Institute of Statistics, a series of aspects, which will facilitate the understanding of the points of view expressed in this article. Thus, the arrival of a tourist is registered when a person is registered in the register of the tourist reception structure with tourist accommodation function, in order to be hosted one or more nights. Therefore, in each tourist reception structure with the function of tourist accommodation, only one arrival per tourist is considered, regardless of the number of overnight stays resulting from his uninterrupted stay.

Regarding the overnight stay, this represents the interval of 24 hours, starting with the hotel time, for which a person who is registered in the tourist accommodation and benefits from accommodation on account of the tariff related to the occupied space, even if the actual stay is shorter mentioned interval.

The index of net use of tourist accommodation places expresses the relationship between the tourist accommodation capacity in operation and its actual use by tourists, in a determined period. It is calculated by reporting the total number of overnight stays, to the tourist accommodation capacity in operation, from the respective period.

The source of the data is the monthly statistical survey on “Attendance of tourist reception structures with accommodation functions” (TOURISM 1 A) for arrivals and overnight stays in tourist reception structures with accommodation functions, in accordance with Regulation (EU) no. European Parliament and of the Council of 6 July 2011 on European statistics on tourism and repealing Council Directive 95/57/EC.

The data regarding the arrivals of foreign visitors in Romania and the departures of Romanian visitors abroad, registered at the border points, are obtained monthly from administrative sources – the General Inspectorate of the Border Police, within the Ministry of Internal Affairs.

Statistically, "international visitor" means any person who travels to a country other than that in which he or she habitually resides, for a period not exceeding 12 months, the main purpose of the visit being other than the exercise of a paid activities in the country visited.

"Arrivals" is the unit of measurement for foreign visitors registered upon entry into the country; "Departures" is the unit of measure for Romanian visitors traveling abroad registered when leaving the country.

The number of arrivals or departures of visitors is different from the number of people entering or leaving the country. The same person from abroad can make several trips to the country during that period, being registered each time as a new arrival. In the same way, Romanian visitors go abroad.

The country of origin of the international visitor is established according to the nationality registered in the visitor's passport.

Data, results and discussions

In Table 1 are structured the data regarding the arrivals and overnight stays of Romanian and foreign tourists in tourist reception structures with accommodation functions, in January 2019 and January 2020.

Table 1. *Arrivals and overnight stays in tourist reception structures with accommodation functions - January 2019 and 2020*

	Arrivals			Overnights		
	January 2019 Thousands	January 2019 Thousands	January 2020 compared to January 2019 (%)	January 2019 Thousands	January 2020 Thousands	January 2020 compared to January 2019 (%)
Total	**758,4**	**796,3**	**105,0**	**1472,8**	**1575,5**	**107,0**
Romanian tourists	618,6	668,7	108,1	1188,0	1299,2	109,4
Foreign tourists	139,8	127,6	91,3	284,8	276,3	97,0
- Europe	102,1	93,4	91,5	208,8	199,2	95,4
- European Union	81,2	72,7	89,5	157,1	150,2	95,6
- Asia	22,6	19,0	84,1	47,4	48,3	101,9
- North America	9,1	6,8	74,7	17,3	13,3	76,9
- South America	1,2	1,0	83,3	2,4	2,2	91,7
- Africa	1,1	1,2	109,1	1,8	2,4	133,3

Source: INS communicated 52/02.03.2020.

Interpreting the data structured in Table 1, we find that in January 2020 compared to January 2019 arrivals in tourist accommodation with accommodation functions increased by 5%, and in terms of overnight stays, they increased by 7%. Thus, the arrivals registered in the tourist reception structures in January 2020 amounted to 796.3 thousand, and out of the total number of arrivals, the arrivals of Romanian tourists in the tourist reception

structures with accommodation functions represented 84% in January 2020, while which foreign tourists accounted for 16.0%.

Regarding the arrivals of foreign tourists in the tourist reception structures, the largest share was held by those in Europe with 73.2% of the total foreign tourists and of these 77.8% were from the member countries of the European Union.

The overnight stays registered in the tourist reception structures in January 2020 amounted to 1575.5 thousand, of which the overnight stays of Romanian tourists in the tourist reception structures with accommodation functions represented 82.5% in January 2020, while the overnight stays of foreign tourists represented 17.5%. Regarding the overnight stays of foreign tourists in the tourist reception structures, the largest share was held by those in Europe with 72.1% of the total foreign tourists and of these 75.4% were from the member countries of the European Union.

Compared to January 2019, in January 2020 at the border points there was an increase in terms of arrivals of foreign visitors by 12.7% and also in terms of departures abroad of Romanian visitors had a positive evolution by 14.1%.

Regarding the average length of stay in January 2020, it was 1.9 days for Romanian tourists and 2.2 days for foreign tourists, respectively.

The index of net use of accommodation in January 2020 was 25% of total tourist accommodation structures, thus registering an increase of 1.6% compared to January 2019. Higher values of the indices regarding the use of accommodation in January 2020, were registered in hotels 31%, in tourist villas 22%, in bungalows 19.9%, in hostels 19.4%, in tourist pensions 18.6% and in tourist chalets 16.4%.

In Table 2 are structured the data regarding the distribution of Romanian tourists' arrivals in the tourist reception structures on various tourist areas in January 2019 and 2020.

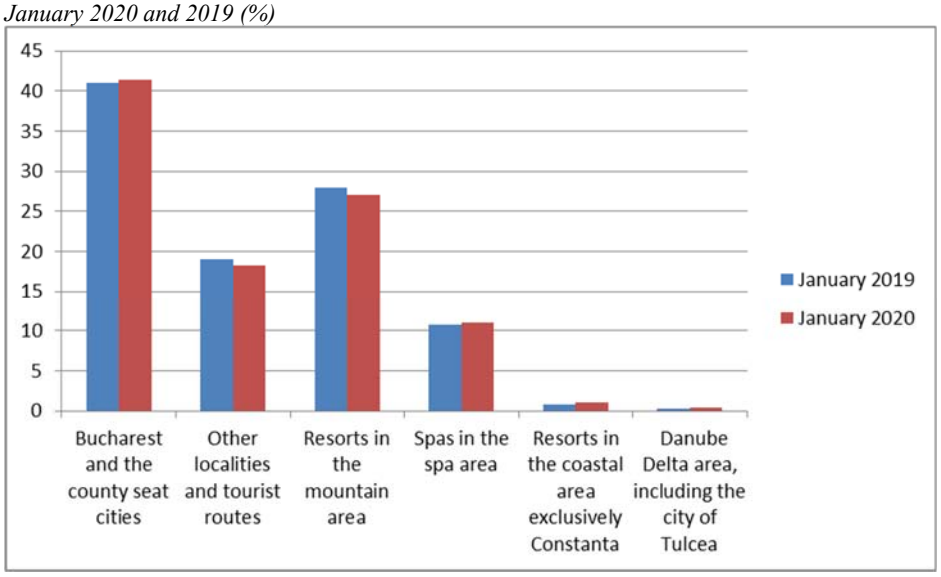
Table 2. *Distribution of Romanian tourists' arrivals in tourist reception structures, by tourist areas, in January 2020 and 2019 (%)*

	January 2019	**January 2020**
Bucharest and the county seat cities	41,0	41,4
Other localities and tourist routes	19,0	18,3
Resorts in the mountain area	28,1	27,0
Spas in the spa area	10,8	11,7
Resorts in the coastal area exclusively Constanta	0,8	1,2
Danube Delta area, including the city of Tulcea	0,3	0,4

Source: INS communicated 52/02.03.2020.

In order to more easily observe the differences between the arrivals of Romanian tourists in the structures of tourist reception, by tourist areas, in January 2020 and 2019, the Graph 1 was drawn up.

Graph 1. *Distribution of Romanian tourists' arrivals in tourist reception structures, by tourist areas, in January 2020 and 2019 (%)*



Interpreting the data presented in Table 2 and Graph 1 we find that Romanian tourists have accessed more Bucharest, county seat cities, seaside and coastal areas, to the detriment of the mountains, where the share of tourists was lower in January 2020 compared to January 2019.

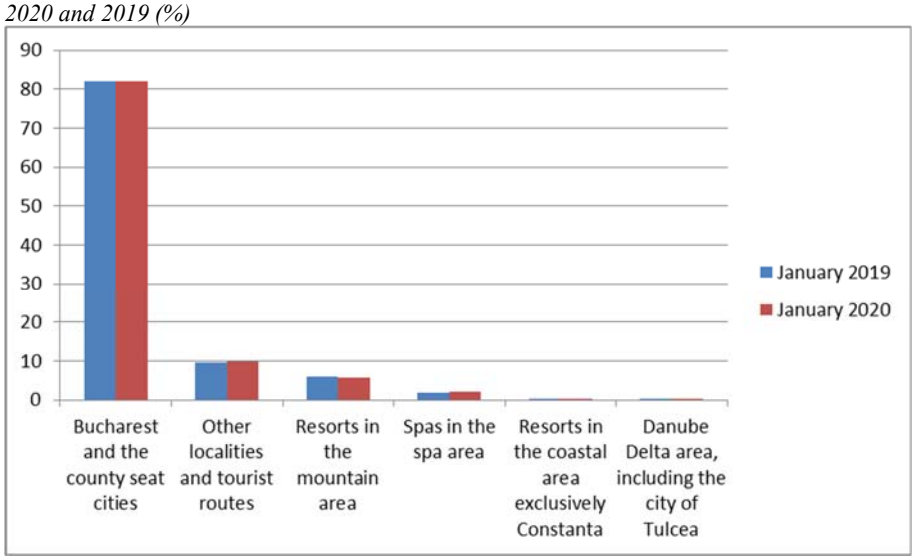
Regarding the distribution of foreign tourists' arrivals in the tourist reception structures, by tourist areas, in January 2020 and 2019, the data were structured in Table 3 and outlined in Graph 4.

Table 3. *Distribution of foreign tourist arrivals in tourist reception structures, by tourist areas, in January 2020 and 2019 (%)*

	January 2019	January 2020
Bucharest and the county seat cities	82,1	81,9
Other localities and tourist routes	9,6	9,8
Resorts in the mountain area	6,1	5,7
Spas in the spa area	1,9	2,1
Resorts in the coastal area exclusively Constanta	0,2	0,4
Danube Delta area, including the city of Tulcea	0,1	0,1

Source: INS communicated 52/02.03.2020.

Graph 2. *Distribution of foreign tourists' arrivals in tourist reception structures, by tourist areas, in January 2020 and 2019 (%)*



Interpreting the data structured in Table 3 and sketched in Graph 2, we find that in terms of the share of foreign tourists in Romania was more significant in January 2020 in seaside resorts, spas and tourist routes.

Table 4 structures the data for January 2020 regarding the arrival of foreign tourists according to the country of residence and the tourist areas where they stayed.

Table 4. *Most arrivals of foreign tourists, by country of residence and tourist areas, in January 2020*

	Total	Bucharest and the county seat cities, exclusively Tulcea	Other localities and tourist routes	Resorts in the mountain area	Spas	Seaside resorts, excluding the city of Constanta	Danube Delta area, including the city of Tulcea
Total foreign tourists	**127620**	**104542**	**12444**	**7339**	**2650**	**528**	**117**
Israel	**14210**	13247	184	723	50	6	0
Italy	**12979**	10993	1561	285	65	33	42
Germany	**12718**	10582	1509	471	122	26	8
Republic of Moldova	**7505**	2796	652	2329	1704	23	1
France	**7340**	6325	641	251	106	7	10
UK	**6957**	5982	401	503	16	53	2
US	**5969**	5223	521	122	19	83	1
Hungary	**5314**	3025	1789	356	142	2	0
Greece	**3506**	3138	223	116	8	17	4
Spain	**3264**	2730	387	102	29	13	3
Turkey	**3195**	2703	291	120	44	37	0
Poland	**3006**	2340	466	153	23	16	8
Ukraine	**3002**	2282	279	398	23	12	8
Netherlands	**2863**	2553	232	65	6	7	0
Bulgaria	**2750**	2277	344	49	36	41	3
Austria	**2563**	2147	261	129	25	1	0
Serbia	**2154**	1823	271	43	11	5	1
The Russian	**1799**	1354	169	229	37	10	0

	Total	Bucharest and the county seat cities, exclusively Tulcea	Other localities and tourist routes	Resorts in the mountain area	Spas	Seaside resorts, excluding the city of Constanta	Danube Delta area, including the city of Tulcea
Federation							
Belgium	**1758**	1428	246	46	35	3	0
Czech Republic	**1380**	1204	148	22	1	5	0
Switzerland	**971**	839	97	16	15	4	0
China	**947**	757	106	70	14	0	0
India	**944**	901	21	8	2	12	0
Ireland	**872**	642	50	173	3	4	0
Sweden	**808**	683	96	21	4	2	2
Canada	**792**	650	92	35	7	5	3
Slovakia	**761**	620	90	49	0	2	0
Japan	**697**	630	45	18	0	4	0
Denmark	**676**	543	106	18	8	1	0
Cyprus	**636**	564	32	39	1	0	0
Norway	**622**	441	87	68	0	9	17
Portugal	**622**	548	45	16	2	11	0
Australia	**525**	470	39	10	5	0	1
Other countries	**13515**	12102	963	286	87	74	3

Source: INS communicated 52/02.03.2020.

Interpreting the data from Table 4, we find that the arrivals of foreign visitors to Romania, which were registered at the border points, were 127,620 in January 2020, thus registering an increase of 12.7% compared to January 2019. The majority of foreign visitors come from European countries, respectively 94%.

Most arrivals of foreign tourists accommodated in tourist accommodation facilities came from Israel with a number of 14.2 thousand, Italy with a number of 13 thousand, Germany with a number of 12.7 thousand, Republic of Moldova with a number of 7.5 thousand and France with a number of 7.3 thousand.

Of the total arrivals of foreign visitors to Romania, 47.9% come from the member states of the European Union. Thus, the most arrivals were from Bulgaria with a share of 38.2%, Hungary with a share of 23.3%, Italy with a share of 8.3%, Germany with a share of 5.8%, Poland with a share of 4.4%, France with a share of 3.7% and the United Kingdom with a share of 3%.

The structure of tourist arrivals and overnight stays by counties in January 2020 is summarized in Table 5.

Table 5. *Arrivals/overnight stays of tourists by counties in January 2020*

Counties	Total	Arrivals		Total	Overnights	
		Romanian	Foreign		Romanian	Foreign
TOTAL	**796256**	**668636**	**127620**	**1575540**	**1299219**	**276321**
Alba	11000	10203	797	21270	19753	1517
Arad	16564	13386	3178	23204	18744	4460
Argeș	13578	11311	2267	22191	17648	4543
Bacău	10940	10253	687	23072	20984	2088
Bihor	36530	33534	2996	78242	72029	6213
Bistrița-Năsăud	5849	5330	519	9631	8876	755

Counties	Total	Arrivals		Total	Overnights	
		Romanian	Foreign		Romanian	Foreign
Botoşani	3205	3028	177	5379	4829	550
Braşov	121673	114181	7492	253700	235842	17858
Brăila	4880	4493	387	7788	6355	1433
Bucureşti	122768	59736	63032	222133	93182	128951
Buzău	5686	5440	246	10411	9832	579
Caraş-Severin	14123	13838	285	36901	35478	1423
Călăraşi	1142	945	197	2445	1849	596
Cluj	35671	30152	5519	64937	52996	11941
Constanţa	18199	16700	1499	39977	35734	4243
Covasna	9671	9132	539	26444	24852	1592
Dâmboviţa	7891	7472	419	15504	14127	1377
Dolj	8646	7545	1101	15718	13299	2419
Galaţi	7551	6771	780	12769	10410	2359
Giurgiu	1459	1399	60	2366	2243	123
Gorj	8491	8374	117	18815	17997	818
Harghita	14740	13104	1636	33988	29559	4429
Hunedoara	10916	10066	850	17179	15858	1321
Ialomiţa	2028	1878	150	7712	7300	412
Iaşi	19722	15902	3820	31672	23336	8336
Ilfov	10746	7238	3508	16075	11441	4634
Maramureş	17035	15595	1440	30702	28360	2342
Mehedinţi	3829	3449	380	5786	5216	570
Mureş	36554	33076	3478	73992	63839	10153
Neamţ	11899	11524	375	19519	18733	786
Olt	2285	2064	221	6675	5823	852
Prahova	48558	44697	3861	111989	101424	10565
Satu Mare	10793	10009	784	14360	12775	1585
Sălaj	2370	2106	264	4923	4090	833
Sibiu	34058	30019	4039	60699	52260	8439
Suceava	36880	35316	1564	77673	73787	3886
Teleorman	857	749	108	1819	1635	184
Timiş	26236	18324	7912	55972	37497	18475
Tulcea	2583	2448	135	5582	5021	561
Vaslui	2870	2688	182	4410	3990	420
Vâlcea	32707	32173	534	77896	76327	1569
Vrancea	3073	2988	85	4020	3889	131

Source: INS communicated 52/02.03.2020.

If we analyze the structure of tourist arrivals and overnight stays by counties in January 2020, we find that the number of tourist arrivals in tourist reception structures with tourist accommodation functions registered higher values in Bucharest with a number of 122.8 thousand, Brasov with a number of 121.7 thousand, Prahova with a number of 48.6 thousand, and regarding the overnight stays of tourists, they registered higher values in: Braşov with a number of 253.7 thousand, the Municipality of Bucharest with a number of 222.1 thousand, Prahova with a number of 112.0 thousand and with a number close to 70 thousand in Bihor, Vâlcea, Suceava, Mureș and Cluj.

Table 6 structures the data regarding the evolution of the arrivals of foreign visitors in Romania and the departures of Romanian visitors abroad in January 2019, compared to January 2020.

Table 6. *Evolution of arrivals of foreign visitors in Romania and departures of Romanian visitors abroad*

	January 2019	January 2020	January 2020/January 2019 (%)
Total arrivals	**730798**	**823665**	**112,7**
-road transport	551375	629653	114,2
-rail transport	7603	8202	107,9
-airline	164591	177785	108,0
-naval transport	7229	8025	111,0
Total departures	**1791552**	**2044547**	**114,1**
-road transport	1227020	1431205	116,6
-rail transport	8816	8870	100,6
-airline	554471	603086	108,8
-naval transport	1245	1386	111,3

Source: INS communicated 52/02.03.2020.

Interpreting the structured data in Table 6, we find that the departures of Romanian visitors abroad, which are registered at the border points, were in January 2020 of 2044.5 thousand, increasing by 14.1%, compared to January 2019. As for the means of road transport, they were the most used for departures abroad, representing 70% of the total number of departures.

Table 7 structures the data regarding arrivals and overnight stays in tourist reception structures with accommodation functions in March 2020.

Table 7. *Arrivals and overnight stays in tourist reception structures with accommodation functions - in March 2020*

	Arrivals			Overnights		
	March 2019 Thousands	March 2020 Thousands	March 2020 compared to March 2019 (%)	March 2019 Thousands	March 2020 Thousands	March 2020 compared to March 2019 (%)
Total	**800,4**	**242,1**	**30,2**	**1519,1**	**483,7**	**31,8**
Romanian tourists	631,3	207,9	32,9	1181,1	413,2	35,0
Foreign tourists of which:	169,1	34,2	20,2	338,0	70,5	20,9
- Europe	125,1	26,2	20,9	242,9	54,0	22,2
- European Union	94,5	18,1	19,2	183,3	37,5	20,5
- Asia	22,0	3,7	16,8	49,6	8,7	17,5
- North America	10,6	2,9	27,4	21,1	4,6	21,8
- South America	1,3	>0,5	-	2,9	>0,5	-
- Africa	1,8	>0,5	-	3,7	1,2	32,4

Source: INS communicated 116/04.04.2020.

According to the data structured and presented in Table 7, we find that in March 2020, compared to March 2019, arrivals, in total, in the structures of tourist reception with accommodation functions, represented only 30.2%, and in terms of only 31.8% concern overnight stays. The proportion is even higher in terms of arrivals and overnight stays of foreign tourists in the tourist reception structures with accommodation functions in Romania, thus registering a percentage of only 20.2% for arrivals and 20.9% for overnight stays, respectively.

We also find that in March 2020 we record minimum values compared to recent years regardless of the reporting month, both in terms of arrivals, departures and overnight stays of Romanian tourists, foreigners and in total, due to the coronavirus crisis (COVID 19), which caused a deadlock in this branch of the national economy.

Thus, as a consequence, we still considered it useful to know the evolution of tourist arrivals, in total, in tourist reception structures with accommodation functions between

November 2013 and March 2020, in order to later highlight the impact that in will have the financial-economic crisis that will precede the current coronavirus crisis (COVID 19).

Therefore, the data related to the series that includes the total number of tourist arrivals between November 2013 and March 2020 are structured in Table 8.

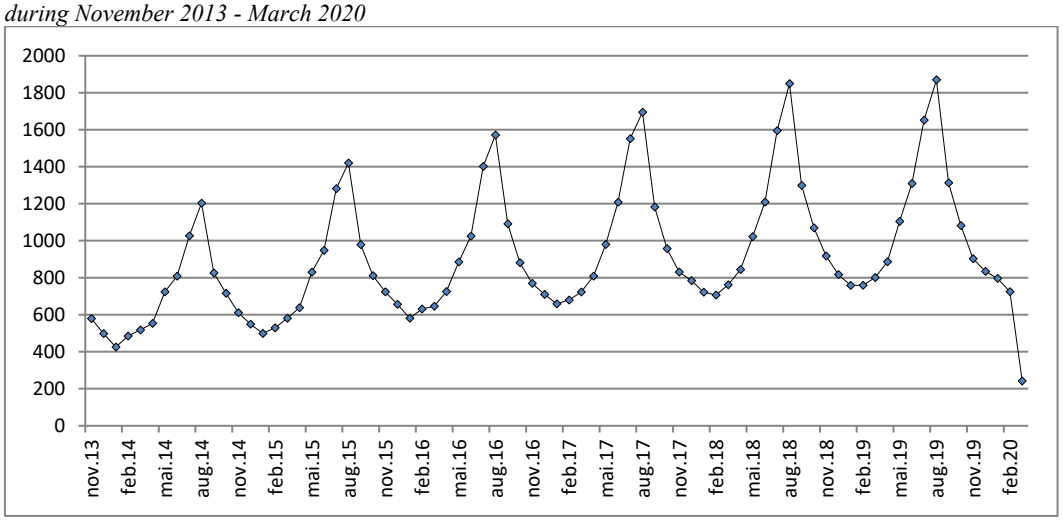
Table 8. *Tourist arrivals in tourist reception structures with accommodation functions during November 2013 - March 2020 (thousands of tourists)*

Month/Year	2013	2014	2015	2016	2017	2018	2019	2020
January		425,5	498,4	581,3	659	722,1	758,4	796,3
February		485,1	529,2	630,7	679,1	705,9	758,8	724,4
March		517,6	581,3	645,8	722,3	761,6	800,4	242,1
April		553,5	638,1	725,6	808,7	844,2	885,8	
May		723,9	829,9	885,5	979,7	1022,2	1103,9	
June		808,3	947,9	1025	1207,7	1208,6	1308,9	
July		1026,6	1281,3	1401,6	1551,5	1594,3	1651,3	
August		1202,8	1420,1	1571,3	1693,9	1849	1869,4	
September		825,7	978,8	1091,2	1182	1298,4	1312,5	
October		715,6	811,1	880,8	957,3	1069,2	1081,8	
November	579,5	611	723,9	769,7	830,9	917,7	902,8	
December	498,1	548,5	655,8	709,4	784,2	816,8	834,6	

Source: INS communicated from 2013-2020 (data processed by the author).

Regarding the evolution of the studied indicator, it was outlined and presented in Graph 3.

Graph 3. *Evolution of the number of arrivals in tourist reception structures with accommodation functions during November 2013 - March 2020*



Following the evolution of the number of tourist arrivals in Romania between November 2013 and March 2020, outlined in Graph 3, we find an oscillating evolution with a high frequency of this indicator. Thus, we identify a seasonal evolution of the data series with maximum peaks in July-August of each year subject to analysis, an aspect that also emerges from the data of the structured series in Table 8. As a consequence, the statistical-econometric method that can highlight the cyclicity, seasonality and trend of the data series is the spectral method. Thus, given that the series totals seventy-seven data for each month from November 2013 to March 2020, i.e. a sufficient number of data for such an analysis,

on the data series, structured in Table 8 and outlined in the Graph 3, the spectral analysis method was applied, using the STATSTICA econometric analysis program, this program allowing such an analysis by accessing the "Time Series Analysis" option. Thus, an oscillating evolution can be written in the form of a finite sum of sine and cosine functions, according to the relation:

$$y_t = \frac{a_0}{2} + \sum_{f=1}^{p} \left(a_f cos \frac{2\pi}{T} ft + b_f sin \frac{2\pi}{T} ft \right) + u_t \quad (1)$$

where: a_0, a_f, b_f – parameters;
T – number of time units;
f – initially set frequency;
t has values in the range [1,T].

What interests us are the parameter estimates $\hat{a}_f$, $\hat{b}_f$, because these are the ones that lead to the approximation of the function *f(t)* by the finite sum of sine and cosine functions. Applying the least squares method, we will follow the integral:

$$\frac{1}{2\pi} \int_0^{2\pi} \left[f_{(t)} - y_{n(t)} \right]^2 dt \quad (2)$$

Thus, the minimization of the function implies the equalization with zero of the partial derivatives of the first order, which will lead to the following calculation relations of the estimated parameters:

$$\hat{a}_f = \frac{2}{T} \sum_{t=1}^{T} y_t \, cos \frac{2\pi}{T} ft \quad (3)$$

$$\hat{b}_f = \frac{2}{T} \sum_{t=1}^{T} y_t \, sin \frac{2\pi}{T} ft \quad (4)$$

$$\hat{a}_0 = \frac{\sum y_t}{T} \quad (5)$$

These coefficients are necessary in the continuation of the analysis to determine the specific indicators of the spectral analysis such as the amplitude:

$$A_f = \sqrt{\hat{a}_f^2 + \hat{b}_f^2} \quad (6)$$

As for the density function, it is given by the relation:

$$d_{(f)} = \frac{\hat{p}_f}{\hat{\sigma}_f} = 2[1 + 2 \sum_{k=1}^{\infty} r_k cos 2\pi \cdot fk] \quad (7)$$

where: $0 \leq f \leq \frac{1}{2}$, and r_k represents the autocorrelation coefficient.

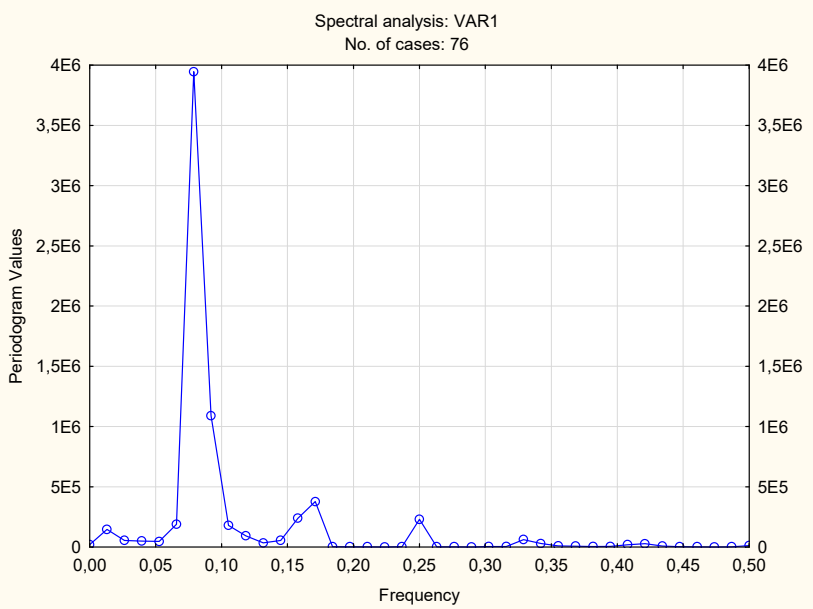
The results regarding the frequency of the oscillations, the Euler-Fourier coefficients, as well as the values of the periodogram and the density are structured in Table 9.

Table 9. *Results of the spectral analysis on the evolution of the total number of tourists arriving in tourist reception structures with accommodation functions during November 2013 - March 2020*

Spectral analysis: VAR1 No. of cases: 76 Largest Periodog. values						
	Frequency	Period	Cosine - Coeffs	Sine - Coeffs	Periodogram	Density
6	0,078947	12,66667	-317,802	-53,4579	3946522	2078030
7	0,092105	10,85714	142,713	91,0972	1089293	1490826
13	0,171053	5,84615	-73,725	-67,0126	377190	228938
12	0,157895	6,33333	74,917	26,5093	239980	212596
19	0,250000	4,00000	37,285	68,2850	230014	103738
5	0,065789	15,20000	-65,691	-25,6633	189008	1087559
8	0,105263	9,50000	57,616	37,1522	178596	507024
1	0,013158	76,00000	-56,205	-26,2578	146244	90297
9	0,118421	8,44444	44,664	21,5199	93403	133928
25	0,328947	3,04000	9,939	-38,8811	61200	35850

Below are the values of the periodogram related to the frequency of oscillations are shown in Graph 4.

Graph 4. *Representation of the periodogram by frequency*



In Graph 4 we identify on the horizontal axis the base frequency $\left(\frac{1}{76}\right) = 0{,}013$ with its harmonics up to $\left(\frac{1}{76}\right) \cdot 38 = 0.50$ and the periodogram values are recorded vertically.

Regarding the dependence of the amplitude on the priodogram, it can be determined according to the relationship:

$$A = \sqrt{\frac{2 \cdot V_p}{T}} \qquad (8)$$

where: A – amplitude;
V_p – the value of the periodogram;
T – number of time units of the series (in case of analyzed number of months).

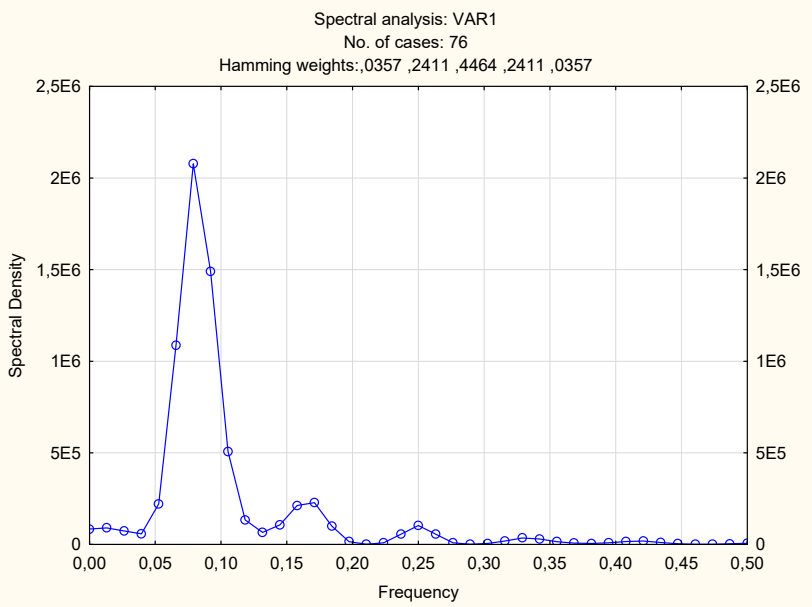
Interpreting the data from Graph 4 and Table 9, we find that the most important oscillations are from 3.946.522 at 12.6 months, from 1.089.293 at 10.8 months, from 377.190 at 5.8 months and from 239.980 at 6.3 months. Therefore, noting that we have the largest fluctuations for periods of one year and one year we can report a strong influence of seasonality in terms of the evolution of the total number of tourists arriving in tourist accommodation with accommodation functions between November 2013 and March 2020. In the same vein, interpreting the data structured in Table 8, we can identify extreme, maximum points in July-August, due to the period of leave enjoyed by employees correlated with an optimal period in terms of climate in Romania, which confirms the seasonality of the studied indicator evolution.

The existence of the trend is signaled by the high amplitude values (indicated by the periodogram in Table 9 column six) for frequencies lower than the unit value (Table 9, column two). Also, the upward trend of the data series is confirmed by the values recorded and sketched in Graph 3.

In other words, due to the large amplitudes recorded for periods of less than one year (10.8 months, 6.3 months and 5.8 months, respectively), I conclude that the presence of cyclicality is not confirmed.

Graph 5 shows the evolution of spectral density depending on the size of the frequency.

Graph 5. *Representation of spectral density as a function of frequency*



Observing the Graph 5 and interpreting the results of the structured spectral analysis in Table 9, we find that the maximum peaks recorded by the spectral density as a function of frequency are also at 12.6 months and 10.8 months, which is expected, because the values of spectral density are analogous to those of the periodogram by its very calculation formula, which represents the first derivative of the process spectrum function.

What is noteworthy is the fact that in March 2020 the upward trend of the evolution of the number of arrivals in tourist reception structures with accommodation functions in Romania experienced a sudden drop, an aspect that can be easily seen in Graph 3, due to coronavirus crisis (COVID 19) which severely affected this important branch of the national economy. From now on, the trend will be different and it is very important what support measures will be adopted in the next period, so that this area can return to some normality, and I say some in the context in which we expect a new crisis, for example this economic-financial date created by the economic blockage created by the coronavirus crisis.

Conclusions

The article published by the authors is based on a study in which data are presented, figures related to the evolution of tourism in our country, from which a series of theoretical and practical conclusions can be drawn. Theoretically, it is simple to assume that the tourist activity must become an important activity, a particular activity for Romania, which has a special tourist area from all points of view.

Another conclusion is that Romania has a tourist attraction throughout the year, in the sense that there are tourist attractions for the summer activity Black Sea, mountain resorts and others. Also, Romania has an attraction for winter sports in which we have enough companies specific to the tourism field and in which there can now be an important number of people who love winter sports. Last but not least, Romania has historical and cultural attractions, which are also important to attract tourists, green Maramures area, monasteries in Moldova, remains of the Olt Valley, Prahova Valley, Danube Delta and other areas that are particular and even specific unique for Romania.

Another conclusion is that tourism has been less supported in the previous period, but at this time when we are facing this pandemic caused by the coronavirus crisis (COVID 19), a significant participation is required, a government action plan to ensures for the moment the maintenance of the tourist structures in our country and then their support through some measures that facilitate the return to the potential they had.

Also, the workforce in the field of tourism should not be neglected and in a short time, through appropriate programs to reach their attraction in the activities in which they have been and others, so that this field of tourism becomes important again and even to be developed because it is one that can make a more important contribution to the formation of the Gross Domestic Product in Romania.

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Investigating personnel dynamics within SMEs: A survey analysis for the case of Romania

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Abstract. *Recently and especially within emerging economies such as Romania, most of the uncertainties and risks of the economic and business environment stem mainly from the changes in the wage and fiscal policies, as well as from the conditions on the labour market.*
In this paper we focus on the main causes of personnel dynamics within the Romanian SMEs, using survey data on 1200 companies. The survey was conducted at the end of 2019 and is representative at national level in terms of size, regions and main fields of activity.
Through this survey analysis we investigate aspects related to both wage and personnel policy for the Romanian companies, looking as the proportion of temporary employees, the types of non-wage incentives offered by the Romanian SMEs to their employees and the participation of their own employees in vocational training programs.
Among the most frequently offered non-wage incentives to their employees we identify: flexible work schedule, subscriptions to medical clinics, meal vouchers or transportation to work. To a much lower extent, however, they may offer subscriptions to gyms or even company shares.
Our findings highlight the following main determinants of recent personnel fluctuations: lower wage attractiveness than competition, too high labour taxation, as well as limited attractiveness of non-wage incentives to their employees. Moreover, it is relevant to also point out the proportion of employees who decided to leave their job in order to start their own business, which represented about 26% of the cases reported by the surveyed SMEs.

The regional analysis of the effects of these factors on personnel dynamics ranks the Bucharest-Ilfov region first with the most notable recent personnel fluctuations, followed by the North-West region. In addition, the results also show that the effects of personnel fluctuations are more visible in urban areas as compared to the rural area.

Keywords: personnel dynamics, wages, regional analysis, economic sectors, survey analysis.

JEL Classification: M51, M12.

1. Introduction

Europe's 25 million small and medium enterprises (SMEs) represent a force of the EU economy. SMEs accounted for 99.8% of all enterprises in the EU-28 non-financial business sector in 2018, generating almost 67% of employment in the non-financial business sector (30% the micro enterprises, 20% the small enterprises and 17% medium-sized enterprises). With the indirect impact of their profits and wages, European SMEs are a fundamental pillar of the European welfare states (European Commission, 2019).

Some of the important challenges facing SMEs are considered the attraction, motivation, development and retention of employees, while human resource practices are recognised as important contributors to the success of SMEs (Krishnan and Scullion, 2017). Management of human capital is not only about attracting and attaining employees, but also related to giving the employees a chance to develop as that will increase the corporate knowledge base, both for the individuals and for the company (Kyndt and Baert, 2013).

The economic crisis in 2008-2009 has affected majority of the economies in the EU, to varying degrees. The impact on SMEs has been mixed (Broughton, 2011), and dependent for example on the sector in which they operate: there are countries where the SME sector has expanded (like Germany, the Netherlands, Belgium and Estonia), or it remained constant (Spain). In Bulgaria, there are trends towards both an increase and a decrease in the number of SMEs, depending on the sector. And there are other countries in which the SMEs were badly affected. One possible reason for the different responses to the crisis of the SME sector may come from a different capacity to absorb laid-off workers. Understanding this may be helpful for the national policies targeting employment in general and support of the SMEs in particular.

Recently and especially within emerging economies such as Romania, most of the uncertainties and risks of the economic and business environment stem mainly from the changes in the wage and fiscal policies, as well as from the conditions on the labour market. And since the SMEs are the backbone of every economy, in this paper we focus on the main causes of personnel dynamics within the Romanian SMEs. We are using survey data on 1200 companies, investigating aspects related to both wage and personnel policy for the Romanian companies, looking at the proportion of temporary employees, the types of non-wage incentives offered by the Romanian SMEs to their employees and the participation of their own employees in vocational training programs.

2. Literature review

There are several papers that addressed short-term firms' expectations on the labour market. A very recent study, the CNBC and Survey Monkey investigation regarding the expectations of small firms on the labour market, collected responses from over 2000 small business managers. The purpose of the survey was to measure both the vitality of the US economy and their perspective on jobs, taxes and other topics of interest. In addition to measuring the confidence of small businesses at the national level, the large sample size

makes it possible for CNBC to discover trends depending on the geographical region and certain small business cohorts.

The key results of the CNBC questionnaire applied in the second quarter of 2019 refer to employment, incomes and general expectations of small companies. One of the results is that 60% of small business managers expected a revenue growth in the second quarter of 2019, compared with 57% in the first quarter of 2019. In addition, 31% expected an increase in the number of full-time employees, compared to only 28% in the first quarter of 2019. At the same time, the general confidence index is tempered by the diminishing positive impact of changes in fiscal policies. Only 28% of small business owners expect fiscal policy changes to have a positive effect on their business over the next 12 months, compared to 31% in the first quarter and 44% in the second quarter of 2018. Moreover, 52% of small business managers said that it is more difficult to find qualified individuals in the present (Q2 2019), compared to the previous year. In the case of companies with more than 50 employees, 63% of the owners find it more difficult to find qualified employees. In addition, 44% of companies with more than 50 employees anticipate that, over the next year, the cost of labour will increase faster than the cost of raw materials or the cost of capital. This indicates that companies anticipate that the increase in wages will result in filling the vacant positions.

A Czech survey of small and medium enterprises in South Bohemia region (Holátová and Březinová, 2018) revealed also some interesting results:

- The number of employees that left the company in 2012 was most often measured by medium-sized companies (75.3%), followed by small enterprises (70.5%), with micro-companies ranking lowest.
- Most companies interviewed (39.9%) had a personnel fluctuation rate higher than 10%. 23.0% of the companies declared zero employee fluctuation, while the companies with a fluctuation rate of 5–10% accounted for 22.4%.
- The benefits most frequently reported by employees of SMEs included “catering” (highly out-ranked all other mentioned categories) and the “pension schemes”. Respondents further mentioned various types of bonuses which may be said to represent a material (financial) stimulator. Other also relatively frequently mentioned benefits included “paid leave”, “sports and culture”, “education”.

The study of the National Bank of Romania (2016) analysed the factors under which the economic growth in Romania re-started during the post-crisis period but was not accompanied by a similar boosting of the labour market. The analysis starts from a data set obtained at microeconomic level, following the implementation in 2014 of the first labour market survey by the National Bank of Romania in cooperation with the Wage Dynamics Network (WDN – a research network of the European System of Central Banks).

The questionnaire was constructed in a manner that allows the evaluation of the way the labour market in Romania was adjusted during 2010-2013. Moreover was targeted the evaluation of the impact of the reforms implemented in 2011 on the activity of the companies. The questionnaire included a group of questions regarding the source of the shocks that induced the crisis at European level and the strategy that the companies adopted to deal with these shocks, in terms of adjusting the size and structure of the workforce,

respectively of the salary policy. Another section was dedicated to the minimum wage policy for the Romanian economy: the share of employees paid with the minimum wage, as well as those on a higher level, which would benefit from an increase in the case of raising the minimum wage. The survey was addressed to non-financial companies, established before 2010, which are active in Industry, Construction, Trade and Market Services. A simple random stratified survey was chosen, the layers of which were defined according to the main field of activity and the size of the company, the latter being determined according to the average number of employees. The sample comprised approximately 2300 companies, covering one third of the private sector personnel in 2013 and had a response rate of 88%.

The economic environment was characterized during the period targeted by the survey by moderate fluctuations of the demand. The companies showed a relatively high reluctance to reduce the salaries (nominal and real) of the existing employees, an attitude that later conducted to an increase the probability of the company to lay off some of the employees or limited the creation of new jobs (based on the estimation of several probit models).

Although the companies did not identify any significant shocks in the 2010-2013 period, most of them complained about the increase in labour costs, a trend that probably continued after 2013 in the context of multiple increases in the gross minimum wage. The strategies adopted by the companies in order to reduce these costs aimed mainly at adjusting the labour factor, both along the intensive and extensive margin. Similar to the empirical evidence provided by previous WDN surveys, the downward rigidity of wages is best explained by the theory of the influence of wage adjustments on labour productivity (efficiency wage theory) and that of implicit and explicit contracts.

In the early recovery period of the business cycle, the results of the study indicate a more pronounced pro-cyclicality in establishing the salaries of the new employees. Apart from the presence of wage rigidities, other frictions on the labour market that have complicated the job search process can be associated with the perception of a high level of labour taxation, the policy of the minimum wage, the structural changes of the economy, but also the growth in the mismatch between the training of candidates and the demands of employers. Although some measures have been taken in the direction of making the labour market more flexible, the companies have perceived a modest influence from the reforms. The study highlights some positive effects of the reforms (the possibility of reducing the work program for economic reasons and improving the framework for the use of temporary and fixed-term employment contracts).

Another survey, at European level this time, conducted during the final quarter of 2010 revealed some interesting facts (de Kok et al., 2011):

- Although 24% of SMEs showed an increase in employment, while 48% mentioned no change, a larger share of enterprises (28%) showed a decline of employment levels during 2010.
- Around 17% of the small and medium sized enterprises lay off employees during 2009Q4-2010Q4. At the opposite end, 70% of the SMEs declared that they hired employees during 2009Q4-2010Q4 (31% solely for replacements, 18% solely for newly created jobs and 21% both replacements and newly created jobs).

- By the end of 2010, the majority of the entrepreneurs seemed to be slightly optimistic about the future: only around 11-12% of the entrepreneurs expected layoffs due to the crisis in the next 12 months (namely 2011).
- In general, employees in SMEs tend to receive lower wage levels than in large enterprises, with 4 possible explanations: labour productivity increases with firm size; larger firms have more financial resources; SMEs can better monitor individual employees, whereas large enterprises pay a premium to avoid shirking, family owned and managed enterprises pay less and are relatively often SMEs. In addition, job satisfaction is higher in SMEs.

3. Data and research methodology

In order to analyse the causes of personnel dynamics within the SMEs we designed a survey to be applied on Romanian companies. The survey was conducted at the end of 2019 and is representative at national level in terms of size, regions and main fields of activity. The sampling method had a standard error of ± 3.02% and a confidence level of 95%. It was decided to use a stratified sample, since they respect the population structure from which they are extracted, are therefore considered to be more robust and lead to an even smaller sampling error than that calculated for the simple random samples. The stratification criteria considered were: the size class of the company (under 9 employees; between 10-49 employees; between 50-249 employees; over 250 employees), the county / development region, the main economic activity of the company (NACE Rev.2) and the turnover level. The total volume obtained was of 1200 valid questionnaires.

The research instrument consisted of a structured questionnaire and the interviews were conducted through a mixt of methods: CAWI combined with face-to-face and CATI.

The database obtained through the survey was next processed in SPSS and STATA. The primary analysis consisted in descriptive statistics and cross-tabulation, while for the econometric analysis we considered to be appropriate a logistic model.

Agresti (2010) defines the logit model as a single-period classification model for which estimates are based on a maximum likelihood function in order to determine the conditional probability of an individual belonging to a category based on the independent variables. The logit model describes the relationship between a binary variable Y (takes the values 1 or 0) and n explanatory variables x_1, x_2,..., x_n. Starting from a linear probability model described by $\Pr(y = 1|x) = x\beta + \varepsilon$, if we restrict the probabilities to be in the [0,1] range, the following model is obtained: $\Omega(x) = \frac{Pr(y = 1|x)}{Pr(y = 0|x)} = \frac{Pr(y = 1|x)}{1 - Pr(y = 1|x)}$. In order to obtain the logit model we apply logarithms to these probabilities and obtain the following relation: $ln\Omega(x) = \beta_0 + \sum_{j=1}^{n} \beta_i x_{i,j}$. This latter equation is the logit form of the model, where $\ln\Omega(x)$ is the logarithm of the probability for an individual to be part of one category or another in relation to the explanatory variables $x_{i,1}$, $x_{i,2}$,..,$x_{i,k}$.

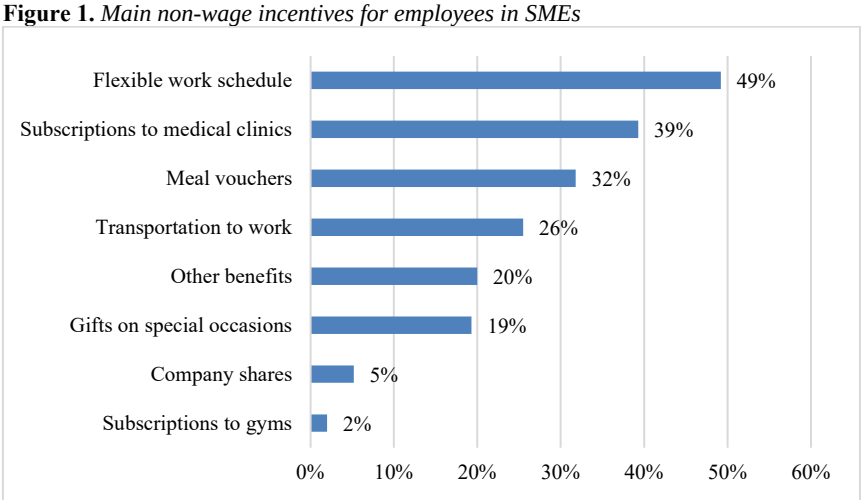
4. Main findings

The most frequently offered non-wage incentive to their employees was identified to be a flexible work schedule, 49% of the respondents choosing this option for their firms. This incentive is offered more often in the micro (48.9%) and small (56%) enterprises than in the medium ones (33.9%).

Other non-wage incentive offered to the employees turned out to be the subscriptions to medical clinics (39%), meal vouchers (32%) or transportation to work (26%). The incentive "subscription to medical clinics" is offered in more than half of the small firms (56.5%), compared to 48.2% in the medium firms and 38% in the micro firms. Meal vouchers is significantly more present as incentive in the medium firms (80.4%) and in the small ones (63.4%), compared to only 27.1% in the case of micro firms. Also, the incentive "transportation to work" is offered more in the small (41.4%) and medium (46.4%) enterprises than in the micro ones (23.2%).

To a much lower extent, firms may offer subscriptions to gyms (2%) or even company shares (5%).

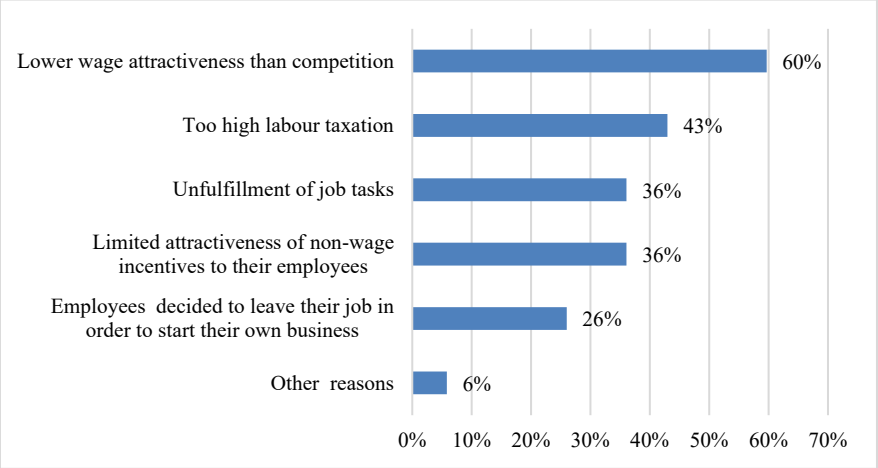
Figure 1. *Main non-wage incentives for employees in SMEs*



Source: authors' calculations based on data collected in the survey.

When questioned about the main determinant of recent personnel fluctuations almost two thirds of the respondents (60%) mentioned the lower wage attractiveness than competition. This cause for personnel fluctuation appears to be a greater impediment in the medium-sized companies than in the smaller ones. Also, too high labour taxation was considered as a determinant of personnel fluctuation for 43% of the firms. In this case, too high labour taxation was more often seen as a problem for the small enterprises than for the micro and the medium ones.

Figure 2. *Main determinants of recent personnel fluctuations in SMEs*



Source: authors' calculations based on data collected in the survey.

A third of the respondents declared that the limited attractiveness of non-wage incentives to their employees was a cause of personnel fluctuation, as well as unfulfillment of the job tasks. The limited attractiveness of non-wage incentives to their employees is more of an inconvenient for the medium enterprises, while the unfulfillment of the job tasks appears to be more problematic for the micro firms.

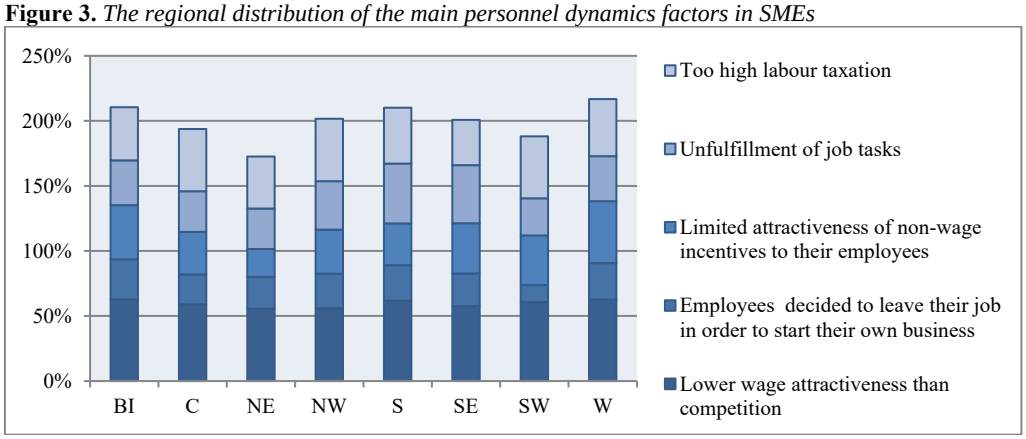
It is relevant to also point out the proportion of employees who decided to leave their job in order to start their own business, which represented about 26% of the cases reported by the surveyed SMEs.

The regional level analysis revealed some interesting information. First, the major problem when speaking of personnel fluctuation appears to be the lower wage attractiveness than competition in all regions, with very low fluctuation (the percentage is as high as 62% in Bucharest-Ilfov region and West region, while he lowest value is around 55% in North-East and North-West regions).

The second main determinant varies among regions:

- In Bucharest-Ilfov and West regions the limited attractiveness of non-wage incentives to their employees was the second cause for their personnel fluctuation (41.6%, respectively 47.7%).
- In Centre, North-East, North-West and South-West the second factor causing personnel fluctuation appears to be the too high taxation of labour (47.9%, 40%, 48%, 47.6% respectively).
- In South and South-East regions the unfulfillment of job tasks was the second cause for personnel fluctuation (46.1% respectively 44.7% of respondents in these regions chose this cause).

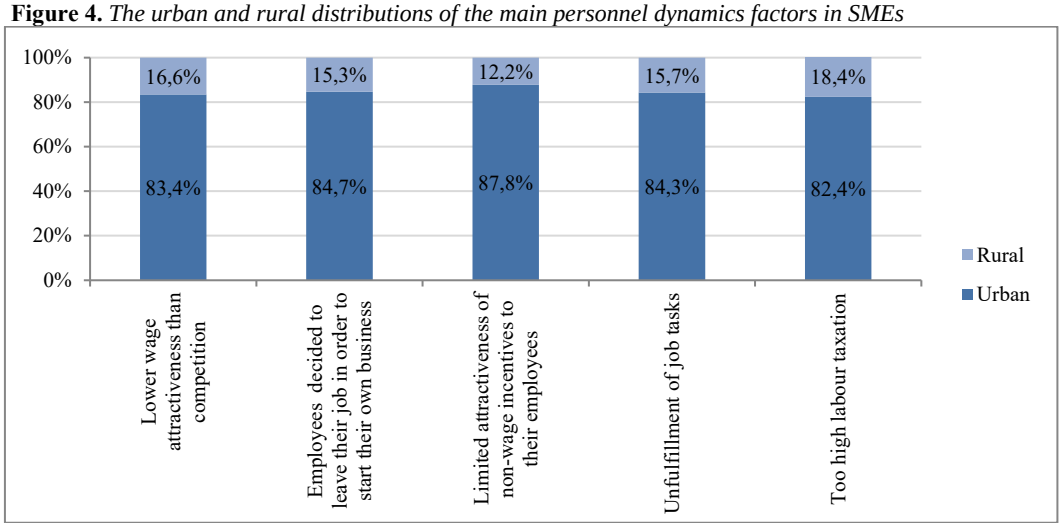
Figure 3. *The regional distribution of the main personnel dynamics factors in SMEs*



Source: authors' calculations based on data collected in the survey.

The results also show that the effects of personnel fluctuations are more visible in urban areas as compared to the rural area. Each determinant considered in the questionnaire for the recent personnel fluctuation it is mentioned by at least 82% of the SMEs in urban areas. The results are as expected, since the personnel fluctuation is expected to be more visible in urban areas, where there are many more options to find a new job.

Figure 4. *The urban and rural distributions of the main personnel dynamics factors in SMEs*



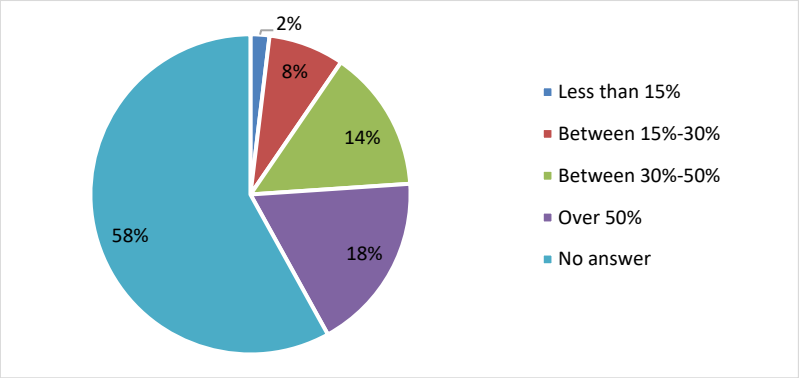
Source: authors' calculations based on data collected in the survey.

Regarding the structure of their employees, 22% of the surveyed SMEs have reported the percentage of their temporary employees. More than half of them (57%) declared that the temporary employees account for 15-30% of total employees. Another 20% say that some 30% to 50% of their employees have temporary contracts, while 23% report less than 15% temporary contracts in their firms.

As for the participation of the employees at different vocational training courses, other than those imposed by law, the situation is presented in Figure 5. 18% of the SMEs participating at the questionnaire declared that more than 50% of their employees have participated in

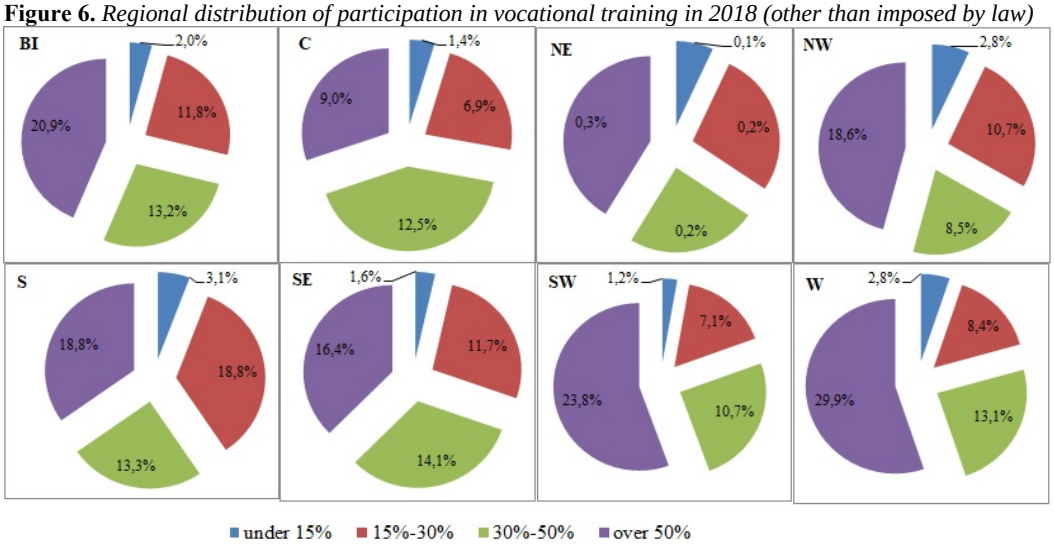
vocational training courses in 2018. Another 14% of the respondents said that 30-50% of their employees participated in 2018 in different vocational training course, other than those imposed by law. The proportion of the firms declaring smaller percentages for the participation in vocational training of their employees is under 10% (8% for a participation rate of 15-30%, respectively 2% for a participation rate under 15%). It is worth mentioning that more than half of the SMEs included in the analysis didn't respond to this question.

Figure 5. *Participation in vocational training in 2018, other than imposed by law*



Source: authors' calculations based on data collected in the survey.

Figure 6. *Regional distribution of participation in vocational training in 2018 (other than imposed by law)*



Source: authors' calculations based on data collected in the survey.

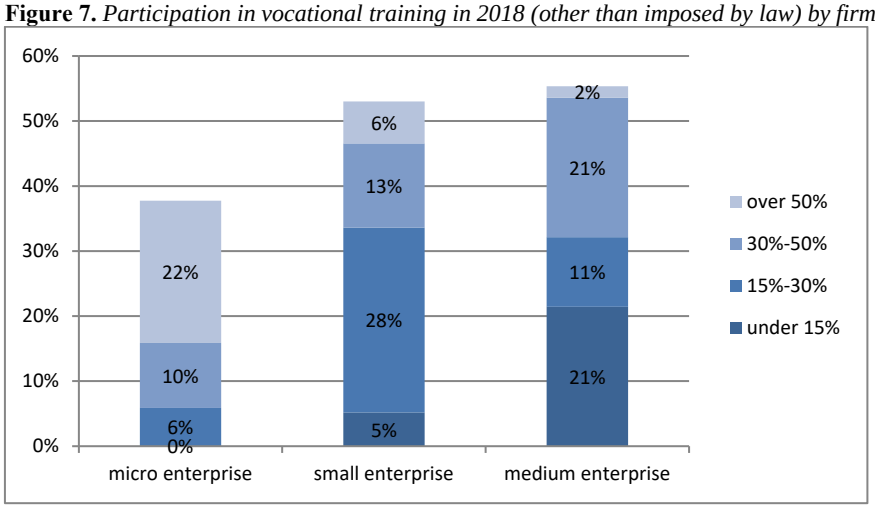
At regional level the following representation was obtained:

- More than 50% of the employees have participated in vocational training courses in 2018 in majority of the firms in Bucharest-Ilfov, North-East, North-West, South-East, South-West and West.
- In the Centre region the majority of the firms declared that 30-50% of their employees participated in vocational training in 2018.

- In the South region, the same percentage declared that over 50%, respectively 15-30% of their employees participated in vocational training in 2018.

As can be noticed in Figure 7, one in four small firms (28%) declared that 15% to 30% of their employees participated in 2018 at different vocational training, other than those imposed by law. For the medium-sized enterprises resulted that 21% of them place themselves in the category with less than 15% of their employees participating in vocational training, and the same percentage (21%) place themselves in the category with 30-50% employees participating in vocational training in 2018. One in five micro enterprises (22%) declared that over 50% of their employees participated in 2018 in vocational training, a percentage much bigger than the one registered by the other 2 firm-classes.

Figure 7. *Participation in vocational training in 2018 (other than imposed by law) by firm size*



Source: authors' calculations based on data collected in the survey.

Furthermore we investigated which are the firms more likely to face personnel fluctuation through an econometric model. Our dependent variable is a binary variable that takes value 1 if the firm experienced a drop in the number of employees in 2018 as compared to 2017 and 0 if not (*personnel_drop*). As mentioned before, taking into account the dependent variable as a binary one, we turned to a logistic econometric model.

The independent variables in our model are all binary variables, as following:

- *training15_30*→firms with 15-30% employees participating in vocational training: takes value 1 if the firm is in this category and 0 if not.
- *training50+*→firms with over 50% employees participating in vocational training: takes value 1 if the firm is in this category and 0 if not.
- *Q1_TO_17*→firms with the turnover obtained in 2017 in the first quartile: takes value 1 if the firm is in this category and 0 if not.
- *Q2_TO_17*→ firms with the turnover obtained in 2017 in the second quartile: takes value 1 if the firm is in this category and 0 if not.
- *Q3_TO_17*→ firms with the turnover obtained in 2017 in the third quartile: takes value 1 if the firm is in this category and 0 if not.

- *Q1_Profit_17*→ firms with the profit obtained in 2017 in the first quartile: takes value 1 if the firm is in this category and 0 if not.
- *Q2_Profit_17*→ firms with the profit obtained in 2017 in the second quartile: takes value 1 if the firm is in this category and 0 if not.
- *Q3_Profit_17*→ firms with the profit obtained in 2017 in the third quartile: takes value 1 if the firm is in this category and 0 if not.
- *trade*: takes value 1 if the firm activates in the trade sector, and 0 if not.

The estimation of the logit model provided the following results:

Table 1. *Results of the logit model*

Logistic regression	LR chi2(9)	62.81
	Prob > chi2	0
Log likelihood = -627.22207	Pseudo R2	0.0477

Dependent variable: *personnel_drop*	**Coef.**	**Std. Err.**	**z**	**P>z**
training15_30	**-0.61**	0.288107	-2.13	0.033
training50+	**-0.31**	0.197956	-1.58	0.115
Q1_TO_17	**-1.57**	0.249318	-6.28	0
Q2_TO_17	**-0.98**	0.223539	-4.37	0
Q3_TO_17	**-0.40**	0.198038	-2.02	0.044
Q1_Profit_17	**1.24**	0.233647	5.29	0
Q2_Profit_17	**0.50**	0.234009	2.12	0.034
Q3_Profit_17	**0.40**	0.215339	1.85	0.064
trade	**-0.28**	0.158097	-1.74	0.082
_cons	**-0.86**	0.165619	-5.18	0

Source: authors' calculations using STATA, based on data collected in the survey.

These results show that the reduction of personnel is less likely to happen in those firms that offer or facilitate access to training programs (other than those required by law) to their employees. The result is not surprising, since the training programs are an important way for the personnel in SMEs to grow and improve their skills.

In terms of turnover, it seems that the reduction of personnel is more visible in firms with high turnover (the fourth quartile), than in the firms belonging to the first quartiles. This may be explained through the fact that usually, the more employees in the firm, the bigger the turnover and the personnel drop was more present among medium firms than in the micro ones. As for the profit, our results indicate that the lower the profit, the higher the probability of losing employees. Since a drop in the firm's profit might normally be associated with lower business performances, then fluctuations of personnel are to be expected under such circumstances and especially in economic sectors with more notable changes in the goods and services demand dynamics. Our empirical analysis has shown that, for instance, the reduction of personnel is less likely to happen in those firms that activate in the Trade sector as compared to other sectors, as it is a more stable business sector.

5. Conclusions

The small and medium enterprises (SMEs) in the EU represent a force of the economy. Among the challenges that SMEs have to face daily, the attraction, motivation, development and retention of employees are some of the important ones. A key to success

in every company, aside from attracting and attaining employees, is also giving the employees a chance to develop as that will increase the knowledge base, both for the individuals and for the company. Having that picture in mind, the paper focused on the main causes of personnel dynamics within the Romanian SMEs. For that we designed a questionnaire and obtained survey data on 1200 companies.

Our primary analysis indicated that the most frequently offered non-wage incentive to their employees is a flexible work schedule (49%), followed by the subscriptions to medical clinics (39%), meal vouchers (32%) or transportation to work (26%). The main determinants of recent personnel fluctuations resulted to be the lower wage attractiveness than competition (60%) and too high labour taxation (43%). In this regard it is relevant to point out the fact that 26% of the SMEs reported as a cause for personnel loss the decision of those employees that resigned to start their own business. This situation occurred more in the micro and small firms, than in the medium ones. Another interesting fact is that only 18% of the SMEs participating in the survey declared that more than 50% of their employees have participated in vocational training courses in 2018, but if looking more into the data, we can see that a larger proportion of the micro firms are found in this position, as compared to the small and medium ones.

The primary analysis was extended with an econometric model, for us to investigate which are the firms more likely to face personnel fluctuation. The results indicated that the reduction of personnel in the Romanian SMEs are more visible in SMEs with higher turnover, but lower level of profit and less visible in the SMEs offering access to training programs or activating in the Trade sector.

In the future, the analysis may be enriched with other econometric models in order to investigate other aspects in the SMEs activity and even a new wave of the survey to capture the new reality we are in, since the firms around the globe faces difficulties in surviving as a result of the pandemic.

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Causes of the curve: Assessing risk in public and private financial economics

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Abstract. *Can bond yield curves, the Anxious Index, and/or institutional factors indicate if investors expect too much risk in the short-term, and therefore recessions? While hypothesizing that they can, yield curves may also be affected by shocks, inflation, debt, and maturity preferences, controlled for using both short-term, and wide-spanning, post-World War II regressions, in various countries. While these theories are found valid, the three main hypotheses are most presaging, and the effect of debt stands out, though dependent on savings. Finally, the article analyzes risk in financial institutions, finding that diversification of society can buffer risky, volatile finance institutions, and vice-versa.*

Keywords: bonds, yield curve, Anxious Index, interest rate, debt, monetary policy.

JEL Classification: G12, G21, G28.

I. Introduction

The topics of "finance and government" nourish both consumption and trade with the money necessary to operate. As they do so, bond yield curves are constantly changing. Can bonds, and other factors, indicate if too much or little risk is expected in the short or long-term? One of the central hypothesis considered here is that indicators like government bonds, one type of investment, can to an extent indicate coming periods of growth or recession. Bond yield curves, showing interest rates for short- versus longer turn bonds, turn inverted before recessions hypothetically because investors have more worried risk expectations about the present, than the future, and are willing to pay greater risk premiums, while in the future they cannot bear more risk. Little has been researched on these issues in countries other than the United States.

The primary growth of society is through financial risk, which is the cardiac aspect of the system, supplying each part with blood. Too much risk can spell disaster, whether through crisis, recession, or volatility. British economist John Maynard Keynes was the first to write about the qualities of money, which affected investment, and, in turn, affected the labor market, all in the short-run, in *The General Theory* (1936). The Investment: Saving-Liquidity: Money (IS-LM) Model, developed slightly later by J.R. Hicks and Franco Modigliani, links the goods market to the financial market through interest rates. Due to riskiness, the return on a project or investment may differ from the original interest-rate-level source of funding, which require use of macro models. As interest rates rise, there is more risk for demand, and less for supply. Firms take out loans at specific interest rates, to fund projects they believe will have higher returns, what Keynes called the "marginal efficiency of capital" (Keynes, 1936, p. 135), now called the "internal rate of return". Nearly every recession in the United States in the 20th and 21st Century, except for 1991, was predated by an inversion of the bond yield curve.

Investors may also move back and forth between stocks and bonds over riskiness, or between different lengths of bonds due to tastes and preferences, as suggested by "market segment theory", or "the preferred habitat hypothesis". Fiscal or monetary policy, inflation from oil, shocks, or micro issues collectively called the "financial accelerator", also raise bond yields, called "premiums". Others point to policy decisions by central banks in raising interest rates, while government debt raises interest rates, through supply and demand, and thus risk, as well. The central idea is that the yield spread between short-term bonds and long-term bonds indicates the risk expectations of investors of the near future compared with the distant future. This idea of "expectations" dates back to works by Lucas and Romer from the 1970s, and is now called New Classical Economics (Klamer, 1984, p. 1). New Keynesians have diffidently accepted expectations. If bond yields turn inverted, it not only signals expectations of upcoming recessions, but also that the country has absorbed as much financial risk possible. The hypotheses are that the expectation effects of the yield curve are real, that premium theories are more significant than the market segmentation theory or the preferred habitat hypothesis, that government monetary and fiscal policy (debt) also raise or lower yield curves via risk (Arnold, 1998, p. 319), and that the Anxious Index and institutions, mainly more long-term, also matter in divining volatility. The author will attempt to unearth which of all of these theories are veritable.

II. Literature review and theories of interest rates

Empirical evidence in recent years substantiates that the market segmentation hypothesis holds for the short term, in the contexts of studies by Mustafa and Rahman (1995), Park and Switzer (1997) Simon (1991), and Taylor (1992). Research for longer periods is weak. One examination of the theory was a paper by Phillips (2003), which looked specifically at the United States (U.S.) government in 1999 (Phillips, 2003, p. 1). The "market segmentation" theory contends that bond investors have a market segment in which they like to invest, for business reasons. A similar theory, the "preferred habitat hypothesis", argues that bond holders will only move out of their habitat for a premium (Kidwell et al., 2000). Phillips (2003) examined this "preferred habitat hypothesis", using the Constant Maturity Treasury (CMT) yields, a weekly yield curve estimate by the Treasury Department. Using OLS regression analysis**,** he subtracted forecasted yields from the CMT expectation and found only a slight, insignificant difference, but significant at the time in November, 1999 when the Federal Reserve announced its buyback program. He finds this as verification of his initial hypothesis, but also notes that bond yields may have reacted to Federal Reserve interest rate policies. However, short-term yields did not cause investors to move from longer term markets to shorter ones (Phillips, 2003, pp. 1-5).

Turning to another theory, Thomas and Wu (2006) considered interest rate moves *following* announced changes in future deficits. These two authors cite several studies which find that following decrees proposing laws reducing deficits, such as in 1985 and 1990, interest yields fell (Thomas and Wu, 2006, pp. 1-2). Relatedly, Thomas and Wu find that each one percent increase in the expected two-year-ahead deficit/GDP ratio likely increases the yield spread by 20-50 basis points (Thomas and Wu, 2006, p. 5). According to Fisher (2001), such expectations can remove arbitrage (Fisher, 2001, p. 1), the ability to shift money for slight gains in yield variations.

Another possible causal path of why yield curves are related to recessions is microeconomic- yield curves worry bank managers by putting pressure on the margin between interest earnings and funding costs. Low margins can lead bank managers to take more *risks* in hopes of earning more. During the 2001 recession, the charge-off rate for U.S. banks, which are losses divided by total loans, increased by 50% until it reached a height of 0.16% in December of 2002. Loans usually have longer time-spans than shorter term deposits. When the yield curve inverts, and long-term rates fall, margins on loans oftentimes shrink, as do profits, which encourages greater bank risk taking, called "chasing yield" (Balla et al., 2007, pp. 37-38).

Banks can also pursue a leverage-growth strategy, of expanding assets owned in an effort to broaden out risk. Surprisingly, banks usually try to take on more *risk*, by lowering standards and lending in areas they would typically avoid, or providing new instruments (Balla et al., 2007, p. 38). This risk taking actions by banks is another causal factor of why flattened curves may actually "cause" recessions, but usually there is a lag before recessions, which gives more weight to expectations theory, and banks as of 2019 are more cautiously managing assets and using fixed rates and fees, which over three decades was a great basis of revenue (Balla et al., 2007, p. 2).

Still, Wang and Yang (2012) disagree, claiming both recessions and inversions may be caused together by some event, such as a financial crisis or tight monetary policy, which first affects the yield curve, and then output, but not *causing* the decline in GDP. This explanation differs from theories that higher short-term rates drive out investment and *cause* recessions. The yield curve inversion is merely a "by-product" (Wang and Yang, 2012, p. 6). The LM, or money market curve, shifts left, and Y (GDP) decreases. Regrettably, they offer no real world examples of the "shocks" that they say affect these changes (Wang and Yang, 2012, pp. 5-6). Using another example, Hamilton and Kim (2002) theorize what occurs when central banks use tight monetary policy. Investors expect there will be a temporary rise in the short-term rate, then long-term rates will rise less, the curve will flatten, and there will be less short-term spending, hurting growth. A policy of expansion would have the reverse effect (Hamilton and Kim, 2002, p. 4).

The issue of whether yield curves predict recessions involves two types of literature; first, trying to predict the actual future growth rate, and second, trying to predict the probability of recessions; here, the latter theory is of concern. Though most research is post-World War II (WWII), some economists find predictions of output dating to the 1870's in the United States and Germany (Haubrich, 2006, pp. 2-3). Balla et al. (2007) report that "a recession has not followed every inversion" (Balla et al., 2007, p. 39). The largest discrepancy was 1966-1967 when the curve flipped but there was no *official* recession (Balla et al., 2007, p. 39). Still, today, other economists claim the yield curve "might not be as reliable a predictor … as it used to be" (Haubrich, 2006, p. 1). In the 1992-1994 period, Federal Reserve Chairman Allan Greenspan commented on the flat yield curve, arguing that the traditional yield curve is less important than the gap between "the current and long-run levels of the real *federal funds rate*" (Haubrich, 2006, pp. 2-3).

This gap theory leads into an analysis by Wright (2006-07), who believes that the probability of a recession can actually be predicted by the *degree* of inversion (Wright, 2006-07, p. 7). Such evidence seems to verify Chairman Greenspan's comments. Wright, in 2006-2007, predicted a 50% chance of recession in the next four quarters using the model with the federal funds rate, but only 20% when not including it – his results were prophetic (Wright, 2006-07, p. 60).

In addition, attempts to predict growth may fail due to the powerful lack of inflation in the 21st Century, which in the past has made future yields look less steep, an area that Haubrich has examined (Haubrich, 2006, p. 4). Phillips (2003), mentioned earlier, also questions orthodoxy by rejecting that the central bank's monetary policy affects the yield curve. He notes that the federal funds rates rose in 2000, yet the yield curve declined in this period. Phillips then tested the expectation hypothesis with a statistical regression in which the yield on the U.S. 30-year bond was a function of a constant and on a premium from all of the shorter term bonds, with a high explanatory R2 of 0.98 (Phillips, 2003, p. 5).

Stock and Watson (1989) reinitiated the discussion of *why* yield curves might affect economies, using the premium difference between the six-month commercial paper (private bonds) and the six-month Treasury bill, as well as the difference between the ten-year and one-year Treasury bond rates (Hamilton and Kim, 2002, p. 1). Zamsky provided several reasons why the T-bill is the best metric. They are the "benchmark rate for …

decisions", and the "pricing of new bond issues", they are used to "hedge interest rate risk", they are used for international "value comparison", and they are very liquid (Zamsky, 2000, p. 2). Estrella and Trubin (2006) added United States data since World War II. Another round of papers followed, including Harvey (1988, 1989), who linked term structures to output growth, and Estrella and Hardouvelis (1991), who used the difference between the ten-year Treasury bond and the three month T-bill and several European states beyond the United States. Plosser and Rouwenhorst (1994) examined three industrialized countries, and found the curve is a better predictor than monetary policy. Estrella and Mishkin (1998), the most famous study, found term structures to be the best predictors of a recession in the next four quarters. Haubrich and Dombroski (1996) and Dotsey (1998) found that the yield curve's utility is diminishing over time (Hamilton and Kim, 2002, p. 1).

According to Hamilton and Kim (2002), the causation of the yield curve is unclear, because "no one has yet proposed a way of separately measuring the role of the term premium itself in accounting for the spreads' usefulness in forecasting" (Hamilton and Kim, 2002, p. 1). This would involve very timely surveying of premiums investors would pay based on risk. Using the spread of the 10-year Treasury bond and the three month T-bill, and independent variables for the Federal Funds' rate, estimates for M1 and M2 money supply, and an index for oil prices, the coefficient for recessions linked with GDP remained significant two years ahead (Hamilton and Kim, 2002, pp. 2-4). Therefore, methodology is the key to how one views the subject.

Still, market expectations of future *macroeconomic* growth may play a role, because if one expects high growth, the yield on long-term bonds should rise, based on "expectations". But *risk* plays a role as well. If interest rates become very volatile toward the end of an expansion, expectations do not change, but the risk premium does, which could lead to a flattening of the curve (Hamilton and Kim, 2002, p. 4). According to Estrella and Trubin (2006), most research has been empirical, developing correlations rather than building theories. They furthermore state that short-term rates are more predictive, because prior to four United States' recessions, the long term rates rose instead of falling. They also find that the more pronounced inversions, especially the two in the 1980s, are "associated" with deeper recessions (Estrella and Trubin, 2006, p. 3).

Mody and Taylor (2003), in light of the yield curve's lack of inversion before the 1990-91 U.S. recession, offer an alternative hypothesis discussed in the literature, that of the "financial accelerator" (Mody and Taylor, 2003, p. 1). This is calculated as the premium on "high yield" or "junk bonds" on top of government debt or high-rated, AAA corporate bonds. They found the accelerator theory particularly useful for predicting in the 1970s and 1980, yet since then they do have "a high predictive content" (Mody and Taylor, 2003, p. 1). Tight U.S. monetary policy, through short-term interest rates, increase capital outflows to developing countries. The reduced U.S. supply steepens yield curves. Higher yield spreads predict higher default rates, less access to credit, and slower economic activity (Mody and Taylor, 2003, pp. 1-3).

The financial accelerator begins when, and only when, there is friction in the financial market, as in the case of asymmetric information or contract enforcement costs, or more *risk*. High yield bonds are at times more available in the developing world, creating a

"premium" for external funds from the more prestigious United States (Mody and Taylor, 2003, p. 4). Until recently, theorists struggled to explain this premium, but it is related to the concept of "chasing yield", which the accelerator theory portrays (Mody and Taylor, 2003, p. 4).

Write Mody and Taylor (2003), a high yield spread in particular tends to predict an economic slowdown, but yield curves lost their predictive power in the mid-late 1980s, already discussed, due to more aggressive policies targeting inflation. Conversely, the 1970s had high inflation, and oil shocks, which resulted in flatter yields and less economic activity. One should note, this is contrary to other findings that oil prices play only a small part in yield curves. Mody and Taylor predicted, in 2003, that the accelerator's friction would decline over time (Mody and Taylor, 2003, p. 11), which was apparently wrong, as rates are low today, driving savings oversees.

Writing in 2006, directly before onset of the 2008 U.S. financial crisis, Thomas and Wu (2006) asked why the yield curve was flat, in spite of large deficits, numerous rate hikes by the Fed, a "major" upsurge of energy prices, and higher US inflation, leading Greenspan to call it a "conundrum" (Thomas and Wu, 2006, p. 5). Asian countries were investing heavily in U.S. long-term bonds, but one would think this demand would cause the curve to increase. Thomas and Wu had foreseen that Social Security and Medicare could put strains on the system and cause longer-term rates to rise. The crises that followed was self-obvious (Thomas and Wu, 2006, pp. 5-6).

Of importance is distinguishing between the shape of the yield curve and the height, or level, of the curve, the former which is more useful here. Europe is a good place to analyze debt theories, as, by 2007, countries were highly integrated. Integration convinced some borrowers there was little difference between nations, when there *was* a difference, in terms of risk. Greece had a margin over European Monetary Union bond yields until 2001, but it disappeared once it joined the Euro after that year. The Treaty of Maastricht made clear that each country maintained full responsibility for its own debts, with no "bail-out" (Holland et al., 2011, p. 1). In 2010, the markets started to diverge, revealing European debt was not risk-free. Credit agencies downgraded Greek and Irish debt, in 2009, then Portugal in 2010. From November 2009 to May 2011, these three countries saw 32 agency downgrades (Holland et al., 2011, pp. 1-6).

In mid-July 2011, Greek bonds were 15 points higher than in Germany (a stable country), Ireland's bonds were 11.2 points higher, and Portugal's bonds were 10.3 points higher. The EU and IMF agreed to reduce rates of interest in order to make borrowing more profitable. In other countries, Spain had a spread over Germany of 3.1 points, Belgium was at 1.5 points higher, and Italy was at 2.7. These borrowing spreads not only mean, as already stated, the loss of wealth to citizens, but losses to firms and banks, reducing consumer spending, weakening balance sheets, crunching credit for banks, and increased bank lending margins. The European rescue plans, given its debt crisis, involve restructuring and swapping existing bonds for new, altered bonds with less principal or interest, and more length, so-called refinancing (Holland et al., 2011, pp. 1-6).

Europe gives further evidence to the theory that fiscal discipline lowers interest rates. In addition, a country's credit risk ratings, forecasts of its fiscal debt, and the liquidity of its markets, which is related to market size, also affect yields levels. Additionally, Bayoumi, Goldstein, and Woglom (1995) found that bond yields of U.S. states are determined by level of state debt, while national debt may also affect spreads between public and corporate bonds, according to Alesina et al. (1992). Another statistic used for risk prediction is known as the "Anxious Index" (Trader's "Reassessing", 2010, pp. 1-3).

With the Anxious Index, also called the Survey of Profession Forecasters (SPF), and with the Livingston Survey and the University of Michigan prediction of inflation, the SPF relies on human intuition rather than direct data alone. While, in the course of this analysis, the "yield curve" and the "Anxious Index" are neither themselves "rules" which affect policy, the Anxious Index does indeed rely more upon human "gut" feelings, best made by a holistic examination of the market, whereas the "yield curve" simply follows data (Keane and Runkle, 1989, p. 24).

In 1968, the SPF forecasts were used on 10 macroeconomic variables; four were eliminated and 11 were added in 1981 (Baghestani and Nelson, 2011, p. 1). The SPF was created in-part by Victor Zornowitz, and since then number of respondents have varied between fifteen and sixty "experts" (Kean and Runkle, 1989, p. 27). There has been some discrepancy over what exactly constitutes a recession for all such studies. A study by Lahiri and Wang (2006) concluded that "external shocks cannot, by definition, be predicted". However, shocks can time "to generate", during the early stages of which they can be better predicted. Their study shows experts as having under-confidence, since the average forecast of a recession was 7.2%, whereas in other sciences weather or earthquakes are over-predicted (Lahiri and Wang, 2006, pp. 26-28).

A study by Keane and Runkle (1989) tested whether or not people are "rational", in the context of "rational expectations", or the "efficient market hypothesis", in which case prices are in essence "built into the system" by everyone beforehand, all having similar information. They theorized, though, that professional forecasters have an incentive to be more accurate since their reputation is on the line, as is their business. Further, they contend their study uses different and more accurate data, and assume that forecasters' errors may be correlated (Keane and Runkle, 1989, p. 29). The moment "*when* forecasters have current [information] is crucial" (Keane and Runkle, 1989, p. 32). In this study, forecast errors were low and were themselves unpredictable, indicating rationality. Forecast errors were duly low for inflation (Keane and Runkle, 1989, p. 33)

According to Lahiri and Wang (2006), "Psychologists have shown that individuals (tend to) bias their estimated probabilities towards an anchor, the base rate in this case (30%), particularly when they face difficult forecast situations" (Lahiri and Wang, 2006, p. 32). The SPF did not forecast the 2001 recession, and had true false signals in 1975 and 1980, probably because, for the last, the National Bureau of Economic Research (NBER) denied the economy was in recession definition-wise when it most likely was (Lahiri and Wang, 2006, p. 33). Stock and Watson (2003), proponents of the yield curve, noted the 2001 miss (Lahiri and Wang, 2006, p. 35). Still, "the variance (error)… was found to be three times

more than necessary", due to "cues or predicators that are not related to … negative GDP growth" (Lahiri and Wang, 2006, p. 35).

Baghestani and Nelson (2011) cite Bernstein and Silbert (1984) as finding that professional forecasters are "better than naïve predictions" (Baghestani and Nelson, 2011, p. 1). They find that some variables are easier to predict than others, and that forecasts made at later times are more accurate than early forecasts. For instance, the unemployment rate is easier to forecast than the 3-month T-bill rate. Inflation was found to be the most difficult, even using a Phillips Curve model. Nevertheless, while no single forecaster was "constantly accurate", "average forecast error" was considerably low, and professional forecasters were evaluated to be more accurate than "naïve" ones (Baghestani and Nelson, 2011, pp. 1-2).

A Su and Su (1975) study suggests professional forecasters are more accurate than econometric time-series models and also better at predicting changes in data rather than the resultant data itself, such as changes in Gross Domestic Product (GDP) versus exact future GDP. A Hafer and Hein (1985) research paper found forecasters to be more accurate about inflation than models based on interest rates, which usually foresee higher inflation. A Lahiri and Teigland (1987) study concluded that that forecasts are not usually normally distributed. Consequently, there is a greater tendency for experts to skew their predictions either right or left of the mean. Lahiri, Teigland, and Zaporowski (1988) interestingly found that real (not nominal) interest rates actually decline upon heightened uncertainty over inflation (Croushore, 1993, p. 13).

A 1990 Keane and Runkle paper implies that forecasters are rational, meaning they do not "leave useful information unexploited" (Croushore, 1993, p. 13). Changes are anticipated and built into the market ahead of time so that individual profit-making is more difficult. A paper by McNees (1992) discovered that forecasting mistakes are greater when recessions or expansions begin than at other times, and a Rudin (1992) study recognized that forecasters all have very different beliefs, which are not always consistent with time series models (Croushore, 1993, p. 13).

Regarding the ability to predict *inflation*, the author compares two articles, one by Levy (1982), the other by Estrella (2005). Levy took the yield curve in times of low inflation and "compare[d] it with the yield curves observed during periods of high inflation in order to obtain an estimate of future inflation rates as predicted by the market" (Levy, 1982, p. 37). He agreed that short term rates indicate "liquidity preferences and [risks]" (Levy, 1982, p. 37). When compared with the benchmark, low inflation years of 1961-1964, "estimates were [close to] actual inflation… " (Levy, 1982, p. 37). The only era when estimates missed was 1972-1981. In the late 1970s investors could not foresee policies during very high inflation (Levy, 1982, pp. 37-42).

The second article, Estrella (2005), summarizes itself: "The slope of the yield curve has been shown empirically to be a significant predictor of inflation and real economic activity…," but adds that it does so not *because* of anticipations of changes in monetary policy (Estrella, 2005, 722). Estrella cites a paper by Mishkin in which inflation was predicted better in a shorter time horizon (Estrella, 2005, p. 723), especially if it "is optimally supplemented with other information" (Estrella, 2005, p. 734). The relationship

between the "term spread" and inflation is stronger from 1963-1987, than it is after 1987, when Alan Greenspan was appointed Federal Reserve Chairman, after which inflation targeting was used more (Estrella, 2005, pp. 738-743). These findings, though, are only true if monetary policy is active, not passive (Estrella, 2005, p. 724), and if monetary policies is not based on different goals (Estrella, 2005, p. 727). The curves predictive power declines long-term as bond rates approach infinity (Estrella, 2005, p. 742).

III. Methodology

This article contributes by containing more countries over a longer time period than most others, and by testing sundry different theories. Methodologically, the analysis contains several regressions for each. Statistically, the Ordinary Least Square method can be used to link independent variables with dependent variables based on the "line of best fit" that minimizes the collective difference from such line. Beta tests are used to measure the standard deviation of variables to compare them, since they are inevitably in different units, to see which theories are more plausible. Dummy variables are binary variables that indicate the presence or absence of some phenomenon, in this case, a recession or financial crisis, which will be used as the x variable, so as to include other explanatory variables (Wooldridge, 2009, pp. 68, 187-188, 225). Investment institutions may try to restrict long-term lending if they believe the curve will flatten, trying to solidify expensive rates, which may be another cause, not only a harbinger, of the recessions, along with a lack of demand in taking out short-term, risky loans.

The United States' Operation Twist at the end of Chairman Ben Bernanke's term flattened out the current shape of the US curve, raising it at the beginning, and lessening it at the end, with little effect in the middle, a deliberate move. This action gives some support for the preferred habitat hypothesis, since bond buyers remained in their same "habitat". As a result**,** the author will regress the 30-year minus 20-year premium on the Twenty year bond minus ten year premium and also the volume change between the two, and look at the beta, to see if theories related to premium are stronger, that is, if one premium affects the other across time periods, or if market segmentation theories (which would increase demand and premiums), hold in this period. One caveat of the regressions is that of multi-collinearity, because the 20-year and 30-year bonds were also affected by the change in volume. Premiums indicate that longer term bonds have more risk, which they should, because of increased chance of default.

In an analysis of European countries, the author will test an additional, age-old question of whether debt-GDP ratios increase interest rate levels. A regression is run using the debt-GDP ratios for randomly chosen 2nd quarter, which is in the middle of the year, from 2012-2015, with the average 10-month European country bond. The European data is excellent to use, since many countries have such high levels in the 2000s, and data is easily obtainable. Using the European countries: Portugal, Italy, Ireland, Greece, and Spain, and a number of other random European countries, the author tests the hypothesis that larger deficits create higher interest rate levels. This researcher also runs a regression for non-Euro-zone, European states, after noticing that these countries had much lower debt levels.

Finally, and most importantly, this article creates an historical model, to prove the "expectations" hypothesis, by regressing long-minus-short-term yield spreads by a dummy variable for recessions that followed shortly afterwards, the money supply, and a deficit/debt statistic, again, with a beta. This article will aim to include diverse global countries. Homer and Sylla's (2005) *A History of Interest Rates* includes data on short- and long-term rates, namely Japan, India, South Africa, Sweden, Denmark, Norway, and New Zealand, Australia, the United Kingdom, and the United States from the 1940s to the present. As bond denominations differ across countries, just a long- and short-term rate is used. Brian Mitchell's *International Historical Statistics*, was used, from the Yale and Southern Connecticut State University libraries. Some of the bond data came from the Quandl Investing Database, and from the OECD for Australia, the United States, and New Zealand after 1990. Data missing needed counter-factuals, such as with the United Kingdom where M2 was used, and India, where rates were deduced from a graph for 1998-2006, and 2010. Investment taxes were not used. Breusch Pagan tests measure heteroscedasticity, data divergence: all tests pass but one, which will be indicated.

IV. Results

I. Preliminary Findings

Below, data from Fall 2011, the start of "Operation Twist", gives credibility to the market segmentation hypothesis since a change in volume affected supply and therefore the value of the three month T-bills, short-term.

Table 1. *Market Segmentation Test. A change in volume affects interest rates.*
Dependent Variable: Three_month_T_bill P > F = 0.0077* R2 = 0.6098 Obs: 10

Variable	Coefficient	t	p
Average_Volume	0.0732064	3.54	0.008*
constant	-0.0035081	-0.72	-0.0147582*

* significant at 95% or greater.

Next, Operation Twist, the Fall 2011 policy of the United States' Federal Reserve's to lower long-term rates, was tested by regressing the change in 30-year rates via changes in volume initiated by the Federal Reserve. It also had an effect upon the shape of the yield curve between 30-year bonds and 20-year bonds, but not upon the difference between 20-year bonds and ten year bonds, which are shown below. Overall, then, its effect was to flatten out the current shape of our curve, raising it at the beginning, and lessening it at the end, with little effect in the middle, a deliberate move by the U.S. Federal Reserve. This gives some support for the preferred habitat hypothesis.

More volume means greater supply, so Ho: B = 0, Ha = B < 0

Table 2. *Monetary Policy and Rates. Operation Twist lowered long-term rates*
Dependent Variable: Thirty_over_Twenty P > F = 0.0146* R2 = 0.5458 Ob:10

Variables:	Coefficient	t	p
Average_Volume_rise	-0.4685	-3.10	0.015*
Constant	0.4136515	11.62	0.000*

* Significant at 95% or greater.

The negative sign indicates that the average volume rise reduced the 30-year over 20-year premium. Consequently, the United States' Federal Reserve's Operation Twist was effective at reducing long-term bond rates.

To compare the two, the statistical work below represents running a regression of the 30-year minus 20-year premium on the 20-year bond minus 10-year premium and also the volume change, and the model with just these two variables was highly significant. Both variables were significant, but the beta of the premium was almost twice as strong at predicting the change as volume change, which leads one to presume that theories related to premium are stronger. One premium for one period affects the next. A caveat of the regressions is that of multi-collinearity, because the 20-year and 30-year bonds were also affected by the change in volume brought about by the Federal Reserve. The 30-year bond, meanwhile, varies day to day based on unintelligible factors. The 20-over-10 is less than the 30-over-20, so the coefficient should be positive. Ho: B1 = 0, Ha: B1 < 0, while volume increases supply, so: Ho: B2= 0, B2 < 0.

Table 3. *Premium Theory and Rates. One bond rate affects the rest*
Dep. Variable: 30-over-20 F > p = 0.000* R2 = 0.9665 Obs: 10

Variables	Coefficient	t	p	beta
Twenty-over-ten	0.7253331	9.38	0.000*	0.7224276
Average_Vol.	-0.2667448	-5.46	0.001*	-0.4206301
constant	-0.2070382	-3.46	0.018*	No beta

* Significant at 95% or greater.

These sample sizes are small, but the R2, and adjusted R2, are still high.

In an analysis of European countries, to test an additional, age-old question of whether debt-GDP ratios increase interest rate levels, the author ran a regression using the debt-GDP ratios for the 2nd quarter, randomly chosen, from 2012-2015, a "strong case" since Europe has such high levels but was *recovering* from its debt crisis, with the average 10-month European country bond during this period. As one can see below, the results were highly significant, strongly indicating that debt levels result in higher interest rates. Based on the data, a one percentage point increase in the debt-GDP ratio, which is significant at the 1% level, increases 10-year bonds by 0.12 percent. The author also ran a regression for non-Euro zone, European countries, after noticing that these countries had much lower debt levels. The results shown were insignificant, meaning that belonging to the Euro zone may have some intrinsic quality that links debt to interest rates, which demands further research. Perhaps investors see putting forth money for so many countries, not diversified, is more risky: perhaps the euro is a more risky currency since it is linked to the European Central Bank's monetary policies, or perhaps because Europe only has debt limit "suggestions", which, when not met, may raise rates.

Fiscal Policy and Debt/Deficits:

Euro countries: Ho: B1 = 0, Ha: B1 > 0

Table 4. *European Zone Debt and Rates. Debt raises interest rates, short-term.*
Dependent Variable: Average 10 yr. bond yield P > F = 0.000* R2= 0.2590 Obs: 64

Variable	Coefficient	t	p
Debt_GDP	0.0547321	4.66	0.000*
constant	-1.238575	-1.11	0.272

* Significant at 99%.

Table 5. *Non-Euro Zone Countries and Rate. Debt is not significant*
European, Non-euro Countries:
Dependent Variable: 10 yr. non-euro bond yield P > F = 0.6058 R2 = 0.0071 Obs: 40

Variable	Coefficient	t	p
Debt_GDP	0.0078588	0.52	0.606
Constant	2.788855	3.53	0.001*

The constant is significant at 99%, but, more importantly, the model as a whole is not, after witnessing that P > F is 0.6058, which is extremely high.

It is meaningful to note that Croatia was explicitly excluded from the regressions because it changed its European Union status in the midst of the time frame, 2012-2015. In the non-Euro area above, the relationship is less strong, and even non-existent, perhaps, also, because non-Euro states have more control over their interest rates, or there is greater incentive, given the increased responsibility, to manage their own fiscal policy.

These findings confirm the seminal papers by Reinhart and Rogoff (2010, 2012), whose data were found non-duplicable by a professor-led group undergraduate students at the University of Massachusetts. Still, the works suggest that economies collapse when they approach 90% debt to GDP ratio, yet there is no theory for the reason why. The elasticities of debt and interest payment, which depend on risk, make a difference as to the effect if a country exceeds a 100% debt to GDP ratio, based on the institutional strength of a countries central bank, and its willingness to allow for inflation. These factors will both allow for greater GDP, but would reduce investment, depending on the elasticity of investment with regards to the interest rates, compared to a debt unchecked by monetary policy, that would increase rates in this model.

Growth of state spending is equal to total spending itself, aside from inflation, so this elasticity is 1, meaning that the loss of investment must not be caused by elasticity than a loss of 1, but anything less than 1 will still generate growth, except for the inflation; once investment reaches 0, no more growth would plausibly be possible, but people may rely on previous savings for consumption, or else personal debt. The higher the interest rate, the more investment should taper off with additional interest increases, assuming that the risk of investment does not change, which can cause liquidity traps. The elasticity of investment can vary, ranging from high numbers during liquidity traps to possible low numbers closer to 1 when investments are less risky and more fruitful. The greater the investment elasticity, the harder it is for states, while already at high levels of debt, to stimulate the economy, because increases in deficits will raise rates and lessen investment. Government spending from debt depends largely on entitlements. Some studies, from White (1956) to Guiso and Parigi (1999), find inelasticity of investment to interest rates, but elasticity should taper as it rises, except during liquidity traps (see Figure 1, in the Appendix).

2. Recession Theory and All Variables Together:

Ten countries, chosen semi-randomly based on the availability of data (Japan, India, Denmark, Norway, the United Kingdom, the United States, Sweden, Australia, New Zealand, and South Africa), offer the most information on historical interest rates and recessions of this dissertation. Incidentally, none of the European countries utilize the euro, making the interest rate data consistent across the time scope from World War II, 1945, thereby including European integration. Of the 10 countries, four are significant as to yield curve inversions predicting recessions, the United States and the United Kingdom, with a one year lag, and South Africa, and Australia. Australia is significant only including the 1974 oil crisis as a recession, indicated by Hancock (2017), but not in the statistical yearbooks.

With the United States, the significance was at least 98.5%: for the United Kingdom, it was 99.8%: for South Africa, it was with at least 99.9% significance, and for Australia, it was with 99.6% significance. The magnitude of the effect of the inversion, that is, the coefficient of the recession, was greatest for South Africa, and least for the United States; in other words, the more developed the financial markets, the less the inversion. As financial systems have become more complex, the time between yield curve inversions and recessions appeared increased. Likely, developed markets, especially the United States as an example, can see risk further out.

However, for the other countries under consideration, Denmark, Sweden, and Norway did not have enough recessions over this period, to indicate a significant relationship, while for India and Japan, GDP was too volatile over this period to connect to inversions. Though the United Kingdom was significant, the Quandl data set was used from 1961-2010, since interest rates varied among different sources, most likely due to the strict austerity of its Exchequer from conservative governments in the 1970s forward. This type of banking likely influenced its colonies, such as India, which also had very high interest rates during this time. As for New Zealand, its yield curves were inverted almost constantly during this time, indicating a lack of stable financing, which one could call “development”. Denmark, Sweden, and Norway also have weak economic institutions. Their central banks may not be able to keep rates low enough that would lead to inversion. The institutions of banking systems is discussed later in this article.

The most interesting finding is perhaps the difference between the significant and insignificant countries. There have been dramatic changes in savings since World War II, with some rates falling from 20% and 30% down to 0%, but countries averaging over 7% saving over the last 25 years (1985-2010) were not significant for the yield curve inverting before recessions, and those for those under 7% the yield curve held (OECD.org 2017l “Saving”, 1). New Zealand was the exception, because it did not save 7% and yet was not significant with the yield curve. This suggests that higher savings may allow investors in countries to react to higher interest rates in the short-term with plentiful funds able to bring down short-term rates before recession.

A *penultimate* regressions was run amongst both groups, those where there was a yield curve-recession linkage, and those in which there was not. This regression, for both groups,

added variables for money supply, as measured by change in M1, cash and short-term notes, the most liquid form of money making it a strong case, and change in national debt, which is represented by a proxy variable of trade account deficit since data on government debt is not available since 1945, and the two figures are similar conceptually, as government debt goes to finance a trade deficit, known as the "twin deficit" problem. The equation and results are below:

Ho: B1 = 0, Ha: B1 < 0, Ho: B2 = 0, Ha: B2 > 0, Ho: B3 = 0, Ha: B3 >0

Yield Curve Inversion= B1 recession (dummy variable) + B2 debt + B3 monetary policy

Table 6. *Interest Rate Variables Combined. Recessions and inversions are linked*
Significant states Prob > F 0.0000* R2: 0.1461 Obs: 244
Dependent Variable= yield curve spread

	Coefficient	t value	p value	beta
Recession	-1.9181	-5.55	0.000*	-0.3316
% Δ Debt	0.0046	1.50	0.136	0.0897
% Δ in Money	2.9883	2.91	0.004*	0.1741
Constant	1.4108	0.00	0.000*	N/A

* Significant to at least 95%.

In this analysis of the four significant countries, the variable for a recession occurring sometime within one year, and the variable for monetary policy, had the largest effects on interest rates over the 1945-2010 year period, with recession having a slightly greater influence of the two, at a 0.1575 higher beta. Changes in debt fell just short of significance. Growing the money supply typically brings down short-term rates, thereby increasing the yield spread. Despite this, the R2 explanatory power is very low at 0.1461, meaning that many other economic factors contribute to interest rates. For the six countries in which the yield curve was not linked with recessions, first, the model is not significant, and additionally, none of the variables are. Premium theory could not be included in these models because it is designed to study the effects of one bonds relationship to another, and in these regressions, the dependent variable includes all of the possible yield curve spread, volumes of bond trades over this length are lacking.

3. The Yield Curve vs. The Anxious Index

The yield curve and "Anxious Index" were compared as to their predictive power, with data only going back to 1969 because that was the inception of the "Anxious Index". When using a lag for the bond yield curve, the yield curve for the United States was a better predictor of yield curve inversions, at 98% significance, than the Anxious Index, since over 30% of "experts" predicted recession. But, when the Anxious Index was changed to having a lag, then it turned out to be a better predictor, at 99% significance, an unexpected finding. When recession was the dependent variable, and the "Anxious Index" is lagged, the "Anxious Index" is a better predictor, with 89.6% significance, which would be higher if economic quarters were used, not years. Still, the yield curve is much more significant at 99% without a lag. These results, though, had high heteroscedasticity. The Anxious Index can also predict more variables, like inflation, which the yield curve cannot since inflation is already built into long-term premiums.

V. Institutions

This part looks longer-term, at institutional concentration in society and finance.

Interest rates also depend on governments, culture, structures, policies towards regulations, and the concentrations of firms and society themselves, which are combined in a scatter plot to evaluate growth and interest rates later on. Now, combining society and finance, while a society may be diversified, and financial/ economic institutions also may be, the relationship between the two is important. A strong, diversified society should be able to buffer centralized economic organizations, and vice-versa. In the Appendix, Figure 2, descriptive scatter plots are used to juxtapose concentrations of finance, with the concentration of society. The matrix itself is a Boston Consulting Group model originally developed to pinpoint segments in a firm. One can place economies in the matrix, as long as one realizes that there are just two variables. The Herfindahl-Hirschman (HHI) Index is used to measure financial diversification, and the data comes from an average calculated by a paper by Liu and Mirzaei (2013) over a ten year period of 2001-2010. The GINI coefficient is a measure of societal income inequality, used from the United Nations, which is rough since it is not calculated every single year, but has been averaged. Volatility is: [(abs. growth-ave)/ave.]. The nations were chosen semi-randomly so that some states Migdal (1988) cites were used, plus the United States: the rest are fully random.

One would expect countries in the matrix to look like what the BCG (Boston Consulting Group) calls a "cash cow" (Berkowitz et al., 1997, p. 38), with fast, developing states in the first and third quadrants, where most of the countries should fall, and the smallest growing, developed states in the 4th, the conclusion of the pathway. In the model (Figure 2, again, in the Appendix), the clear circles indicate countries' average growth over this time frame, from the World Bank. The time spans includes the 2008 stock crash. The blue circles indicate volatility, sometimes greater than the country's average growth itself; volatility was calculated as the average of the absolute value deviations over yearly growth average. Interest rates varied, typically lowest in IV, with highs in II (CEIC 2019). The results are as expected, showing that a strong society can buffer dense businesses, and vice-versa, in a Migdal sense, reducing risk, in two of the four quadrants, with the developing countries in Quadrants I and II, the emerging countries in Quadrant III, and the sluggish developed countries in Quadrant IV, which need to rejuvenate their economies. The United States seems to be repeating the model, which would expressly turn true once the baby-boom generation passes, and will reformat the world economy. The suggestions for the example countries based on this policy area, at this time frame, would be for Argentina: continue along the same path, for Egypt to take more risky policies because it can increase volatility, for Slovakia to continue as it is, but be weary of immobility, for Portugal to diversify firms, for Israel to take less risk, by diversifying its tech businesses, for Austria to take more risk to jump-start its economy, for Germany, which was hit hard by the 2008 global financial crisis, but soon recovered, to focus less on income equality. The United States will likely merge and consolidate firms, which it has been, and hopefully deal with inequality to diversify its society. Japan should free up business concentration even more; Mexico should diversify its industry for less volatility.

VI. Conclusion

The central issues of this article, again, were how risk and its associated policies and behaviors affect interest rates, mainly bond yield curves, contrasted with other theories (Charles, 2008, p. 128). The control theories under consideration, (premium, market segmentation/ preferred habitat hypothesis, debt financing, recessions, and monetary policy) all were significant in terms of effects on interest rates. However, the penultimate regression showed that recessions and money supply have the strongest long-term effects on interest rates. Strikingly, a 7% of GDP national savings rate can explain the differences between states. These findings counter "modern monetary theory", that states can simply issue money without consequences.

The "Anxious Index" is a better predictor of the yield curve inverting than the recession measure does, but yield curve inversions have higher significance and is a thereby a better indicator of recessions than the "Anxious Index". In short, the comparisons depend entirely on methodology and how one defines a recession, but both measures have value. In terms of government institutional concentration, there may not be one best model, but some today question the extreme tradition of concentration of economists in so few agencies, which is a British model and used by the countries they colonized, including the United States. The use of more diverse and diversified, inter-department task forces, or subgroups might be advisable.

Some other interesting findings of this research are: the one-year U.S. yield curve lag was found linked with recessions, corroborating Trobias, Estrella, and Shin (2010). They write there is a significant relationship between the maximum spread before the recession and the length *until* the U.S. recession. These three find it to be almost constant at 12.6 months, or 4 quarters, after the inversion. Their study corroborates the 12 month lag used in this article's regressions. The length of the recession in the 2010 study was not affected by the spread, but, all of the U.S. recessions since 1968 average 11.6 months. In their work, the recession length was not linked with how long the yield curve stays inverted, and the spread size did not affect the duration.

In summation, while some believe that watching for yield curve inversions, as well as levels, is like reading tea leaves, others fervently hold that it is a predictor of doom to come (Estrella and Trubin, 2006, p. 3). In 2008, before the "Great Recession", after the yield curve inverted, Estrella's models forecasted the United States as having a 40% chance of going into recession in the next month. But, even a month before "the Crash", New York Fed officials were saying there was no possibility (Hahn 2008, 1). One strategist at RBC Capital Markets in London, asserted, "I don't think it's a recessionary signal, it's (sic) a bit simplistic to look at yield curves as a sign of recessions" (Chibber, 2006, p. 9), completely ignoring the signals in 2006. Two other businessmen said, "Some people talk about recessions, but I don't see it as a sign of one" (Chibber, 2006, p. 9). They, and many others, were probably shocked by the 2008 global crisis. Even former Fed chairman Greenspan, as noted, told Congress in July 2005, prior to inversion, that "there is 'a misconception' of the yield curve importance. The curve's efficacy as a forecasting tool has diminished very dramatically" (Chibber, 2006, p. 10).

To the contrary, say the results from this article; the yield curve is a strong predictor, with more theories, countries, variables, and time horizon than in previous studies. This article addressed each of the interest rate theories involved both distinctly and all together. Investors prefer to purchase bonds, to finance investments, within certain markets, they pay premiums in interest for expected risk, which are also affected by monetary and fiscal policy, and these risks in premiums spike before recessions, the penultimate result of 10 countries from 1945-2010. If the findings are correct, as more developing economies save less than the key 7% of GDP discovered, predicting recessions should become even more accurate. In Spring 2019, the U.S. bond yield curve turned partly inverted, an ominous sign, and did so again in early 2020. Future research could contribute with a governmental institutional concentration index based on the theories used here, and using quarterly statistics, rather than yearly data.

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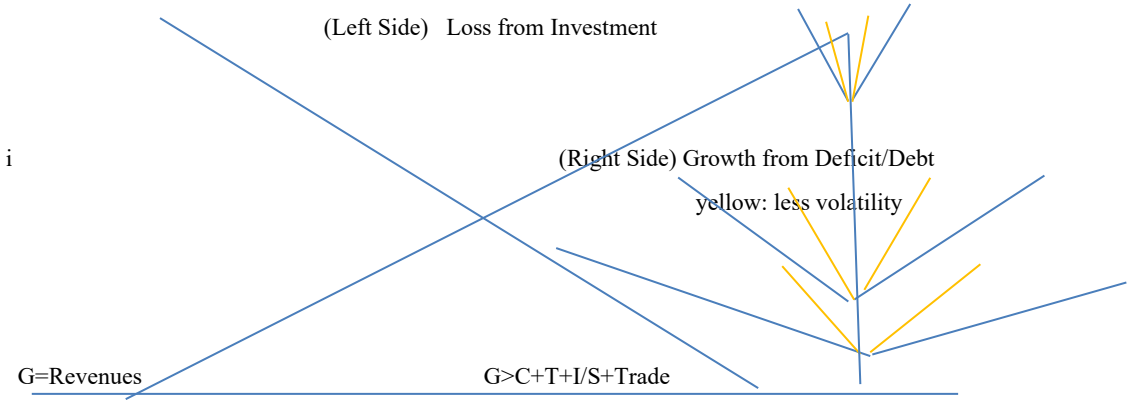
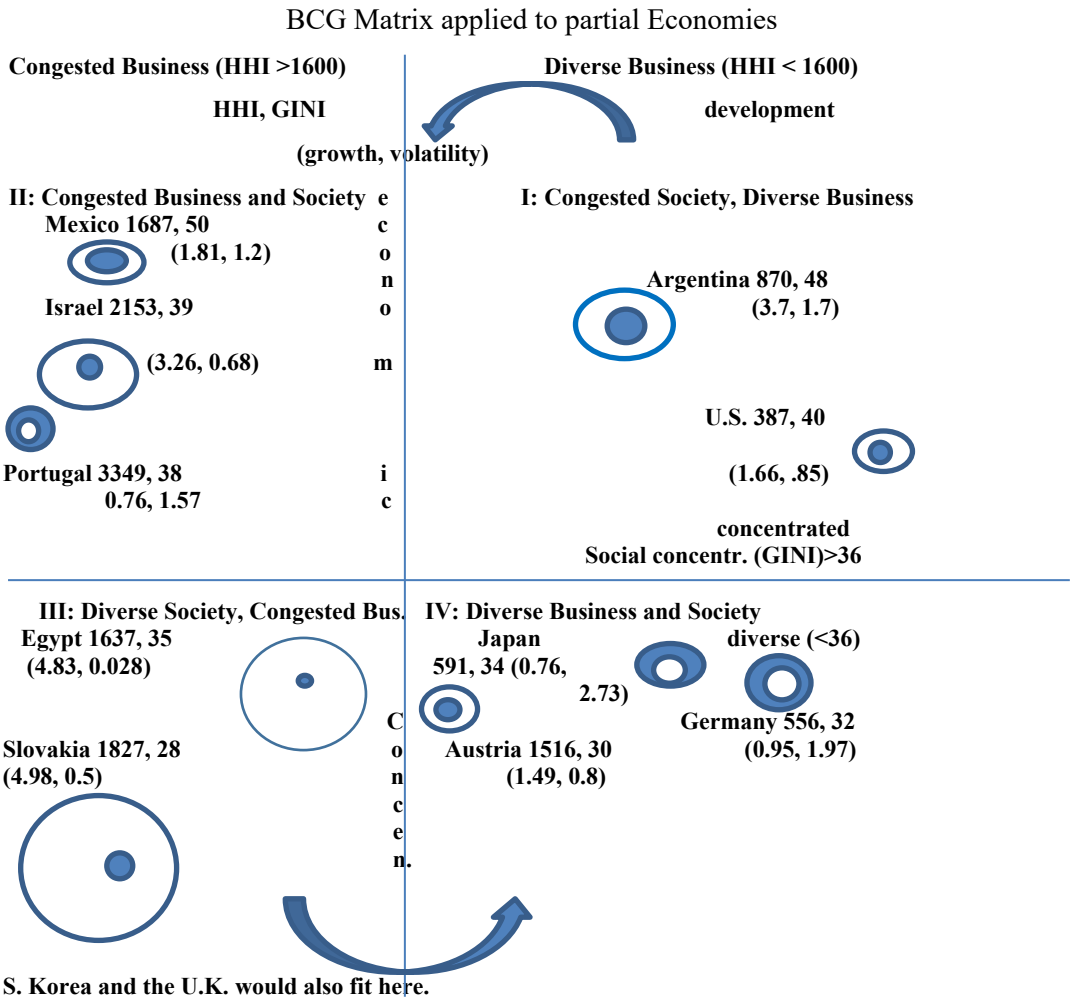
Figure 1. *Risk of government debt*

Growth = elasticity of G gained compared to I lost at the Federal Reserve-able interest rate.



Once a nation's resources have been close to fully used, public (government) debt can increase GDP, rightward, but can crowd out investment, leftward, dependent upon the elasticity of liquidity and the country's central bank ability to control interest rates while debt is rising (Barry, 2018).

Figure 2. *The BCG matrix for a nation*



Above, from 2001-2010, one expects the graph to look like a cash cow in the first and third quadrants, and smallest in the 4th, since a strong society can buffer a strong state, which it does. The HHI is a diversification Index, and growth (clear circle) and volatility (blue circle), are also indicated in the parenthesis (,) (Barry, 2018).

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An approach to the index of economic freedom using the data mining technique in the economic environment context

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Abstract. *Economics, at the macroeconomic level, can be viewed as a complex dynamic system consisting of a multitude of subsystems linked together by direct and indirect connections of different types. This dynamic system forms an economic cybernetic network composed from these subsystems, which evolves according to the economic environment and its own objectives, which are conditioned by the achievement of a general common objective. One of the most important indices that could characterize the economic environment for all countries is the Economic Freedom Index and it is very important to be taken into account by companies that want to be active in international market. In this article we analyzed the Index of Economic Freedom, divided into four subcategories: the rule of law, the size of the government, the efficiency of the regulations and the opening of the market. The analysis was performed on a set of data extracted for the year 2019 corresponding to 174 countries. Also, with the R software solution, I will apply multidimensional data analysis techniques to perform the proposed research.*

Keywords: economic freedom, R, data mining, cybernetics approach, dynamic system, classification.

JEL Classification: N1, N4, A1, C1.

1. Introduction

The scientific knowledge in any field of human activity, implies, regardless of the nature and the specific of the concrete objectives pursued, a complex and rigorous quantitative analysis of the phenomena and processes that are the object of the research. It is visible to everyone, and more and more, that in the modern era almost every individual engaged in a human activity deals, in one way or another, directly or indirectly, with data and information, with collecting, their processing and interpretation.

Although data analysis methods and techniques are used in most areas of human activity, we can say that data analysis has the largest use in the economic and social field, and the efficiency of its use in this field has an extremely high efficiency.

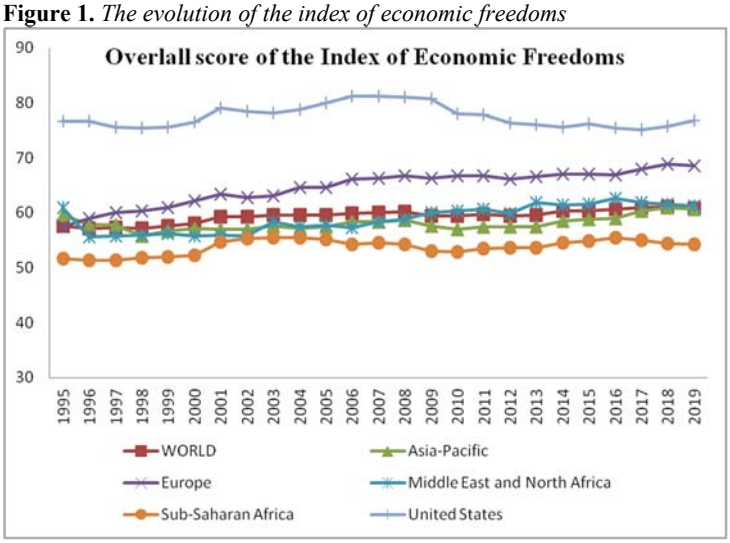
The Index of Economic Freedom is an annual index and ranking created in 1995 by The Heritage Foundation and The Wall Street Journal to measure the degree of economic freedom in the countries of the world. The creators of the index have adopted an approach similar to that of Adam Smith in The Wealth of Nations, according to which the basic institutions that protect the freedom of individuals to pursue their own economic interests lead to greater prosperity for society at large. (Ott, 2016)

The Index of Economic Freedom and it is very important to be taken into account by companies that want to be active in international market. If the value of this index is small, we can say that the system of governance is corrupt and there are a lot of factors that stand in the way of trade. If the value of the index is very high, companies can safely invest in the respective economy. (Musetescu, 2011)

The analysis was based on the corresponding data of 174 countries, extracted for the year 2019. The data source can be found at the following web page: https://www.heritage.org/index/download.

The 2019 ranking points to aspects of economic freedom between 0 and 100, with 0 meaning “maximum repression” and 100 meaning “total economic freedom”. The Economic Freedom Index is calculated as an arithmetic mean between its twelve components, divided into four categories, as we mentioned earlier, in total 13 quantitative variables. As qualitative variables, the names of the analyzed countries were used, as well as the regions in which they are found. They bear the names: “United States”, “Asia-Pacific”, “Europe”, “Middle East and North Africa” and “Sub-Saharan Africa”.

Figure 1. *The evolution of the index of economic freedoms*



Source: The data were extracted from the https://www.heritage.org and processed by the authors.

In the cybernetic approach of the economy at the macroeconomic level we must start, first of all, from the knowledge of the subsystems and the way in which they interact in the process of achieving their own and the general objectives. Thus, households, firms, commercial banks, different public institutions can be analyzed as separate (individual) systems at the microeconomic level, but they form at the macroeconomic level sectors (systems) that have emerging properties and objectives, thus deriving from the simultaneous operation of the multitude of systems of the same type at the microeconomic level. (Scarlat and Chirita, 2019)

Economic freedom is the essential condition of development, as demonstrated by classical and neoclassical economists (A. Smith, J.B.B., Mises, F.A. Hayek) in their research. Therefore, the macroeconomic system is influenced by this economic freedom, contributing to its well-being.

The components of the Heritage Foundation Economic Freedom are based at the four pillar: rule of law, limited government, regulatory efficiency and open markets. The first pillar is composed of two sub-components: property rights freedom and freedom from corruption. The second is based also to two sub-components: fiscal freedom and government spending. The next three sub-components, business freedom, labor freedom and monetary freedom constituted the base of the pillar three. Trade freedom, investment freedom and financial freedom are the sub-components of the last pillar. (Naanwaab, 2013)

According to the information of the heritage.org, the countries with the greatest economic freedom on the world map are Hong Kong, Singapore, New Zealand, Switzerland, Australia, Ireland, United Kingdom, Canada, United Arab Emirates and Taiwan. The country without ranked are Iraq, Libya and Liechtenstein (https://www.heritage.org/ index/ranking). It is easy to see that there is a direct link between economic freedom and the prosperity of a country. The Heritage Foundation report and the *Wall Street Journal* prove that poverty is not a fatality, that wealth is not a miracle and is not reserved for the privileged.

2. Theoretical background and mathematical model about data mining techniques

The main purpose of the analysis of the principal components is to reduce the size of the data set. Principal component analysis is a multidimensional analysis technique which, by constructing linear combinations of initial variables $\boldsymbol{x_i}$, allows the information contained in them to be rewritten in an identical number of other variables $\boldsymbol{z_i}$, called principal components, with variance distributed decreasing and uncorrelated between them.

Mathematically, if we consider a vector of n original variables $(x_1, x_2, x_3, \dots x_n)$, the analysis of the principal component consists in the identification of a variance maximizing linear transformation by applying it to a vector of p principal components $(z_1, z_2, z_3, \dots z_p)'$ $(p < n)$ which retains a satisfyingly large amount of initial variability. The principal components can be written: (Maer-Matei et al., 2019)

$$z_1 = \alpha_{11}x_1 + \alpha_{21}x_2 + \cdots + \alpha_{n1}x_n$$

$$z_2 = \alpha_{12}x_1 + \alpha_{22}x_2 + \cdots + \alpha_{n2}x_n$$

$$\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots$$

$$z_n = \alpha_{1n}x_1 + \alpha_{2n}x_2 + \cdots + \alpha_{nn}x_n$$

In the matrix form, this relationship can be transposed into:

$$\begin{pmatrix} z_1 \\ z_2 \\ . \\ . \\ . \\ . \\ z_n \end{pmatrix} = \begin{pmatrix} \alpha_{11} & \alpha_{21} \dots . \alpha_{n1} \\ \alpha_{12} & \alpha_{22} \dots . \alpha_{n} \\ & . \\ & . \\ & . \\ & . \\ \alpha_{1n} & \alpha_{2n} \dots . \alpha_{nn} \end{pmatrix} \begin{pmatrix} x \\ x_2 \\ . \\ . \\ . \\ . \\ x_n \end{pmatrix}$$

Where

$$z = \begin{pmatrix} z_1 \\ z_2 \\ . \\ . \\ . \\ . \\ z_n \end{pmatrix}, \text{x} = \begin{pmatrix} x \\ x_2 \\ . \\ . \\ . \\ . \\ x_n \end{pmatrix}, A' = \begin{pmatrix} \alpha_{11} & \alpha_{21} \dots . \alpha_{n1} \\ \alpha_{12} & \alpha_{22} \dots . \alpha_{n} \\ & . \\ & . \\ & . \\ & . \\ \alpha_{1n} & \alpha_{2n} \dots . \alpha_{nn} \end{pmatrix}$$

2.1 . The mathematical model of the principle components

The identification of the principle components starts from the formulation of the problem of maximizing their variance.

If the covariance matrix of initial variables is $\sum$, then variance of the principle components, then variance of the principle components z_i can be written:

$$var(z_i) = var\left(\propto^{(i)\prime} x\right) = \propto^{(i)\prime} \sum \propto^{(i)}$$

Where $\propto^{(i)} = \begin{pmatrix} a_{1i} \\ \cdots \\ a_{ni} \end{pmatrix}$ is the i-vector of the column of matrix A.

Therefore, for construction z_i, it is necessary to identify the vector $\propto (i)$ which ensures a maximum level of variability.

Although, traditionally, PCA(1) is applied to the covariance matrix of the initial variables, its application is also common to the matrix of the correlation coefficients between them. Opting for the latter is justified by the existence of variables with different units of measurement, which affect the covariance and variance, and the obtained components would be meaningless, but not the correlation coefficients. (Morrison, D.S., 1976)

The choice of the number of principal components needed to effectively synthesize the set of variables, under minimal information loss, can be made according to several criteria (Rencher, 2002):

- Criterion of the quantity of information – the choice of a small number of variables to ensure a good representation of the initial variables provided that the percentage of the total variance retained by them is large enough. The choice of the threshold over which the conserved variance is considered satisfactory is at the discretion of the one performing the analysis, an amount of 70-75% of the information being sometimes sufficient, at other times the loss of 25-30% of the variability being considered too high.
- Kaiser's criterion – keeping those principal components whose variances are greater than the average. In the case of using standardized data or applying the PCA on the correlation matrix, the level with which the eigenvalues will be compared is 1 (the average level of variance).
- Granulosity criterion (Screeplot) – this criterion involves analyzing the graph constructed based on the eigenvalues of the variance-covariance matrix Σ and identifying a turning point. For example, if up to the eigenvalue noted with λ3 the graph had a slow downward slope, but between λ3 and λ4 the descent is steep and followed by a relatively constant evolution between the following eigenvalues, the number of principal components selected will be equal to 3. The explanation for this choice is that the information gain brought from component 4 is very small, almost insignificant, compared to the variability retained by the first 3 components.

2.2 . Mathematical model of factor analysis

The factorial analysis aims to identify and evaluate those factors of unobservable nature that are the basis of the common evolution of the variables and that generate the manifestations of the correlations between them. These latent and directly measurable factors are intrinsically found in the data structure, and their existence is suggested by the structure of the relationships between the variables. It is a method often used in the socio-economic and behavioral sciences, as it allows to highlight certain preferences, traits, behavioral factors that underlie the evolution of the studied phenomena.

The factorial analysis model expresses each variable as a linear combination of common and specific factors. In addition to these two categories of factors, in the mathematical

writing of the model there is also a residual component (the errors) which overcomes accidental factors, measurement errors, being insignificant in explaining the variables.

The model can be written as follows:

$x_1 - \mu_1 = a_{11}f_1 + a_{12}f_2 + \cdots + a_{1p}f_p + u_1 + \varepsilon_1$

$x_2 - \mu_2 = a_{21}f_1 + a_{22}f_2 + \cdots + a_{2p}f_p + u_2 + \varepsilon_2$

……..

$x_n - \mu_n = a_{n1}f_1 + a_{n2}f_2 + \cdots + a_{np}f_p + u_n + \varepsilon_n$

Where:
μ_i is the mean of the variable i;
f_i is the commune factor;
u_i represent the uniqueness element;
ε_i represent the residual element;
$p < n$;
$the\ coefficient\ a_{ni}\ represent\ the\ intensity\ of\ the\ factor.$

Given the low importance of the residual component, given its random nature, many authors ignore the errors or consider them part of the uniqueness and thus eliminate this component from the model writing.

The assumptions of the factorial model are (Rencher, 2002):
- The average factors are 0, variance equal to 1 and the factors are uncorrelated it means that their covariance matrix is therefore the identity matrix.
- The unique factors are, in turn, of average 0, uncorrelated between them but of variance different from 1.
- The common factors and the unique factors are not correlated.

There are a multitude of criteria used in determining the number of common factors, their efficiency being the subject of a high number of studies over time.

A. The Bartlett test – this involves testing the hypothesis that all eigenvalues are equal. When the null hypothesis can no longer be rejected from a number of factors, that is the number of main components retained.

B. The minimum of partial averages (minimum partial average – MAP) – is a method that involves calculating the partial correlations between the variables, conditioned by the common factors. The squares of the elements on either side of the diagonal are summed, and the number of common factors will be the one for which the minimum of the squares of the partial correlations calculated after eliminating the influence of the common factors is recorded.

The contingency table is the primary input of this analysis. The main purpose of the correspondence analysis is to provide an intuitive graphical representation, most often bi- or three-dimensional, that clearly shows the correspondences between the categories of the variable in the column and that of the rows. Therefore, the objective is to reduce the number

of axes from min {(p-1),(q-1)} to a smaller number of dimensions allowing easy identification of associations between variables.

Greenacre (2007) formulates the problem of correspondence analysis as identifying a small subspace S that contains the centroid and against which the sum of distances (measured as hi-squared distances from centroid) is minimal.

3. Description of the variables used in the analysis

The Economic Freedom Index is calculated as an arithmetic mean between its twelve components, divided into four categories, as we mentioned earlier, in total 13 quantitative variables. As qualitative variables, the names of the analyzed countries were used, as well as the regions in which they are found. They bear the names: "United States", "Asia-Pacific", "Europe", "Middle East and North Africa" and "Sub-Saharan Africa". The quantitative variables have the following description:

A. The rule of the law: properties right freedom and freedom from corruption

The degree of legal protection of a country of private property rights and the degree of application of these laws. It is divided into the following sub-factors: physical property rights; intellectual property rights; the power of investor protection; the risk of expropriation; quality of land management. The degree of efficiency and fairness of the judicial system, especially as regards property laws. It is divided into the following sub-factors: judicial independence; the quality of the judicial process; the probability of obtaining favorable judicial decisions.

The integrity of the government analyzes how widespread forms of political corruption and practices such as bribery, extortion, nepotism, cronyism, patronage, embezzlement and graft are involved. It is divided into the following sub-factors: public confidence in politicians; bribes and unusual payments; transparency in the elaboration of government policies; absence of corruption; perception of corruption; government and public transparency.

B. Limited government: fiscal freedom and government spending

The fiscal pressure analyzes the marginal tax rates on personal and corporate income, respectively the general level of taxation (including direct and indirect taxes imposed by all levels of government) as a percentage of GDP. Its sub-factors are: the highest marginal tax rate on individual incomes; the highest marginal tax rate on corporate income; total fiscal pressure as a percentage of GDP. Government spending quantifies the pressure of government spending, including government consumption and all payments for social programs. The ideal level varies from country to country, but zero-level spending is used as a benchmark. The fiscal health analyzes how well a country manages its budget, quantifying debt and growing deficit. It is divided into the following sub-factors: average deficits as a percentage of GDP for the last three years (80% of the score); debts as a percentage of GDP (20% of the score).

C. Regulatory efficiency: business freedom, labor freedom and monetary freedom

Business freedom analyzes the cost, time and freedom to open, operate and close a business, taking into account factors such as electricity. It is divided into thirteen sub-factors: starting a business – procedures (number); starting a business – time (days); starting a business – cost (% of income per capita); starting a business – minimum capital (% of income per capita); obtaining a license – procedures (number); obtaining a license – time (days); obtaining a license – cost (% of income per capita); closing a business – time (years); closing a business – cost (% of ownership); closing a business – recovery rate (cents in dollars); obtaining electricity – procedures (number); obtaining electricity – time (days); obtaining electricity – cost (% of income per capita).

Labor freedom quantifies the intrusiveness of labor rights, such as the minimum wage, laws that inhibit redundancies, compensation requirements and measurable regulatory restrictions for employment and hours worked, plus the labor force participation rate as an indicative measure of employment opportunities in the labor market. It is divided into the following sub-factors: the ratio between the minimum wage and the average value added per worker; obstacle to hiring additional workers; the rigidity of the hours; difficulty dismissing non-performing employees; period of mandatory legal notice; compulsory payment for dismissal; the labor force participation rate.

Monetary freedom analyzes how stable prices are and how much microeconomics is involved. It is divided into the following sub-factors: the weighted average inflation rate for the last three years; price control.

D. Open market: trade freedom, investment freedom and financial freedom

Trade freedom quantifies the extent to which tariff and non-tariff barriers affect imports and exports of goods and services into and from the country. Its sub-factors are: the weighted average tariff rate; non-tariff barriers (NTB).

Investment freedom analyzes how free or restricted the investment capital flow of individuals and companies.

Financial freedom indicates bank efficiency, as well as how independent the financial sector is from the government. This aspect concerns five broad areas: the measure of government regulation of financial services; the degree of state intervention in banks and other financial firms through direct and indirect ownership; the influence of the government on the allocation of credit; the extent of financial and capital market development; opening to foreign competition.

4. Data mining analysis, results and discussions

First, we will analyze each numerical variable from the point of view of descriptive statistics, such as mean, median, standard deviation, coefficient of variation, quartiles, but also distribution, with the help of asymmetry and vault coefficients. It was interesting to note that based on the heterogeneous distribution and existence of high value outliers, we can conclude that there are countries where the factors that determine the integrity of the

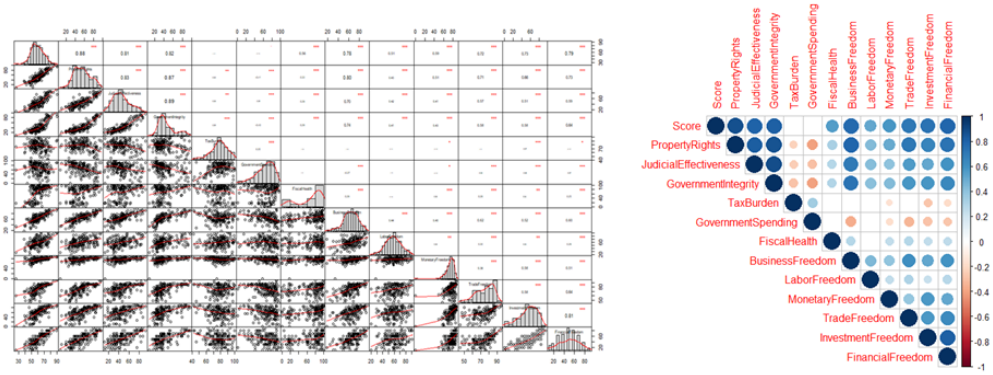
government are at a very high level compared to the rest of the countries, so these countries have a high level of unusually low corruption. We observe by the presence of some outliers of small values, so that the fiscal pressure in certain countries is a high one, a fact that is also reflected in a significant decrease of the Economic Freedom Index. The histogram of the Business Freedom variable confirms the previous analysis, and the boxplot shows low aberrant values, which confirms that some countries are dealing with restrictive policies regarding the business environment.

Of all the variables analyzed, the values of freedom in terms of work are closer to a normal distribution. However, according to the boxplot, there are countries that are well below the usual level in this chapter (low value outlays). The histogram of the variable Monetary Freedom shows that prices have a very high stability in most countries, but according to the boxplot, we also have a significant number of countries suffering from high instability in this regard.

4.1. Principal component analysis

The analysis of the principal components is a technique of multidimensional analysis of the data sets and that aims to summarize the information. This operation uses an orthogonal transformation to convert a set of observations of correlated variables into a set of values of linearly uncorrelated variables, called principal components. This transformation is performed in such a way that the first principal component has the largest possible variance, representing as much data variability as possible. The obtained vectors are non-correlated orthogonal bases. The first stage in the analysis of the principle components is the investigation of the correlation matrix. Thus, one can find information redundancies and apply the analysis of the principle components.

Figure 2. *The matrix of correlation (graphic representation in R)*



Source: Authors' own research results.

A positive correlation between two variables results in the fact that when the value of one variable increases, then the other variable will have a higher value. Negative correlation implies a decrease in the value of one variable as the other increases. The intensity of the connection is measured on a scale from 0 to 1 (-1, in case of negative correlation), 0 being a total lack of correlation between indicators, and 1 (respectively -1) a total correlation (identical indicators).

For example, since we have a strong positive correlation of 0.79 between the Score and Financial Freedom variables, we can say that when increasing by one point the financial freedom, the final score will increase by 0.79 points. Similarly, there is a negative correlation of -0.40 between government spending and government integrity. Thus, as government spending increases by one point, government integrity will decrease by 0.40 points.

Further we will determine if the coefficients determined are statistically significant by comparison with the significance threshold 0.05.

Figure 3. *The matrix of probabilities associated with the correlation coefficients*

P

	Score	PropertyRights	JudicialEffectiveness	GovernmentIntegrity	TaxBurden	GovernmentSpending	FiscalHealth
Score		0.0000	0.0000	0.0000	0.3257	0.0648	0.0000
PropertyRights	0.0000		0.0000	0.0000	0.0031	0.0000	0.0000
JudicialEffectiveness	0.0000	0.0000		0.0000	0.0011	0.0001	0.0001
GovernmentIntegrity	0.0000	0.0000	0.0000		0.0001	0.0000	0.0000
TaxBurden	0.3257	0.0031	0.0011	0.0001		0.0000	0.2005
GovernmentSpending	0.0648	0.0000	0.0001	0.0000	0.0000		0.5412
FiscalHealth	0.0000	0.0000	0.0001	0.0000	0.2005	0.5412	
BusinessFreedom	0.0000	0.0000	0.0000	0.0000	0.2685	0.0000	0.0001
LaborFreedom	0.0000	0.0000	0.0000	0.0000	0.1432	0.4174	0.1715
MonetaryFreedom	0.0000	0.0000	0.0000	0.0000	0.0450	0.0205	0.0010
TradeFreedom	0.0000	0.0000	0.0000	0.0000	0.4905	0.0000	0.0001
InvestmentFreedom	0.0000	0.0000	0.0000	0.0000	0.0003	0.0001	0.0012
FinancialFreedom	0.0000	0.0000	0.0000	0.0000	0.0175	0.0003	0.0007

	BusinessFreedom	LaborFreedom	MonetaryFreedom	TradeFreedom	InvestmentFreedom	FinancialFreedom
Score	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PropertyRights	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
JudicialEffectiveness	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
GovernmentIntegrity	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TaxBurden	0.2685	0.1432	0.0450	0.4905	0.0003	0.0175
GovernmentSpending	0.0000	0.4174	0.0205	0.0000	0.0001	0.0003
FiscalHealth	0.0001	0.1715	0.0010	0.0001	0.0012	0.0007
BusinessFreedom		0.0000	0.0000	0.0000	0.0000	0.0000
LaborFreedom	0.0000		0.0011	0.0000	0.0028	0.0002
MonetaryFreedom	0.0000	0.0011		0.0000	0.0000	0.0000
TradeFreedom	0.0000	0.0000	0.0000		0.0000	0.0000
InvestmentFreedom	0.0000	0.0028	0.0000	0.0000		0.0000
FinancialFreedom	0.0000	0.0002	0.0000	0.0000	0.0000	

Source: Authors' own research results.

It can be observed that a correlation between fiscal pressure and the Economic Freedom Index is not significant, since the associated P-value is 0.32 > 0.05. Of course, this is just an exception in the dataset. Thus, the use of principal component analysis is fully justified.

Own values aim to indicate how the information taken down decreases with each component. Thus, the first component takes the largest amount of information, the second less than the first and so on. The *princomp* function also highlights this aspect.

Figure 4. *Output after applying the principal function*

```
> acp <- princomp(dateNumerice, cor = TRUE)
> summary(acp)
Importance of components:
                          Comp.1    Comp.2    Comp.3     Comp.4     Comp.5     Comp.6     Comp.7
Standard deviation     2.6186727 1.1806256 1.0390414 0.94094578 0.84757806 0.76400897 0.69119731
Proportion of Variance 0.5274959 0.1072213 0.0830467 0.06810607 0.05526066 0.04490075 0.03675029
Cumulative Proportion  0.5274959 0.6347172 0.7177639 0.78586995 0.84113061 0.88603136 0.92278165
                           Comp.8     Comp.9    Comp.10     Comp.11     Comp.12      Comp.13
Standard deviation     0.5879691 0.52816452 0.41335714 0.340724301 0.303660683 2.486199e-03
Proportion of Variance 0.0265929 0.02145829 0.01314339 0.008930235 0.007093062 4.754760e-07
Cumulative Proportion  0.9493745 0.97083283 0.98397623 0.992906462 0.999999525 1.000000e+00
```

Source: Authors' own research results.

Because we worked with standardized variables, we will keep in the analysis only those components that have the dispersion value greater than 1. From the previous figure we can notice the dispersion of 2.61 of the first component, 1.18 of the second component and 1.03

of the second third component. It is noted in figure above that the first component takes 52% of the information, the first two components take 63%, and the first three 71%. This is yet another proof that the component elements are getting less and less information as their number grows. Thus, we will have three principal components, according to the coverage percentage criterion. Further, we will highlight the utility of our own vectors for calculating the scores of the first principal component.

The formula for scores of the first principal component in this analysis is as follows: $W_1 = -0.36x_1 - 0.35x_2 - 0.32x_3 - 0.33x_4 + 0.09x_5 + 0.15x_6 -$

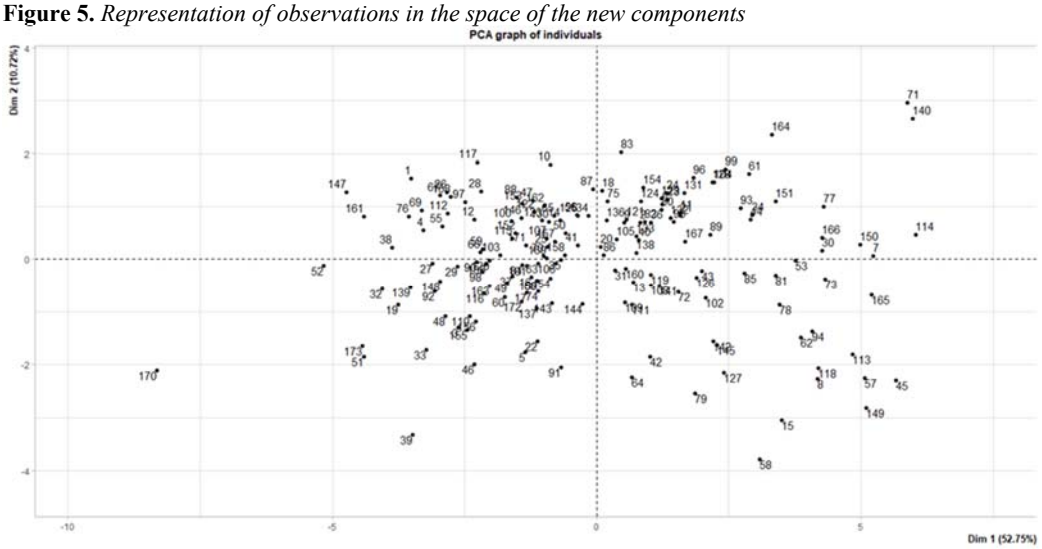
$-0.15x_7 - 0.31x_8 - 0.18x_9 - 0.23x_{10} - 0.29x_{11} - 0.29x_{12} - 0.31x_{13}$

The circle of correlations is used to graphically represent the links between the initial variables and the principal components kept in the analysis. The closer a variable is to the edge of the circle, the stronger the correlation with the respective component.

Thus, we can draw the following conclusions regarding the correlation of the principal components:

- Component 1: strong direct links to Score (0.95), Property Rights (0.93), Judicial Effectiveness (0.85) and Government Integrity (0.88).
- Component 2: positive correlations with Tax Burden (0.75) and Government Spending (0.66).
- Component 3: positive correlation with Fiscal Health (0.57) and negative with Labor Freedom (-0.45).

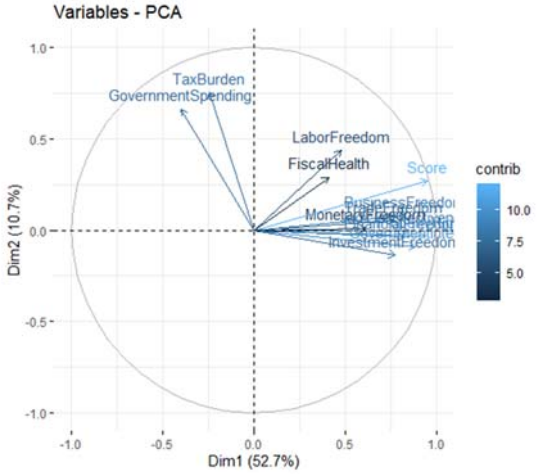
Figure 5. *Representation of observations in the space of the new components*



Source: The graphics was processed by the authors.

The reduction of the dimensionality of the data allowed a visualization of the 174 countries in a two-dimensional graph and the identification of the similarities and differences existing between them from the point of view of the variables that compose the Index of Economic Freedom.

Figure 6. *Biplot – the contribution of the original variables to the main components and the amount of information taken from them*



Source: The graphics was processed by the authors.

The figure above shows that the first main component takes 52.7% and the second 10.7% of the information. Thus, the first two main components take up 63.4% of the information, and together with the third, 71% of the information. Thus, the remaining 29% of the information contained in the other 10 components will be lost.

4.2. Factor analysis

Factor analysis is a multivariate analysis technique used to describe the variability between observed and correlated variables through a small number of uncorrelated variables, called factors.

Using the Bartlett sphericity test and calculating the KMO index is a crucial phase in factor analysis.

It has as a basic principle the comparison between the correlation matrix and the unit matrix in order to see if the identification of common factors has statistical justification.

- *The null hypothesis* H_0: The variables are orthogonal, so the creation of common factors is not justified.
- *Alternative Hypothesis* H_1: The analysis finds at least one common factor, so we can construct common factors in a justified way.

P-value will have to be below the significance threshold of 0.05

```
$chisq
[1] 5886.149

$p.value
[1] 0

$df
[1] 78
```

We obtain the values chisq = 5886.149, P-value = 0 and a number of degrees of freedom of 78. P-value is below the threshold of 0.05, being even 0, so an excellent value, for which we can go further with the analysis.

The KMO index shows the proportion of the variance of the variables that can be caused by latent factors, identifying variables that are poorly correlated with the others to decide if it makes sense to identify common factors.

For the highest utility of the factor analysis, the value of the KMO index should be as close to 1. The degrees of factorability following the application of the KMO index are the following: 0.90-1.00 – very good workability; 0.80-1.89 – good workability; 0.70-0.79 – average factoriality; 0.60-0.69 – mediocre factoriality; 0.50-0.59 – poor factorability; 0.00-0.49 – no factors.

```
> teste$KMO
[1] 0.20149
```

The value obtained for the KMO index is 0.20, resulting from the fact that there is no factorability in the present case.

Although the Bartlett test showed good value, the KMO index did not indicate a satisfactory value in this regard. Thus, we cannot continue the factorial analysis.

4.3. Correspondence analysis

After researching the correlation matrix, we can see that we have a positive and strong correlation of 0.83 between the Property Rights and Judicial Effectiveness variables, so we will choose these two variables in the correspondence analysis.

Correspondence analysis is a multivariate statistical technique, similar to the analysis of the main components, but applied on categorical variables and not continuous, as in the case of the PCA. Like the PCA, it offers a way of presenting a data set in the form of a two-dimensional graph.

Correspondence analysis is based on the concept of inertia, namely the measurement of the variable in the contingency table using the Chisq test.

The Property Rights variable was named PR, and the Judicial Effectiveness variable was called JE, both having three classes: Low, Moderate, High.

After grouping the data, we were able to obtain the contingency table associated with the two variables in the following table.

Table 1. *Contingency table associated with the variables PR and JE*

PR\JE	Low	Moderate	High
Low	101	1	20
Moderate	15	20	0
High	5	0	11

Source: Authors' own research results.

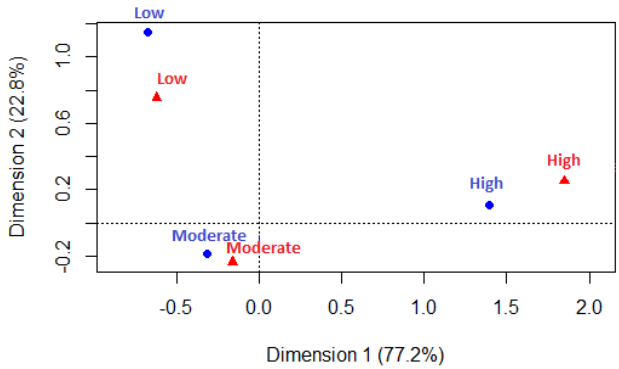
In order to determine the association between the two categorical variables, we will apply the Chisq test, after which the P-value must be lower than the significance threshold 0.05.

```
        Pearson's Chi-squared test

data:  table(dateac[, 4], dateac[, 5])
X-squared = 113, df = 4, p-value <2e-16
```

Thus, we determined the value of $X^2 = 113$, the number of degrees of freedom being 4, and the P-value is of the order $2 * 10^{-16}$, a value well below the threshold of 0.05. Therefore, the link between the two categorical variables is statistically significant and we can estimate the influence of legal effectiveness on property rights.

Figure 7. *Graph of correspondence analysis for PR and JE variables*



Source: Authors' own research results.

We can conclude that, indeed, legal efficiency and property rights are strongly correlated with each other, since their equivalents occupy similar positions on the graph of correspondence analysis.

5. Conclusions

The macroeconomic conditions of a country have a major impact on the strategies of the companies to be present in the respective economy. If economic growth and currency appreciation are an attraction for foreign companies, strong inflation and currency depreciation are challenges that marketing specialists must face.

The expected result of our research in this article was a clear correlation between how the index of economic freedom is composed and the importance of using the techniques of multidimensional data analysis.

International experts, participating in the drafting of the Heritage Foundation Report, argue that, in general, global economic freedom has expanded. At the same time, they emphasize that the states in the top 25% of the top demonstrate higher rates of economic growth. Also, the incomes of the inhabitants of the states with greater economic freedom, are usually about 10 times higher than those in the states with less economic freedom.

Based on the analyzes performed on the components of the index analyzed, I have also noticed that there are countries where the factors that determine the integrity of the government are at a very high level compared to the rest of the countries, so these countries

have a lower level of corruption. At the same time, I noticed that the fiscal pressure in certain countries is high, which is also reflected in a significant decrease in the index of economic freedom.

Another observation was made regarding government spending that in some countries does not have a positive economic justification. According to the correlation matrix, we noticed that there are strong links between the following variables: Score – Property Rights, Property Rights – Government Integrity, Judicial Effectiveness – Government Integrity, Government Integrity – Business Freedom, Business Freedom – Financial Freedom, Monetary Freedom – Investment Freedom, Trade Freedom – Financial Freedom and Investment Freedom – Financial Freedom.

Therefore, we can say that the economic environment of a country is influenced by the behavior of the index of economic freedom so that in our future research we will approach this subject from the point of view of economic cybernetics and the approach based on the system dynamics. It is important to represent the cyber system of the components of the economic freedom index that placed in a dynamic system will simulate behavior with an impact on the economic environment.

Note

(1) PCA – Principle component analysis.

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Banking sector and bank liquidity – key actors within financial crises?

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Abstract. *The paper emphasizes the context of financial crisis and the influence of a selection of indicators on bank liquidity, for a period longer than 50 years. The first part represent the introduction on the topic of the study, followed by the presentation of the related literature. The third part reflects the methodology used within the empirical study, analyzing complex correlations between the bank liquidity and two categories of indicators, macro and bank related indicators, for the countries included nowadays within the Euro Area. The paper links, within the fourth part, the qualitative input from other relevant studies with the empirical evidence and findings of our quantitative analysis, based on data collected for the period between 1960 and 2017. Bank liquidity has received special attention, given its strong association with financial crisis events and periods of macroeconomic instability. The final part reflects our conclusions.*

Keywords: bank liquidity, regulatory framework, financial markets, financial stability, deposits to GDP.

JEL Classification: D53, E44, E58, F61, F62, G21.

1. Introduction

Banking sector support in financing the real economy, mainly via lending activities and securing deposits, represent a catalyzer for growth. The 2008 financial crisis reflected the important role of liquidity creation of the banking sector.

Our paper, providing an analysis over a period of 57 years (between 1960 and 2017), takes into consideration both a traditional approach on liquidity risk, via bank runs, when customer withdraw their money but also a recent approach on liquidity risk, linked with bank exposures to other financial partners, based on interbank financial arrangements. When a shock appears, via losing access to withdraw from undrawn financing facilities, the shock is exacerbated, generating instability on asset side liquidity.

Liquidity creation, liquidity exposure, liquidity risk are concepts very much linked with the most recent financial crisis. Although relevant research was performed, a complete and documented answer to a major question is still missing: "the 2008 financial crisis has started as a liquidity or a solvency crisis"?

In a holistic manner, financial crises are linked with politics, economics, communication, sentiments, expectations, behavior of all the relevant actors. The actions and reactions of authorities, bank customers, financial partners with no access to undrawn loan commitments, influences the crisis context and management, both at the macroeconomic and microeconomic level. At the policy level, there are cross over effects, instruments calibrated for one policy may significantly influence on the objectives of other policy and vice versa.

In Europe, the cultural approach reflects the prevalence for bank financing(1), banking channel being of highly importance in funding the European economy. Thus, bank liquidity has a critical function, being an important pillar for supporting economic activities, representing as well a potential vulnerability in a crisis context. Bank are transforming the risks in their balance sheets and are creating liquidity. Our research analyze, based on a selection of relevant indicators, both at the macroeconomic level and at bank's level, the influence on bank liquidity, in a long-term context.

Other arguments considered for the topic of our research are included within the results and discussions section. They approach aspects such as: the behavioral aspects of liquidity, contagion effects and quick propagation in the market of a liquidity problem for a bank, the connection between liquidity risk and solvency risk, the importance of intraday liquidity management, the impact of maturity transformation, both within the bank's balance sheet but also related to the other banks.

Our qualitative analysis reflects mainly the 2008 financial crisis context, adding value to our empirical study. Within the 57 years analyzed period of the study, lessons have been forgotten regarding aspects such as: sovereign debt, fixed or flexible interest rates, savings, loans, liquidity risk, insolvent banks, junk bonds, currency fluctuations, maturity transformation, irrational exuberance in the market, overheating in different sectors of the economy. As consequences, various crises(2) appeared. The causes of the crises are numerous. Even crises that started from a specific sector of the economy have transformed into financial crises, involving, among the main actors, the banking system.

Historically, and especially since the 1970s, numerous crises in the financial system have affected banking entities in different countries, with consequences such as the generation of high financial and fiscal costs for these countries.

The causes of banking crises are both from the macroeconomic and microeconomic perspectives. Among the macroeconomic factors are, on the one hand, shocks that affect the quality of banking assets, the excessive expansion of monetary aggregates, the funding of resources and credit dynamics and, on the other hand, also influence expectations and external and internal volatility (Hausmann and Rojas-Suárez, 1996). With respect to microeconomic causes, these are mainly characterized by weakness in banking regulation and supervision, precipitation in financial liberalization schemes, inadequate accounting aspects, the increase in financial intermediation margins and in the past due portfolio, the State ownership and participation in banks, the granting of credits to related parties and asymmetric information problems.

The measures adopted within crises context, were focused on preventing the spread of crises, restoring the confidence of depositors, protecting the payment system and promoting the restructuring and recapitalization of viable banks. In most of the cases, the intervention of the government and/or the Central Bank was fundamental to provide liquidity and maintain the integrity of the banking systems. The measures implemented in several countries represented assistance to banks, assistance to debtors and reforms to the legal framework.

The structure and the strategies in managing crisis have evolved and changed, but lessons learned from the crisis times must be analyzed and reflected. In this regard, bank liquidity has to be considered as an all-in-all driver, shadow and mirror of what a bank, in terms of stability, predictability and transparency should look like.

One of the main pillars of banking business has to be considered the management of bank liquidity, especially in a cross-border banking and international context. Financial stability, prudence, financial sustainability represent relevant concepts within the post 2008 financial crisis environment.

As Jorda et al. (2011) reflect in a research study, realized for a selection of fourteen advanced countries analyzed between 1870 to 2008, recessions may be divided into financial recessions and normal recessions. The study presented how GDP recovery varied in severity, according to credit outstanding relative to GDP in the preceding boom. Their conclusions were strongly confirmed, revealing that not only financial recessions are deeper and slower in recovery than in normal recessions, but slower the recovery the greater the credit-to-GDP ratio[3] is.

Accommodating their findings to the 2008 crisis, the answer may be formulated upon the measurement methods of the credit outstanding. With bank loans to the private sector as the measure of credit, the US recovery is about 1% of GDP better than mean recovery for financial recessions. When, in addition, the measure of credit also includes credit granted by the shadow banking system, the results are about 4% better than the median recovery in financial recessions.

The financial crisis of 2008, which has led to the most severe economic crisis worldwide, since the Great Depression of 1930, has called into question, for the first time, the banking business models. A model "originate to maintain" (BIS, 2008, Buiter, 2007, Gorton, 2008, Hellwing, 2008), based on financing through deposits, providing loans to customers, with special attention to the reserves in the long term, based on deposit guarantee systems and the role of central banks as lenders, should be reevaluated and changed.

A new regulatory framework emerged, special provision for liquidity, solvability, supervision and resolution on banking organizations were drafted and implemented. Bail-in and bailout schemes to support authorities, banks and the economy where developed in order to rebalance and recreate a sustainable environment for growth.

Our paper adds value to existing research by analysing data over a 57 years period of time, combining a macroeconomic and a microeconomic approach, via studying the correlations between bank liquidity and a selection of relevant indicators. The focus of our paper is on the countries that are part nowadays from the Euro area, due also to the available data for analysis.

As for the future policies, our research may offer input in designing a new framework for sustainable growth, while building resilience and addressing adequately risks.

2. Literature review

Before the 1960s, bankers considered liquidity almost exclusively in the balance sheet assets and since then, they began to include it in the liabilities side as well. John M. Keynes (1883-1946) adheres to the theory of preference for liquidity to interpret the interest, monetary theory, explaining the phenomenon in terms of money. From that point of view, the interest rate is functionally related to the amount of cash that the public wants to retain, by lowering the interest rates as the supposed cash balances rise. The preference for liquidity function reflects the various reasons for holding cash, such as speculation motives to prefer cash to securities based on expectations that prices will fall. The monetary authorities, by providing the public with greater cash balances, can cause the interest rate to fall, thereby stimulating a greater volume of investment.

The liquidity trap puts a limit on this opportunity because once the interest rate has reached a very low level, the subsequent increase in cash balances will no longer be able to continue to lower it. At this lower level, the holders of securities will believe that the only thing that can be expected is an increase in interest rates or a decrease in the prices of the securities, and will therefore be willing to sell securities to the monetary authorities at prices reigning, in order to maintain the interest rate as it is. Therefore, the pretense of facing a depression through a purely monetary policy can be a failure and should resort to fiscal policy: public works or tax reductions.

The theory of Diamond and Dybvig (1983) applies in "closed" economies. The alteration of the confidence of the depositors in the domestic banking system can cause the economy to move from a "good" equilibrium (without banking crises) to a "bad" equilibrium (with banking crises).

In 1997, Goldfajn and Valdés discovered that the origin of crises is the volatility of international capital flows and the work of financial intermediaries. On the other hand, the theories of Allen and Gale (1998) and Buch and Heinrich (1999) show that banking crises occur when depositors perceive that a deterioration of fundamentals will eventually affect the net value of banking institutions.

According to Adam Smith, banking practices deviate from the idea that they should lend short as they borrow short. There is a lag between the maturities of assets and liabilities on the balance sheet. It is presumed that the interbank business has ceased to function as the entities no longer lend to each other, which has led them to a problematic situation. With the arrival of the credit crisis and the uncertainty about whether another bank may present solvency problems, the interbank credit has been closed. It is considered that this liquidity crisis represents mainly a crisis of confidence. The collapse of subprime mortgages has led to the collapse of large mortgage and financial institutions, which altered the perception of risk among investors.

Also another important role in the history of financial markets and banking systems, were the so-called "panic crisis", led into the commercial banking systems by different endogene and exogene factors. These panic crisis occurred frequently in Europe and the United Stated, were central banks held a leading role in reassuring stability. In this respect, one of the first central banks that took this role was the Central Bank of Sweden, established over 300 years ago (Allen and Gale, 1998).

Relevant studies, mainly performed after the 2008 financial crisis, indicated the importance of global liquidity conditions on financial stability and local macroeconomic performance. Rey (2013) identified the existence of a global financial cycle that transmits the financial conditions of the United States (USA) to the rest of the world.

Similarly, Bruno and Shin (2015) pointed out the importance of global interbank credit as a mechanism for transmitting these conditions to macroeconomic and financial variables at the local level. Given the relevance of credit cycles and the potential effects they may have on financial and macroeconomic stability, they explore the existence of a potential synchronization between these cycles for different countries and monetary regime factors, in the behavior of the credit cycle. In addition, it seeks to identify the effect that global liquidity shocks may have on the behavior of common factors.

Blanchard et al (2010) reflects that, markets are segmented but interlinked. When investors leave one market, the effect on prices may be very large. Considering that, the demand for liquidity extends the banking system, the financial regulation and supervision should consider financial intermediation as a macroeconomic feature.

Regarding post crisis years of observation, for the Euro area particularly, banks are directing their interest policy strategies towards increasing the margins in the retail banking sector, with the economical proof that profitability of banks can improve from their leverage and reduce reliance in wholesale funding (Constâncio, 2016).

In post crisis times, reaching high profitability levels and complying with capital, solvency and liquidity requirements represent challenging tasks for any bank. Profit margin

decreased in the Euro area within the 2008 financial crisis environment, due also to the low interest rates and difficulties for the banks in increasing revenues in a low nominal growth. Some of the tools for the near future are the increase in the credit volumes (based upon adequate liquidity levels), lower impairment costs, capital and investment gains through the stock exchange markets, local and global.(4)

The 2008 financial crisis renewed the interest in the relationships between the real economy and financial sector, with a special emphasis on financial stability, as the axis for the design and implementation of macroeconomic policy (Agénor and Pereira da Silva, 2012).

Ceccheti and Kharroubi (2012, 2015) warned of possible harmful effects of financial sector growth on total factor productivity, thus adding a new line of research to recent literature. This also led to a transformation in the conception of the role played by the financial sector in the economic fluctuations, going from a perspective where it can only amplify the fluctuations generated in the real sector of the economy, to another, in which it can also be a generator of these fluctuations (Helbling, Raju Huidrom, Kose and Otrok, 2011)(5).

Because of the complexity and importance of liquidity, in direct correlation with the solvency ratios of a bank and of a banking system, one of the main challenges, both at the bank's and systemic level, is the management of liquidity risk.

Around the interest on the implications of global financial conditions, the concept of liquidity has been consolidated as one of the relevant factors for the understanding of the gestation and transmission of financial shocks. Borio (2008) identifies liquidity as one of the relevant factors in the consolidation of financial imbalances in the pre-crisis period.

Likewise, Cesa-Bianchi, Céspedes and Rebucci (2015) identify the impact of global liquidity shocks on consumption and housing prices for a sample of advanced countries and emerging economies, concluding that the latter are more sensitive to these shocks, with large impacts on consumption and housing prices.

In addition to the indicators and instruments mentioned in our study, in order to support the operational flows within a bank, the context for demand and supply of liquidity, should be diligently understood.

Thus, a balanced and proper explanation of the creation of demand and supply of liquidity, within the Euro 19 countries banking system may be explained by the interaction of macroeconomic strategies, monetary policies, regulatory framework, implemented by credit institutions, resulting solvency, capital and profitability consolidation.

The indicator of liquidity, represented under the current account holdings, is highly influenced by relevant factors, including monetary policy instruments. Other instruments and tools maybe considered net foreign assets, banknotes in circulation, Government deposits, generally autonomous factors that are in some particular situations generated by/via the regulatory framework, as reflected in Figure 1.

Figure 1. *Simplified Balance Sheet – of the Eurozone (example model)*

Assets		Liabilities	
Autonomous liquidity factors		**Autonomous liquidity factors**	
Net foreign assets (A1+A2+A3-L7-L8-L9)	387.1	Banknotes in circulation (L1)	285.8
		Government deposits (L5.1)	57.2
		Other autonomous factors (net)	92.1
			435.1
		Current account holdings – covering the minimum reserve system (L2.1)	134.9
Monetary policy instruments		**Monetary policy instruments**	
Main refinancing operations (A5.1)	123.0		
Longer-term refinancing operations (A5.2)	60.0		
Marginal Lending facility (A5.5)	0.0	Deposit facility (L2.2)	0.1
	570.1		**570.1**

Source: ECB, "The liquidity management of ECB", Monthly Bulletin.

In addition, regarding the management of bank liquidity, it is also important to emphasize the mechanism of minimum reserve requirements (named in the following MRR). This instrument support commercial banks access to liquidity, when needed, but also reflect a prudent strategy, when buffers/stocks of capital are imposed or required (by regulatory institutions or by central banks). For instance, regarding the European Central Bank, this component is important in managing the volatile nature of liquidity.(6)

Research and studies on liquidity reflect different opinions related to the regulatory framework, best practice in various financial markets, benchmark indicators, factors that influence liquidity, perceptions on adequate liquidity management, lessons from the previous crisis. Those aspects are relevant, both for policy and bank's individual level, liquidity representing one of the most important indicator for banking activity. Within the post crisis environment, due to the financial macro stability approach, liquidity, under all its "interpretations"(7), becomes a critical systemic indicator.

The concept of global liquidity has taken on great strength over the post 2008 crisis period, given its strong association with the global financial cycle.

3. Methodology and database

Our empirical analysis was conducted in order to identify and emphasize correlations between the bank liquidity (endogenous variable) and two categories of selected indicators (as exogenous variables): macroeconomic indicators (Central bank assets to GDP/CBGDP, Deposit money bank assets to deposit money bank assets and central bank assets/DMBA, Financial system deposits to GDP/FSDGDP) and bank related indicators (Bank credit to bank deposit/BCD, Domestic credit to private sector/DCPS).

In order to analyse the correlations between the indicators defined above and to answer the central question of the research: "Is the bank liquidity influenced significantly by macroeconomic indicators or bank related indicators?", the following working hypotheses are formulated:

Hypothesis 1 (I_1): Financial system deposits, as a share of GDP, positively influences bank liquidity.

Hypothesis 2 (I_2): Central bank assets, as a share of GDP, positively influences bank liquidity.

Hypothesis 3 (I_3): Domestic credit to private sector influences bank liquidity.

The methodology used to verify these hypotheses includes the collection of 342 observations and is based on econometric modelling using EViews. The data series included in the regression model have an annual frequency, being based on a data panel from 1960 to 2017, extracted from the Eurostat Date Base Warehouse(8), for 19 countries/economies/financial systems, included nowadays within the Euro area: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, Spain.

We apply the methodology, following the next four steps:
1. Test the stationarity, using the Augmented Dickey Fuler test.
2. Determine if the errors are from a normal distribution, using the Jarque-Bera test.
3. Test first-order autocorrelation, using the Durbin-Watson test, and for the 2nd order autocorrelation using the Breusch-Godfrey test.
4. Correct the hypothesis of heteroscedasticity, estimating in E-Views a new model (Arch test).

The results of our study are relevant for policy actions, reflected as well via the long timeframe selected and analysed (1960-2017).

The methodology enables to perform relevant tests and to analyze, based upon the hypothesis, direct and indirect correlations, to verify if the link between the independent and the dependent variables is significant (test relevance) or not.

In our econometrical approach, we have used "A Least Squares Regression Line model", as our data shows that there is a linear relationship between the variables, but also to quantify the influence, if there are any correlations between independent and the dependent variables.

To estimate the dependence of the selected variables we have used the multiple regression model, generically expressed by the formula:

$$Y = f(\alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n) + \varepsilon$$

Where:
Y – the dependent variable (resultative, random) = bank liquidity;
X1, ..., X_n – independent (factorial) variables, non-aliasing;
ε – random variable or residual variable.

In order to realize link correlations between the Y determinant dependent variable – bank liquidity(9) and X independent variables, the panel model included the whole group of countries (19 countries), the timeframe of fifty-seven years and the two categories of indicators (test performed for both macroeconomic and bank related indicators).

For the first group of macroeconomic indicators and correlations, the formula of the regression line model can be transcript, as follows:

$$L = f(\alpha + \beta_1 CBGDP + \beta_2 DMBA + \beta_3 FSDGDP) + \varepsilon$$

The abbreviations used in the empirical study are:
L – liquidity;
CBGDP – central bank assets to GDP;
DMBA – deposit money bank assets to deposit money bank assets and central bank assets;
FSDGDP – financial system deposits to GDP.

For the second group of bank related indicators and correlations, the formula of the regression line model can be transcript, as follows:

$$L = f(\alpha + \beta_1 BCD + \beta_2 DCPS) + \varepsilon$$

The abbreviations used in the empirical study are:
L – liquidity;
BCD – bank credit to bank deposit;
DCPS – domestic credit to private sector.

Concerning the variables mentioned above, we have tested the significance of the following macroeconomic and bank related indicators, in regard to the bank liquidity levels. The abbreviations and units used within the model are described as follows.

I. Macroeconomic indicators, in accordance with the definitions provided by The European Central Bank, Eurostat and The World Bank:

1) **CBGDP** – Central bank assets to GDP: Ratio of central bank assets to GDP. Central bank assets are claims on domestic real nonfinancial sector by the Central Bank.
2) **DMBA** – Deposit money bank assets to deposit money bank assets and central bank assets: Total assets held by deposit money banks as a share of sum of deposit money bank and Central Bank claims on domestic nonfinancial real sector. Assets include claims on domestic real nonfinancial sector which includes central, state and local governments, nonfinancial public enterprises and private sector. Deposit money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits.
3) **FSDGDP** – Financial system deposits to GDP: Demand, time and saving deposits in deposit money banks and other financial institutions, as a share of GDP.

II. Bank related indicators, in accordance with the definitions provided by The European Central Bank, Eurostat and The World Bank:

1) **BCD** – Bank credit to bank deposit: The financial resources provided to the private sector by domestic money banks as a share of total deposits. Domestic money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits. Total deposits include demand, time and saving deposits in deposit money banks.
2) **DCPS** – Domestic credit to private sector: refers to financial resources provided to the private sector.

The methodology used for both macroeconomic indicators and bank related indicators, were analyzed by performing mathematical/econometrical testing using a Linear Regression Model.

In the study, we have argued to use the interpretation of liquidity[10] from an empirical approach and practicality reasons.

The data for the Y dependent variable bank liquidity has been interpreted and analyzed from Eurostat Date Base Warehouse[11].

The related X independent variables, for the macroeconomic related indicators, were analyzed, transcript, used and implemented within the model, being collected from the European Central Bank and Eurostat Data Base, for 57 consecutive years' timeframe (1960-2017).

4. Results and discussions

Within this part of the research, we present the results of the empirical study and add extra qualitative input, related to financial crisis and banking activities.

As a first step, we have applied the Augmented Dickey Fuller statistic test to see if our dependent variable, the Liquid liabilities to GDP, is stationary. In order to do so, we have applied unit route testing that generated the following results:

Table 1. *Augmented Dickey-Fuller test statistic*

Null Hypothesis: LIQUIDITY has a unit root Exogenous: Constant Lag Length: 0 (Automatic – based on SIC, maxlag =10)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-1.302338	0.6227
Test critical values:	1% level		-3.550396	
	5% level		-2.913549	
	10% level		-2.594521	
*MacKinnon (1996) one-sided p-values. Augmented Dickey-Fuller Test Equation Dependent Variable: D(LIQUIDITY) Method: Least Squares Date: 09/09/18 Time: 14:20 Sample (adjusted): 1961 2017 Included observations: 57 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LIQUIDITY (-1)	-0.052988	0.040687	-1.302338	0.1982
C	4.347365	2.758149	1.576189	0.1207
R-squared	0.029915	Mean dependent var		0.832280
Adjusted R-squared	0.012277	S.D. dependent var		4.313850
S.E. of regression	4.287287	Akaike info criterion		5.783643
Sum squared reside	1010.946	Schwarz criterion		5.855329
Log likelihood	-162.8338	Hannan-Quinn critter.		5.811502
F-statistic	1.696083	Durbin-Watson stat		2.324033
Prob(F-statistic)	0.198228			

Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

Unit route shows that the liquidity is non-stationary, but this hypothesis cannot be rejected because the probability is quite high, more than 60%.

As non-stationary series cannot be forecasted, we created stationaries to our variables and the equations obtained reflect that only the variable Financial system deposits to GDP has a higher influence on liquidity, as its probability is 0%. This variable influences the liquidity with 83%, which means that if the Deposits to GDP increases, also the Liquidity will increase, reflecting that Hypothesis 1 is valid.

The other variables have an insignificant effect on bank liquidity, because their probability is more than 5%.

We observed that the variable Central bank assets to GDP has a negative impact on the Banking liquidity, but this is not significant if we look at its probability which is not less than 5%.

The model chosen headlines that these five variables jointly can influence our dependent variable, as the probability for F-statistics is significant.

Table 2. *Linear Regression model to test bank liquidity interdependency with the selected 5 indicators*

Dependent Variable: DLIQUIDITY				
Method: Least Squares				
Sample (adjusted): 1960 2017				
Included observations: 342 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DBANK_ASSETS	-0.220155	0.430955	-0.510854	0.6117
DCREDIT_TO_DEPOSITS	0.030616	0.074026	0.413588	0.6809
DCREDITTOPRIVATE_SECTOR	0.052315	0.053622	0.975617	0.3339
DDEPOSITS_TO_GDP	0.832826	0.069852	11.92275	0.0000
DASSETS	0.694464	0.828337	0.838383	0.4057
C	0.169747	0.284248	0.597181	0.5530
R-squared	0.787951	Mean dependent var		0.832280
Adjusted R-squared	0.767162	S.D. dependent var		4.313850
S.E. of regression	2.081576	Akaike info criterion		4.403428
Sum squared reside	220.9808	Schwarz criterion		4.618486
Log likelihood	-119.4977	Hannan-Quinn critter.		4.487007
F-statistic	37.90207	Durbin-Watson stat		2.216770
Prob(F-statistic)	0.000000			

Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

The linear regression model no.1, present in Table 2, has tested the nature of correlations of the "y" dependent variable (bank liquidity) with the "x" independent variables (macroeconomic and bank related indicators presented above). Our first regression panel model consists of 342 observations (using 6 indicators for 57 years of time). Considering the validity of the regression, some of the variables are relevant for our analysis.

Regarding the model used to determine the inter-correlations between bank liquidity and Bank credit to bank deposit, Central bank assets to GDP, Deposit money bank assets to deposit money bank assets and central bank assets, Domestic credit to private sector, Financial system deposits to GDP, the valid values reflect the following interpretations.

The results for the R Square, considered as the determination coefficient, shows that 78.7% from liquidity variation is explained by the following variables: Bank credit to bank deposit, Central bank assets to GDP, Deposit money bank assets to deposit money bank assets and central bank assets, Domestic credit to private sector, Financial system deposits to GDP.

Regarding the interpretation for the Adjusted R Square, the results reflect 76.7%, which in our case is significant. The value of R Square can increase as the numbers of variables increase, so it is very important to take into consideration the value of Adjusted R Square. As significance F is 0%, which is less than 5%, it indicates that the test is significant because it has a grade of confidence more than 95%.

Regarding the following tested indicators: Bank credit to bank deposit, Central bank assets to GDP, Deposit money bank assets to deposit money bank assets and central bank assets, Domestic credit to private sector, in direct correlation with "y" variable, "t stat" values are not relevant, being out of the specific interval; this means that there is no direct inter-dependency between the bank liquidity and the indicators mentioned previously, when it had significant fluctuations (out of the interval).

The only indicator (bank related indicator) that influences the bank liquidity rate is the Financial system deposits to GDP. The determination coefficient shows that even a small percentage as per "t stat" value, equal to 11.92275, which is in the interval, express the influence upon the "y" dependent variable. The liquidity variability is explained by this indicator.

In order to answer the hypothesis of our empirical study, analyzing the regression results, we could observe that it also persists an inverse relationship between the bank liquidity and the Bank credit to bank deposit, Central bank assets to GDP, Deposit money bank assets to deposit money bank assets and central bank assets, Domestic credit to private sector, indicators.

The mathematical and statistical interpretation:

β_0 = intercept parameter

$\beta_1, \beta_2, \beta_3$ = partial regression coefficients or slope coefficients.

$\hat{\beta}_0$ **= -0,220155** shows that if the five explanatory variables X1, X2, X3, X4 and X5 are 0, the average value of "Liquid assets to deposits and short-term funding" is estimated to be around -0,22%.

$\hat{\beta}_1$ **= 0.030616** shows that, while maintaining the other constant variables, when "Bank credit to bank deposit" (X1) increases by 1%, the liquidity ratio increases on average by 0.03%.

$\hat{\beta}_2$ **= 0.052315** shows that, while maintaining the other constant variables, when "Domestic credit to private sector" (X2) increase by 1%, the liquidity ratio increases on average by 0.05%.

$\hat{\beta}_3$ **= 0.832826** shows that, while maintaining the other constant variables, when "Financial system deposits to GDP" (X3) increases by 1%, the liquidity ratio decreases on average by 0.83%.

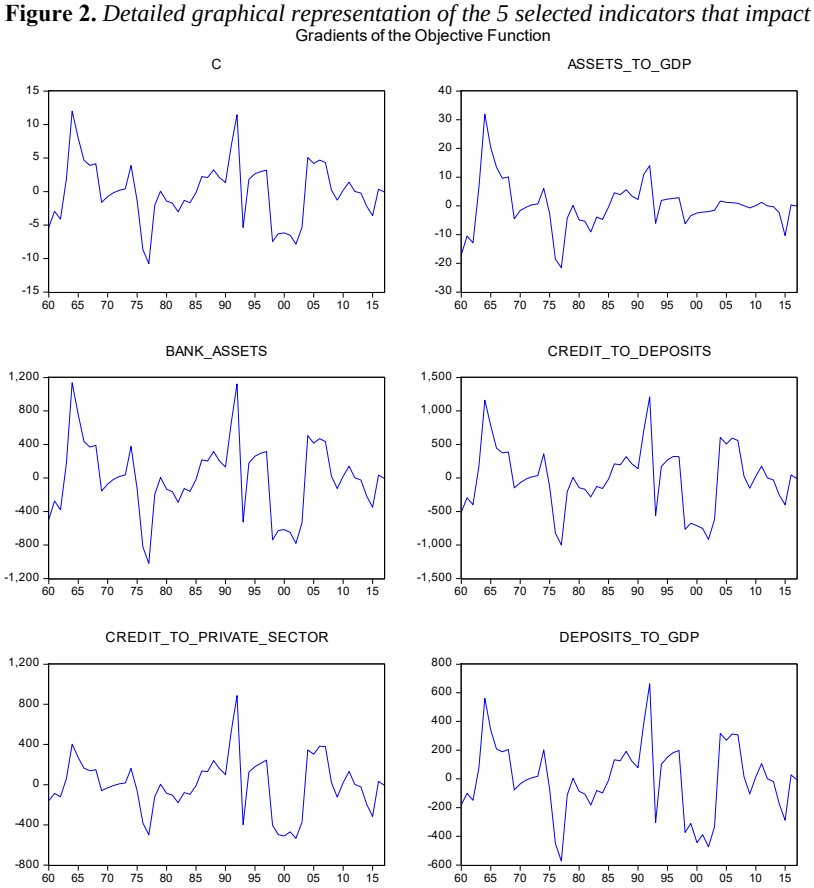
$\widehat{\beta}_4$ **= 0.694464** shows that, while maintaining the other constant variables, when "Deposit money bank assets to deposit money bank assets and central bank assets" (X4) increase by 1%, the liquidity ratio increases on average by 0.69%.

$\widehat{\beta}_5$ **= 0.169747** shows that, while maintaining the other constant variables, when "Central bank assets to GDP" (X5) increases by 1%, the liquidity ratio decreases on average by 0.16%.

Note: These interpretations may change as a result of verification of residue assumptions.

As reflected in the graphs below (Figure 2), all the variables chosen have an influence on bank liquidity, but closer to our dependent variable is the variable Deposits to GDP. Other results confirm that Central bank assets, as a share of GDP, are in an indirect relationship with bank liquidity, in this respect Hypothesis number 2 is not valid.

Figure 2. *Detailed graphical representation of the 5 selected indicators that impact bank liquidity*



Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

Taking into consideration these results, we wanted to estimate the equation, using only the variable Deposits to GDP, and we obtained the following results:

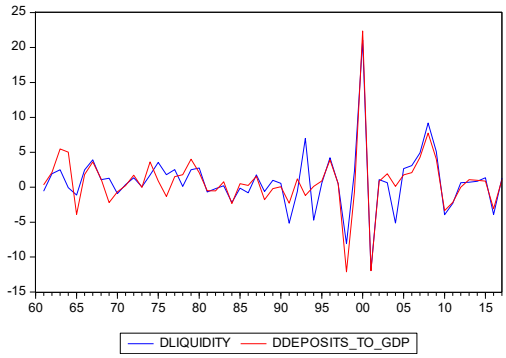
Table 3. *Linear Regression (detailed of model no. 1) to test bank liquidity interdependency with the most relevant of the selected indicators – Deposits to GDP*

Dependent Variable: DLIQUIDITY				
Method: Least Squares				
Date: 09/18/18 Time: 20:13				
Sample (adjusted): 1961 2017				
Included observations: 57 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DDEPOSITS_TO_GDP	0.867225	0.063041	13.75649	0.0000
C	0.163024	0.277889	0.586650	0.5598
R-squared	0.774813	Mean dependent var		0.832280
Adjusted R-squared	0.770718	S.D. dependent var		4.313850
S.E. of regression	2.065617	Akaike info criterion		4.323192
Sum squared reside	234.6725	Schwarz criterion		4.394878
Log likelihood	-121.2110	Hannan-Quinn critter.		4.351052
F-statistic	189.2411	Durbin-Watson stat		2.200620
Prob(F-statistic)	0.000000			

Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

Our results are in line with the macroeconomic theory, a shock on deposits generating a decrease of the bank liquidity and vice versa.

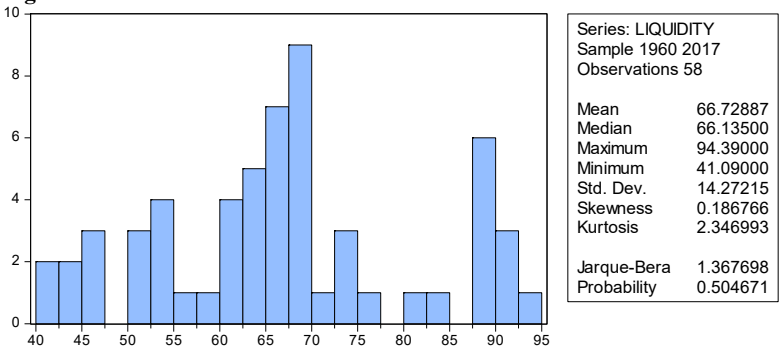
Figure 3. *Detailed graphical representation of interdependency between bank liquidity and deposits to GDP indicator*



Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

To determine if the errors are from a normal distribution, we used the Jarque-Bera test, and we have obtained the following results:

Figure 4



Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

According to this test, Jarque-Bera statistics is 1.367698, and the corresponding probability is 50.46%, which is more than 5%. That means, we cannot reject null hypothesis, because, as we can see in the graph, our dependent variable has normal distribution.

For this model, firstly we want to determine the autocorrelation, by using Durbin-Watson test, and secondly we use the Breusch-Pagan-Godfrey test to check whether the residuals have heteroskedasticity.

Table 5. *Breusch-Pagan-Godfrey test whether the residuals have heteroskedasticity*

F-statistic	1.200396	Prob. F (6,51)		0.3213
Obs*R-squared	7.177332	Prob. Chi-Square (6)		0.3048
Scaled explained SS	0.300153	Prob. Chi-Square (6)		0.9995
Test Equation:				
Dependent Variable: WGT_RESID^2				
Method: Least Squares				
Date: 09/22/18 Time: 15:40				
Sample: 1960 2017				
Included observations: 58				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	57.99369	45.73542	1.268026	0.2105
LIQUIDITY	-0.053282	0.101314	-0.525911	0.6012
ASSETS_TO_GDP	-1.432174	0.880016	-1.627441	0.1098
BANK_ASSETS	-0.547885	0.459942	-1.191203	0.2391
CREDIT_TO_DEPOSITS	-0.003454	0.038962	-0.088646	0.9297
CREDIT_TO_PRIVATE_SECTOR	-0.014665	0.037466	-0.391419	0.6971
DEPOSITS_TO_GDP	0.056967	0.105647	0.539219	0.5921
R-squared	0.123747	Mean dependent var		0.913949
Adjusted R-squared	0.020659	S.D. dependent var		1.765096
S.E. of regression	1.746769	Akaike info criterion		4.066174
Sum squared reside	155.6113	Schwarz criterion		4.314849
Log likelihood	-110.9191	Hannan-Quinn critter.		4.163038
F-statistic	1.200396	Durbin-Watson stat		1.919447
Prob(F-statistic)	0.321301			

Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

Within the below table, we have used Durbin-Watson test to determine autocorrelation in our econometrical model, where:
No – No positive autocorrelation;
Na – No negative autocorrelation;
n = 58 – Number of observations;
k = 6 – Number of explanatory variables.

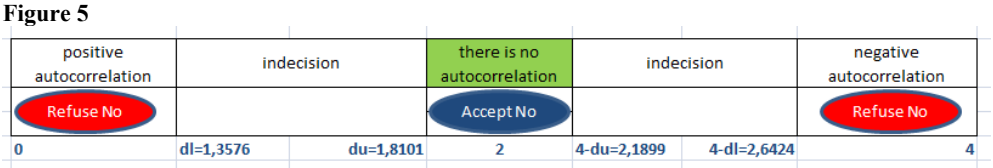
Their values are between 0 and 4, and some levels that will allow us to delimit the areas of non-autocorrelation. These levels are (lower limit) and du (upper limit), the critical values for our equation, which we found in the table Durbin-Watson.

From these levels, we find 2 zones of indecision, one zone of positive autocorrelation, one zone of negative autocorrelation and one zone where autocorrelation does not exist. As Durbin Watson result is very close to the number 2, between du and 4-du, we can accept the null hypothesis of no autocorrelation.

Then the null hypothesis of this test reflects there is no positive autocorrelation and the alternate hypothesis reflects there is no negative autocorrelation. To use the Durbin Watson

table, the first thing we consider is n, which is the number of observations and k is the number of explanatory variables.

Figure 5



Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

Within our model, which has 57 observations and 6 explanatory variables, we used a table with 5% significant points, and we found the values for dl = 1.3576 and du = 1.8101. We calculated also the values for 4-du and 4-dl, and the next step was to locate in which area we can find the value of Darvin-Watson for our model. When reviewing the results of the regression, we find that the statistic value of 1.919447 is between du and 4-du, as reflected in the equation, which means that we can accept the null hypothesis.

Du < Darvin-Waton < 4-Du, indicates that we can accept the null hypothesis, and there is no autocorrelation.

By using the Breusch-Pagan-Godfrey test, we found out that the probability is 30.48%, which is more than 5%, meaning that we can accept null hypothesis, because residuals are homoscedastic, which is desirable for the model implemented.

We used also the Autoregressive conditional heteroskedasticity Model (ARCH) in order to find out the relationships between the selected variables.

Table 4. *Autoregressive conditional heteroskedasticity Model (ARCH)*

Dependent Variable: LIQUIDITY				
Method: M -ARCH (Marquardt) – Normal distribution				
Date: 09/22/18 Time: 13:52				
Sample: 1960 2017				
Included observations: 58				
Failure to improve Likelihood after 39 iterations				
Pre-sample variance: back cast (parameter = 0.7)				
GARCH = C (7) + C (8) *RESID (-1) ^2 + C (9) *GARCH (-1)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-46.24979	41.14882	-1.123964	0.2610
DEPOSITS_TO_GDP	0.906192	0.060682	14.93340	0.0000
CREDIT_TO_PRIVATE_SECTOR	0.129757	0.042474	3.054990	0.0023
CREDIT_TO_DEPOSITS	0.059007	0.052010	1.134549	0.2566
BANK_ASSETS	0.443695	0.408434	1.086332	0.2773
ASSETS_TO_GDP	1.240880	0.922364	1.345326	0.1785
	Variance Equation			
C	3.343993	2.004940	1.667877	0.0953
RESID (-1) ^2	0.650419	0.505869	1.285747	0.1985
GARCH (-1)	-0.199839	0.425354	-0.469819	0.6385
R-squared	0.972902	Mean dependent var		66.72887
Adjusted R-squared	0.970296	S.D. dependent var		14.27215
S.E. of regression	2.459764	Akaike info criterion		4.507246
Sum squared reside	314.6227	Schwarz criterion		4.826970
Log likelihood	-121.7101	Hannan-Quinn critter.		4.631785
Durbin-Watson stat	0.835521			

Source: Authors own processing, based on data provided by Eurostat Data Base Warehouse.

The results are quite similar to the regression model, because the variable which has a strong impact on bank liquidity is also Deposits to GDP, which influences with 90.61% the liquidity. Another valid variable in this model is Credit to private sector, influencing less the bank liquidity, with 12.97%. In this respect, the Hypothesis no. 3 is valid.

Our findings are in line with the macroeconomic theory, as credits and deposits are the indicators that influence mostly on bank liquidity.

Regarding other relevant discussions, related to the correlation between the crisis context, banking activity and bank liquidity, the 2008 crisis emphasized the need for new tools, mechanisms, instruments and policies.

Regulatory response for the 2008 crisis was very important, including a new approach, based on the need to insure high quality liquid assets, diversification, control of stock and management of liquidity.

A key concern supported strongly within the regulatory framework, emphasize on the correlation between liquidity risk and outflows, in crisis times. Via specific indicators(12), the regulations impose limits on short-term market funding, this aspect being one of the key elements(13) in the 2008 financial crisis.

The behavioral aspects of liquidity are very important for banking business, for the banking sector but also for the economy. Based on rumors, real or not real, depositors, other banks may withdraw funds, block access to funds, generating panic and bank run. From this point, the amplification may directly transform a liquidity crisis into a solvency crisis, for a bank or for a banking system.

Although the banks are well capitalized, specific concerns for: intraday liquidity management, strong communication policies in place, specially drafted for a crisis context, disclosure and market discipline, legal and operational arrangements with other banks/financial partners, should be carefully considered.

Due to the fact that banks are attracting short term deposits and funds from the interbank market and provide long term lending, this activity of maturity transformation implies risks and vulnerabilities. A problem from a bank balance sheet may be translated to a systemic level, being linked with the asset prices, collateral valuation changes, cash flows and short-term obligations of interconnected counterparties.

New capital requirements, with a good quality structure of cash, reflected the importance banking activity for insuring sustainable long periods of economic growth and stability(14). The new approach in handling the new global vs. local context required technical and tactical systemic risk management, leading into creating a non-volatile cash cycle and a more long-term cost-efficient quality of the investments portfolios in the banking sector.

Those strategic correlations reflect the key roles played by the banking sector and the key influential role of bank liquidity in crisis times, from economic and financial stability point of view.

Liquidity is included, together with capital, credit constraints among the instruments used both for macro prudential and micro prudential actions. The crisis reflected that micro prudential policy is not enough; soundness of each bank and of the system should be

insured, based on a mix of policies. Capital and liquidity requirements, on and off-site inspections, licensing new actors in the market, contribute significantly to the supervision of the banking sector, based on risk mitigation policies. In order to positively impact on banking activity, it requires rigorous evaluations and policy implementation, supervision and communication.

Under sophisticated umbrella concepts, such as macro stability, macro financial stability, financial sustainability, there are relevant functionalities, of highly importance in every crisis context. As reflected by our study and by the economic realities, key aspects that link micro and macro in a sustainable manner include: deposits in banks and the need to create confidence to secure long term savings, interbank funding based on knowing/trusting your partners, traditional banking activities based on lending and attracting deposits, credits towards real economy, tools to manage exposure to counterparties, when funding is channeled into the banking system and from the banking system to the real economy. Bank liquidity tend to occupy a central pillar of importance for the sustainability of the banking business, both at bank level and systemic level.

Not only from a traditional perspective over the indicators measuring liquidity, but also from market perspectives, indicators such as Loan-to-deposit ratio, Liquidity Coverage Ratio, Global Liquidity Index, together with new instruments, such as Available Stable Funding (ASF), within the existing related specific literature, reflect in a consistent manner, the evolution and signaling policy of bank liquidity.

In a global context, a new paradigm occurred in the form of transferring strategical policies, from global to local markets. For instance, the funding and fund-raising mechanism enabled that the banking system in one country, may affect and be affected by financial covenants from another country. That is why this type of pioneer activities in Europe (and in other continents as well), after the 2008 global financial crisis are in the umbrella of a predictable evolution about future, more consolidated financial structures(15).

Relevant literature reflects that major changes and developments, concerning the banking and financial sector, have roots within financial crises.

Financial crises have affected not only the balance sheets of the banks, but throughout the entire financial ecosystem, financial markets and society. Empiric evidence reveals that after the 2008 financial crisis, the effects of bank liquidity should be adequately monitored, understood and considered, within a new regulatory framework, both at the bank's and banking system level. Sustainable banking business should include a diversified mix of funding, specific tools for managing bank liquidity and adequate calibration with the other relevant bank indicators.

5. Concluding remarks

The financial crises are caused by various catalyzers, such as housing market overheating, inadequate liquidity monitoring and supervision, "unknown" exposures transferring risks into the banking sectors, currency "wars", insolvency for large financial institutions, inadequate regulation of a highly integrated international financial system.

The 2008 financial crisis reflected the difficulty of coordination, in a multipolar economic world but also the strong effects that illiquidity may affect the banking sectors and real economies. The lessons of previous crises have allowed the authorities to react with a certain speed but important challenges persist, looking for more fundamental solutions rather than particular interventions.

Our empirical study includes the analysis of five selected macroeconomic and bank related variables: Bank credit to bank deposit, Central bank assets to GDP, Deposit money bank assets to deposit money bank assets and central bank assets, Domestic credit to private sector, Financial system deposits to GDP. The study uses regression models, based on data collected for a period of 57 years (between 1960 to 2017) for 19 countries, representing nowadays the Euro area.

The results confirm that deposits are linked and influence, in a significant manner the bank liquidity, compared with other selected variables. Credits have also influence on bank liquidity.

The fundamental aspects of the banking business, deposits and credits are impacting on bank liquidity. Considering the role of bank liquidity, both at banks and system level, and the effects within a crisis context, liquidity management becomes a major concern for bank stability and sustainability.

The long period of time considered for the analysis, methods and tools selected, the large number of observations included, may offer support for a future mix of policies, appropriate to current realities and challenges.

The study helps to explain some of the continuous economic stages and developments in banking systems, to identify factors that influence the determinant indicators, directly proportional to the evolution of bank liquidity. The findings emphasize that shocks to global liquidity have an effect on the common component of the credit and deposit cycle. Shocks generated in international financial markets have significant effects on the financial stability and the macroeconomic financial stability of the euro area.

The study also reflects, contrary to some public studies/perceptions, that some bank related indicators do not directly and significantly influence on bank liquidity.

It is also important to highlight that, given the great heterogeneity of countries/specific developments during the analyzed period, further research may explore the transmission mechanisms of the global liquidity shocks for the different countries of the euro area.

Due to the important role of the banking sector within every economy and to the cross effects/interdependencies of bank liquidity, banking sector and bank liquidity represent key actors within crises. If understood, the impact/effects of bank liquidity and its amplification power, risks may be highly mitigated.

The management of bank liquidity, at the banking organization level, add new priorities, in terms of: diversification of funding sources/currencies, short-term focus and long-term sustainability, correlation with capital requirements/other banking business relevant indicators, developing internal capacities for crisis situations and partnering with other financial institutions.

The management of bank liquidity, at the systemic level, should prioritize: coordination between different policies, calibration of macro prudential instruments, assessment of their impact over the banking sector and real economy, monitoring the liaison between liquidity risks and solvability risks, supervisory reviews and assessments for liquidity, liquidity stress testing, analyze the spillover effects of liquidity, strategic communication policies and protocols.

Mixing macro and micro prudential and supervisory tools, in a harmonized manner, add value to the management of liquidity, both at banks and systemic level. The stability of the banking sector on the long run and the mitigation of risks will contribute to sustainable economic growth.

Notes

(1) The indicator Domestic credit to private sector (reflected as % of GDP), for the Euro area, in 2017, registered 88,23 and 96,39 for the European Union, in accordance to International Monetary Fund, International Financial Statistics and data files, World Bank and OECD GDP estimates.

(2) For example, mentioning the beginning of the crises: energy crisis (1970), Savings and loans crisis (1980s), Stock market crush (1987), Junk bond crush (1989), Asia crisis (1997), Dotcom bubble (2000), global financial crisis (2008), European Sovereign debt crisis (2009), Greek government-debt crisis (2009), Portuguese financial crisis (2014).

(3) In accordance with OECD, GDP reflects "an aggregate measure of production equal to the sum of the gross value added of all resident and institutional units engaged in production (plus any taxes and minus any subsidies, on products not included in the value of their outputs"; another generally accepted and used definition: GDP (Gross Domestic Product) reflects the sum of the market value of all goods and services destined for final consumption produced in all branches of the economy within a country within one year.

(4) ECB, Challenges for the European banking industry, Madrid, July 2016.

(5) As indicated by the Bank of International Settlements (BIS) (2011), the literature has identified three channels through which the transmission of the shocks originating in the financial sector of the economy to the real sector takes place, and in turn the retransmission through the financial sector of shocks originated in the real sector; These three channels are: 1) the balance sheet of the borrowers, 2) the balance sheet of the banks and 3) the liquidity. The first two are known as the financial accelerator.

(6) ECB, "The liquidity management of ECB", Monthly Bulletin, as per definition: Reserve requirements are a standard monetary policy tool in central banking.

(7) May be considered, *inter alia:* bank liquidity, global liquidity, official liquidity, private liquidity.

(8) As provided on the site of the entity: http://ec.europa.eu/eurostat), for the timeline of fifty-seven years (1960-2017).

(9) Defined for banks in EU 19 countries, as "liquid assets to deposits and short-term funding" (%), in accordance to the methodology used from definition variable, presented at Eurostat Data Base Warehouse.

(10) Reflected as "the banks capacity to meet its deposits withdrawals"; within the regression model, bank liquidity ratio reflected is Loans/Total Deposits (in percentage %).
(11) As provided on the site of the entity: http://ec.europa.eu/eurostat), for the timeline of fifty seven years (1960-2017).
(12) Such as Net Stable Funding Ratio.
(13) In case of Lehman Brothers, the bank could not roll over its short-term wholesale funding.
(14) Therese Grace, Niamh Hallissey and Maria Woods, The Instruments of Macro-Prudential Policy, Quarterly Bulletin 01/January 15.
(15) Jaime Caruana (GM, Bank for International Settlements), Global Liquidity: Where it stands, and why it matters, Frankfurt, 5 March 2014.

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Existence of rewards for a sustainable enterprise in the context of the human resources strategy

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Abstract. *The paper therefore deals with a sufficiently important and topical issue, with many implications in the decision-making process, because in the context approached by organizations targeting cost-cutting strategies, pressured by the economic environment, but also by rational desire to make a profit, adhering to policies and reward principles remains a challenge for most human resource deciders. The reason why we chose to develop this topic is structured on the belief that the professionalization of HR activities can have a contribution to changing some mentalities and behaviors in Romanian society. We consider it useful to deepen this topic aimed at remunerating employees, because in the context of globalization, of alignment with trends with increasing requirements, as Romania still has a competitive advantage in terms of labor force, there can be found a method of awareness of the principles of reward, so that in a future macroeconomic environment living standards can be assessed at a higher level.*

Keywords: reward, sustainable enterprise, strategy, human resource.

JEL Classification: M2, M54, M11, M14.

1. Introduction

As J. Pfeffer and E. Lawer argue, in the current context the competitive advantage of an organization lies in its people. Therefore, based on a people-oriented management philosophy, we can argue that they will be the ones who represent the organization. In order for an organization to compete in the market through people, special strategic models have been implemented that are based on respect for people (Pitariu, 2000, p. 30). If we start from this simple phrase we can easily get to the question raised by specialists in the field, namely "What is an organization without its employees? There is nothing in the absence of human resources, or maybe just a lot of expensive machinery (De Cenzo and Robbins, 1988, p. 7). In order to better understand the importance of human resource management, it is easy to understand that an argument will be needed first of all about the importance of the existence of organizations. The latter being social inventions, which corroborate efforts, but also common goals, the essential characteristic being the coordinated presence of people and not necessarily of things. In essence, organizations represent human effort, and their efficiency and effectiveness largely depend on human behavior (Kohn, 2001, pp. 29-50).

2. Literature review

Given that large companies spend large sums on their employees, these costs require a permanent investment in hiring, maintaining and developing staff. However, the traditional attitude towards work has a minimalist vision, from this perspective people are seen as mere expenses. At this point, we can say that human resources are the most sensitive point of all the resources of an organization, as two dimensions are corroborated, the first being the psychological dimension, which can produce moral effects on individuals, and the second dimension by which this resource is measured as a profit-making factor, where there is the premise that people are a similar resource to others, therefore must be managed and accounted for according to the calculation of the break-even point for staff training, marginal cost of employment, balance sheets with material and financial assets, finally, everything related to the financial aspect (Cole, 2004, p. 51).

Michael Armstrong in one of his reference works Personnel Management Practice presents in detail the specific fields of activity of HRM. The methodology by which he deals with the aspect of interdependence of personnel activities also translates the degree of formalization and integration of the human resources function. The areas it covers are the Environment, Strategic Plans and the Culture of the organization (Cole, 2004, p. 32).

3. Human resource efficiency

He believes that the requirements of an effective human resources policy can be summarized in obtaining the support of all staff, this being achieved by ensuring an environment of involvement and capitalization of the potential of each employee, positive motivation for individuals who achieve high results and stimulating those who can reach this stage, the orientation of each employee towards self-perfection and not least the

training of individuals who want to participate in the adoption of the decision-making act (Ivancevich and Glueck, 1983, p. 123).

In order to capture a clearer perception of what rewards management involves, we must be aware that it does not only focus on the financial framework related to salary remuneration and employee benefits, but also equals non-financial concepts such as appreciation, learning, opportunities and development possibilities existing in the organization.

Traditionally, this field is called payroll administration, but this concept has long been considered limited because it does not cover all issues. In the theory and managerial practice in the field of human resources, a series of terms are used such as: rewards, compensations, retributions, remuneration, salary, payment, incentives, facilities, advantages, privileges, etc.

But in order to be able to discuss further about these structures that motivate employees directly, I want to involve in the subject the recognition and implications of motivation.

At present, large organizations are facing economic constraints to increase employee spending, and promotion opportunities are fewer and fewer. Thus, research in the field has found that both safety at work and quality of life at work have a much higher priority for a considerable proportion of people.

An American psychologist, Abraham Maslow, gave up research in pathology to try to understand human nature. The alternative was the study of mature, fulfilled and successful people, thus trying to find the common points of the studied subjects and to offer a clear image of finding the balance that can lead to the natural state of man, which converges towards happiness and satisfaction. Maslow was the father of the wave of more optimistic psychological thinking that continues to try to remove behaviorism as a favorite model in the study of the human psyche.

Most experts believe that reward management describes a much broader and more positive spectrum in terms of employee rewards for what they have done or can do for the company. So we can conclude that the rewarding activity is a very important one and with a major influence on the organization.

Existence of rewards for a sustainable enterprise in the context of the human resources strategy

D. Coleman, in *Human Resource Management,* stressed that in order for a reward or work result to act as an effective motivator, several essential conditions must be met: the person in question must want his reward, keep in mind that his extra effort will bring a plus to his performance, and the person must be convinced that the improved performance will also bring him rewards (Ivancevich and Glueck, 1983, p. 88).

In the 1960s, another psychologist, F. Herzberg, built, based on research on several organizations, a two-dimensional model of motivational factors that influence the performance and behavior of individuals in the workplace. According to this theory, the first dimension of hygiene factors, for example company policies and procedures, supervision, way of working or remuneration, interpersonal relationships, are those series

of variables that can create dissatisfaction in their absence, but their presence does not necessarily motivate employees.

Instead, it is a second dimension, which includes a number of factors that motivate and produce job satisfaction: professional achievement, recognition for achievement, work itself, advancement within the company hierarchy and responsibility associated with work (Armstrong and Murlis, 2004, p. 78).

Motivational factors have brought positive effects on long-term employee outcomes and performance, while hygiene factors produce short-term effects on work attitude and performance. In conclusion, the motivating factors have a direct connection with what the employee does, with his tasks, while the hygienic factors have a connection with the work environment in the organizational context.

The special challenge for the reward team in a sustainable organization is the design and implementation of a reward system as appropriate as possible and which has in its model introduced many factors such as the variety of individual values for a particular reward, the great variety of knowledge and skills, systems that impose more than bonuses or salaries, but also benefit packages that must be carefully correlated, the important cost that the approached strategy brings, the employees' desires to negotiate these packages, etc.

Specialists in the field of human resources consider that remuneration is not only a consequence, but even an engine of an efficient social economic activity. For a salary policy to be effective, it must be first and foremost part of the general policy of the organization and must be correlated with two other systems, one being to increase work efficiency and increase employee interest not only to achieve individual performance but also as an added value to the overall performance of the organization in the medium and long term.

Reward management is a concept that encompasses in its spectrum strategies, policies and processes designed to contribute to employee remuneration, both financially and non-financially. In a broader area we can define reward management as the structure that includes the thinking, implementation and maintenance of reward systems, here are the strategies, policies and procedures adopted, which directly aim to remunerate staff correctly, equitably and consistently in accordance with the value they bring to the company (Armstrong and Murlis, 2004, p. 56).

4. Conclusions

Reward management includes in its spectrum strategies, policies and processes designed to contribute to the remuneration of employees, both financially and non-financially. It represents the structure that includes the thinking, implementation and maintenance of the reward systems, here being included the strategies, policies and procedures adopted, which have as direct goal the remuneration of the staff in a fair, equitable and consistent way.

In order for a salary policy to be effective, it must be part of the general policy of the organization and must be correlated with two other systems, one being to increase the

efficiency of activity and increase the interest of employees not only to achieve individual performance but also as added value to the overall performance of the organization in the medium and long term. Wage policies represent a set of action decisions aimed at developing specific, operational tools to achieve objectives.

This area of salary administration is considered as a basic field of human resources management because several factors and functions are corroborated, and their correlations with different economic variables having implications on economic employees.

We cannot omit to mention that for the capital owner, for the entrepreneur, the salary constitutes the most important element of the production costs, and its minimization is a rational requirement and which leads in the end to the increase of competitiveness. For this reason, the specialists in the field consider that the salary policy can be identified with the cost control policy.

The importance of providing estimated images of costs with employees is given by the fact that at the end of financial year, the employer can see what costs may occur along the way and where he can intervene to make them more efficient.

In order to provide a transparent and objective image, it is important that the decision maker can present in the case of financial audits, the methodology of collaboration decisions with certain suppliers.

It is important for the employee to feel the concept of total reward, which includes both the salary, the benefits he has, but also the learning part that the company environment offers him.

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Do export, financial development, and institutions affect FDI outflows? Insights from Asian developing countries

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Abstract. *Focussing on the importance of FDI outflows (OFDI) from Asian developing countries, this study examines the impact of export, institutions and financial development on OFDI. Using a balanced panel of 10 Asian developing countries during 2002-2016, this study employs the Pooled Mean Group (PMG) cointegration test and Granger causality test of Dumitrescu and Hurlin (2012) to explore the long-run causal relationship. To validate the results robustness test is conducted. Overall, the findings show that improvement in institutions encourages OFDI in the short-run, but it impedes more OFDI in the long-run. The financial development and export are positively related to OFDI in the long-run. The Granger causality test confirms that there is a uni-directional causality that runs from the quality of institutions and financial development to OFDI, while OFDI induces more export.*

Keywords: OFDI, export, financial development, institutions, panel data.

JEL Classification: C23, F21, F23.

1. Introduction

The distinctive role of FDI attracts several researchers to focus on its various aspects, particularly outflow of FDI (OFDI) from developing and emerging countries.(1) There has been a long debate among policymakers of developing countries, who have considered OFDI as an important catalyst for their economic development. Given the importance of OFDI over past decades, these countries have captured attention of many researchers to defy the available theories (Child and Rodrigues, 2005; Mathews, 2002; Luo and Tung, 2007; Ramamurty, 2009) and empirically examine from various country perspective (Banga, 2008; Gammeltoft et al., 2010; Kim, 2000; Park and Roh, 2019; Tan et al., 2018).

The expansion of international production networks forces world FDI outflows to increase exponentially from about $240 billion in the year 1990 to more than $1.45 trillion in 2016 (UNCTAD, 2016). The share of developing economies in the world OFDI flows is surged to about 28 percent in 2016 from only around six percent in 1990 (UNCTAD, 2016). But, this surge of OFDI is prominently visible in the aftermath of the Asian financial crisis (1998), in which Asian developing countries have played a major role. These countries have sharply been diversifying their foreign investment and account for more than 26 percent of the World's overall FDI outflows (World Investment Report, 2019). The more active players in this region are South, East, and South-East Asian countries like China, Hong Kong, India, Korea, Malaysia, Singapore, and Thailand. However, following the global competition, the government of other developing countries has also made several macroeconomic reforms and liberalise trade and investments that significantly affect the internationalisation process in the Asian region.

The new wave of developing country MNEs (DMNEs) has seen an upsurge in the early 2000s, although it has already begun in the late 1970s (for example, Lall, 1983; Lecraw, 1977). Mathews (2006) shows that the increasing foreign investment by MNEs from emerging countries aims to overcome their initial disadvantages including lack of skill and knowledge, less developed financial system, and poor institutional quality. However, a series of academic papers empirically analyse the determinants of inward FDI flows to developing countries (Gupta and Ahmed, 2018; Phung, 2016; Wernick et al., 2009), relatively small number of literature deal explicitly with the determining factors of FDI stemming from the developing countries (Bano and Tabbada, 2015; Klimek, 2015; Padilla-Perez and Nogueira, 2016; Rasiah et al., 2010). These studies provide evidence for factors like domestic market size, natural resources, per capita income, trade openness, savings, and institutions that are the key to drive FDI outflows. However, the present study aims to concentrate on export, institutional quality and less studied financial development of source countries and their impact on FDI outflows, particularly from Asian developing countries. Although the literature is available, less attention is paid towards the relationship between home country financial development and OFDI. Further, the causal interaction of determinants like export, financial development, and institutional quality with OFDI is omitted from the previous studies, especially in the current context. Thus, to examine the causal relationship this study uses advanced techniques of cross-sectional dependency test and Granger causality test propounded by

Dumitrescu and Hurlin (2012) to avoid the presence of a common fixed effect among the sample countries.

The rest part of this study is planned as follows. Section 2 describes the pertinent theoretical and empirical literature and frames the hypotheses. Section 3 delivers a description of data and outlines the empirical framework for the present study. In section 4 results are reported and, the study concludes with closing remarks in the last section.

2. Literature review and analytical framework

The motivation for the emergence of FDI outflows from developing countries has well documented in Tolentino (1993). Dunning et al. (1997) summarize the descriptions of empirical literature as "a 'new' kind of MNE that – so it was argued – differed considerably from that of 'conventional' industrialized country MNEs, in terms of its ownership (O) advantages, motivation, geographical direction and mode of overseas activity". Although there are considerable degrees of investment flows from developing countries, many theoretical arguments(2) are explained foreign investment activities from the perspective of developed source countries (Gammeltoft et al., 2010; Narula and Nguyen, 2011; Ramamurty, 2009). Thus, developing countries require new theories to explain the process of internationalisation (Park and Roh, 2019).

From a microeconomic perspective, the OLI paradigm (ownership, locational, and internalisation advantages) addresses the question that why a firm operates its activities in cross border regions. According to this model, it is the firm-specific ownership advantages like brand reputation, patents, managerial skill, and technological know-how that enable firms to internalise their activities in abroad, raising firms' competitiveness to overcome from their fixed investment costs and to acquire the comparative cost advantages of various locations. But, the question arises, if ownership is the only advantage, how could DMNEs go abroad? To answer this question, in a divergence manner theoretical literature assesses the motives of OFDI from developing countries. Moon and Roehl (2001) reveal that the "unconventional FDI" has ownership disadvantages, such as the small size of the market, lack of technology and resources, weak political institutions that push them to invest in abroad to compensate their domestic "imbalance". The study of Mathews (2002) shows that the motives of latecomer MNEs to integrate with global markets ("Linkage"), to take the advantage of cost-efficiency in production ("Leverage"), and to learn new technology and managerial skills ("Learning") to overcome from their home country disadvantages. In another study, Luo and Tung (2007) demonstrate that OFDI from emerging countries aims to acquire strategic assets like technology and managerial capabilities in the foreign market. Combining all the motives of OFDI, Dunning et al. (2008) provides the frame of asset-exploiting and asset-augmenting nature of DMNEs. The asset-exploiting FDI is related to ownership advantages that can effectively coordinate cross-border activities and allow them to access natural resources and large foreign markets. However, the asset-augmenting nature of investment leads to domestically deficient firms to achieve the ownership advantages from abroad and thereby augment their existing assets and local

capabilities. While the former pattern of FDI may encourage DMNEs to invest in other developing countries, but the latter drives them towards developed countries.

On the other hand, it is argued that the internationalisation process of investors originated in emerging countries are different from developed economies with regard to the level of institutional development, macroeconomic conditions, and resource endowments (Madhok and Keyhani, 2012). Similarly, Ramamurty (2009) shows that emerging market MNEs have certain home-specific advantages including understanding the needs of customers, the propensity to function in the adverse business environment, and the ability to produce quality products at a low cost. In this sense, it is not only firm-specific ownership advantages but also country-specific advantages that enable DMNEs to operate cross-border activities.

Mode of foreign market operation: export versus OFDI

The studies of Brainard (1993) and Helpman et al. (2004) review different modes of foreign market operation of MNEs including exports or serve foreign consumers locally by establishing their plant or provide a license to foreign producers to produce their product or any suitable combination of them. Brainard (1993) indicates the "proximity-concentration" hypothesis that gives an explanation for FDI as a preferred mode of foreign market operation over international trade. The firm's decision to export or OFDI depends on trade barriers. The increasing trade barriers induce firms to invest in abroad over export, while the reduction of trade barriers encourages both OFDI and export, which shows a substitute and complementary relationship between export and OFDI respectively. Despite, the literature are available on the linkage between OFDI and export, there is no uniformity in the outcome that both are whether insignificant (Goh et al., 2012) or substitute (Bhasin and Paul, 2016) or complementary (Banga, 2008).

According to the report of Global Investment Competitiveness (2018), outward FDI encourages export competitiveness in the domestic market by shifting knowledge and technical know-how from foreign to home countries that show the complementarity between OFDI and export. Similarly, the study of Bano and Tabbada (2015) pinpoints the growing intensity of trade that facilitates the capability of domestic investors and boosts outflow of FDI from developing countries. In another study, Tan et al. (2018) analyse the determinants of outward FDI using the panel of 10 Association of Southeast Asian Nations (ASEAN) member countries for the period of 26 years from 1986 to 2012. Using a panel cointegration approach the authors suggest that in the long-term trade openness leads to FDI outflows. On the other hand, OFDI allows firms to cross the domestic border, to access new technology, import lower-cost intermediaries from the foreign affiliates and thereby enhance export competitiveness of the parent companies (Herzer, 2008). Amann and Virmani (2015) identify the mediating role of OFDI from developing countries as "knowledge spillover". Despite, emerging country MNEs are at their early stage of internationalisation, they have catch-up capacity to exploit the comparative advantage across countries (Ramamurti, 2012). Though there is evidence in a positive influence from both the direction with respect to OFDI and export, this paper seeks to re-explore the empirical relationship. Thus, this study hypothesise that FDI outflows from developing countries could encourage more export.

OFDI and institutions

Buckley et al. (2007) emphasize the significance of home country institutions(3) to determine the decision of strategic outflow of FDI. It is argued that the paucity of resources is not the prime constraint for the investment of developing countries (Prasad and Rajan, 2008). But, the problems exist in these countries are inadequate infrastructure, low skilled labour force, risk of profitability in investment that arises from lack of institutions, poor protection of property rights and financial underdevelopment (Alfaro et al., 2008; Prasad and Rajan, 2008; Rahman et al., 2019). This argument may explain that it is the institutionally deficient firms in their home, search for complementary assets including better institutional quality in the foreign market. In an empirical analysis, Klimek (2015) examines the linkage between institutions and outward FDI for a sample of 125 countries. The author suggests that the higher quality of domestic institutions have created favorable conditions for the investors in home countries and thereby reduce more OFDI flows. In contrast, examining the determinants of FDI outflows from emerging countries, Cai et al. (2019) find that better institutional quality of emerging source countries encourages more OFDI. Therefore, this study envisages that the improvement in the institutional quality of the domestic market may negatively relate to OFDI.

OFDI and financial development

A series of the paper examines the influence of financial development on FDI inflows as per the definition of the Bayar and Gavriletea (2018), but relatively less attention has been given towards the importance of home country financial development for OFDI, especially from developing countries. The study of Zhao et al. (2017) argues that the availability of financial facilities in the home country will encourage domestic firms to invest in abroad rather than to increase export activities. Similarly, Desbords and Wei (2014) suggest that the financial development of a source country can directly induce OFDI by improving the firms' ability through raising external finance and indirectly by fostering domestic activities. In other words, the availability of financial facilities in home countries encourages firms' foreign investment activities. However, it can be seen that MNEs from developing countries are financially constrained in their domestic market. Thus, these investors are looking for a well-developed and secure financial system in the host countries (Donaubauer et al., 2016). In other words, financial development in the host and source countries acts as a substitute for each other. On the other hand, in case of any financial adversity in the host countries, it could affect mostly DMNEs due to their financial dependency on the foreign market (Desbordes and Wei, 2014). Thus, this study expects that initially, financial development in the domestic market discourages foreign operations of DMNEs. But, after financially sufficient in the source, DMNEs can able to sustain their investment in the host countries even in case of a lack of financial availability through raising external finance from their source countries. Therefore, the current study envisages that the effect of financial development of source countries on OFDI is conditional on the level of financial availability in their domestic market.

3. Specification of data and methods

Data

The present study uses a balanced panel of 10 Asian developing countries as China, India, Bangladesh, Singapore, Indonesia, Philippines, Malaysia, Thailand, Korea Rep., and Hong-Kong(4). The selected countries are considered as the top Asian investors and contribute about 85 percent of total outward FDI from this region (UNCTAD, 2016). This study covers a time period from 2002 to 2016, as the increasing outflow of FDI from this region has intensified in the aftermath of the early 2000s. The present study uses the outflow of FDI and export (percent of GDP). Financial development index and index of institutions are used as proxies for financial development and development of institutional quality. The authors make use of the variables of interest in the current study are based on the previous literature (see, Bhasin and Paul, 2016; Klimek, 2015; Donaubauer et al., 2016). The detail description of variables and data sources used in the present study is reported in Table 1.

Table 1. *Description of variables and data source*

Variables	Descriptions	Data Source
OFDI	Foreign direct investment, net outflows (% of GDP)	WDI
Export	Exports of goods and services (% of GDP)	WDI
DCPB	Domestic credit to private sector by banks (% of GDP)	WDI
DCPF	Domestic credit provided by financial sector (% of GDP)	WDI
DCP	Domestic credit to private sector (% of GDP)	WDI
PCMB	Private credit by banks and other financial institutions to GDP (%)	GFD
Liquid	Liquid liabilities to GDP (%)	WDI
FinI	Financial development index	Calculated
GE	Government Effectiveness	WGI
PS	Political Stability and Absence of Violence/Terrorism	WGI
RQ	Regulatory Quality	WGI
CC	Control of Corruption	WGI
RL	Rule of Law	WGI
VA	Voice and Accountability	WGI
Insql	Institutional quality index	Calculated

Note: WDI: World Development Indicator, the World Bank
GFD: Global Financial Development Database, the World Bank
WGI: World Governance Indicator, the World Bank
FinI: FinI is a combined form of DCPB, DCPF, DCP, PCMB, and Liquid
InsqI: Institutional quality index is a combination of GE, PS, RQ, CC, RL, and VA
Source: The authors.

This study makes use of the Principal Component Analysis (PCA) to construct the two indices of financial development (FinI) and institutional quality (InsqI). PCA is widely used among other multivariate techniques to reduce the dimensions of a large number of correlated variables in a smaller set. The financial development index consists of the variables like domestic credit to the private sector (DCP), domestic credit from banks to the private sector (DCPB), credit provided by the financial sector (DCPF), private credit by banks and other financial institutions (PCMB), and liquid liabilities (Liquid). These proxies measure the availability of credit to domestic firms and covered a broader measure of financial development (Kholdy and Sohrabian, 2008; Pradhan et al., 2018). While, the institutional quality index contains highly correlated proxies such as the effectiveness of government (GE), regulatory quality (RQ), law and order (RL),

corruption (CC), accountability (VA), and political stability (PS), for which this study follows Kurul (2017).

Methods

Theoretically, the influence of export, financial development, and institutions on the flow of outward FDI depends on the positive and negative effects and on the direction of causality. To examine the above linkages, this study yields the following benchmark econometric model:

$$OFDI_{it} = f(Export_{it}, Financial\ development_{it}, Institutions_{it}) \quad (1)$$

Where the subscript $i = 1, 2, \ldots,$ N denotes the sample country and $t = 1, 2, \ldots, T$ is the time period. OFDI is the dependent variable and the explanatory variables are Export, Financial development, and Institutions. The following sub-sections show the detail discussion of various econometric steps to analyse the linkage.

Cross-sectional dependence test (CD test): The current study is based on the Asian region and selected factors are broadly influenced by the global effects, so there may be a possibility of the occurrence of a common unobserved effect among countries. However, the existence of a fixed effect in the panel time-series data may report the erroneous result. To examine the presence of cross-sectional dependency among countries, this study uses adjusted Lagrange Multiplier (LM_{adj}) test proposed by Pesaran et al., (2008), because the time period (T) = 15 is larger than the cross-section (N) = 10. The LM_{adj} test is the extension of Breusch and Pagan's (1980) LM model.

Panel unit root tests: To measure the cointegration among the variables, it is a prerequisite to examining the stationarity of the proposed variables. This study uses both the first (Im et al., 2003) and second-generation (Pesaran, 2007) panel unit root tests. Though the IPS (Im et al., 2003) unit root test allows heterogeneity among cross-sections, the second-generation cross-sectional augmented IPS (CIPS) test assumes cross-sectional independency. Thus, this study conducts a second-generation CIPS (cross-sectional augmented IPS) test that has suggested by Pesaran (2007). CIPS unit root test is a robust and reliable estimator in the existence of cross-sectional dependency than conventional IPS unit root tests. The CIPS unit root test is a simple average of discrete cross-sectional augmented Dickey-Fuller (CADF) test and the equation is:

$$CIPS = \frac{1}{N}\sum_{i-1}^{N} CADF_i \quad (2)$$

Where N is the sample size. Here, the null hypothesis is the homogeneous non-stationary against the alternative hypothesis of stationary.

Panel cointegration tests: In order to examine the presence of cointegration among the variables, the current study uses the Pooled Mean Group (PMG) method provided by Pesaran et al. (1999). As time period (T) is larger than sample countries (N), the PMG estimation, the panel version of the Autoregressive Distributed Lag (ARDL) model is appropriate for this analysis (Tan et al., 2018). The main advantage of PMG method is unlike standard cointegrating techniques, it evaluates the existence of short- and long-run relationship between the variables and ignores the order of integration, whether it maybe

I(0) or I(1) or a combination of I(0) and I(1). In addition, despite the PMG estimation keeping the long-run coefficients identical, it is advantageous over the Mean Group (MG) method that allows coefficients of the short-run and speed of adjustment varies across countries. The appropriate technique between MG and PMG is verified by using the Hausman test. This study formulates the following framework for the empirical analysis:

$$\Delta OFDI_{it} = \phi_0 + \sum_{j=1}^{p} \theta_i \, \Delta OFDI_{i,t-j} + \sum_{j=1}^{p} \psi_i \, \Delta Export_{i,t-j} + + \sum_{j=1}^{p} \delta_i \, \Delta FinI_{i,t-j} + + \sum_{j=1}^{p} \rho_i \, \Delta InsqI_{i,t-j} + \gamma_0 OFDI_{i,t-1} + \gamma_1 Export_{i,t-1} + \gamma_2 FinI_{i,t-1} + \gamma_3 InsqI_{i,t-1} + + \mu_{it} \quad (3)$$

Where Δ is the difference operator; p is lag order; ϕ_0 represent fixed effect term and μ_{it} is a white noise error term. In the above equation coefficients of the summation signs (∑) represent the short-run effects of the variables. The estimates of γ correspond to the long-run cointegration that assumed to be equal for all the countries.

Panel Granger causality test: Finally, this study investigates the causal interaction among the variables. The panel cointegration method measures the short- and long-run relationship, but not the direction of causality. Due to the existence of cross-sectional dependency, the current study uses the heterogeneous panel non-causality test proposed by Dumitrescu and Hurlin (2012), which is considered as the improvement over the Granger (1969) causality test. The Wald statistics is the average value of each individual cross-section and the equation is:

$$W_{N,T} = \frac{1}{N} \sum_{i=1}^{N} W_{i,T}$$

Moreover, this test follows two distributions as asymptotic and semi-asymptotic distribution. Asymptotic distribution is employed when T > N and semi-asymptotic distribution is used in the case of N > T. In this study, our sample contains a large time period (T) and small cross-section (N). Hence, if T > N the standardized statistical equation is:

$$Z_{N,T} = \sqrt{\frac{N}{2K}} (W_{N,T} - K) \rightarrow N(0,1), \quad (4)$$

where K is the lag order.

The null hypothesis is no causality in any of the cross-sections, whereas the alternative hypothesis is the presence of causality at least for some cross-sections.

4. Empirical results

The preliminary information about the samples is summarized in Table 2 and Table 3 through descriptive statistics and matrix of correlation respectively. It is noted in the correlation matrix that the proxies of financial development and institutions are correlated. More specifically, OFDI is highly correlated with export and institutional quality.

Table 2. *Summary statistics*

Variables	Mean	Std. Dev.	Min	Max
OFDI	.049	0.089	-0.012	0.483
Export	0.724	0.665	0.111	2.312
DCPB	66.9	49.92	19.34	233.2
DCPF	104.2	49.60	34.18	235.9
DCP	97.09	50.60	21.27	233.2
PCMB	63.90	46.25	16.47	218.9
Liquid	104.6	76.71	0	362.1
CC	.0992	1.051	-1.496	2.325
GE	.5360	.6998	-.9113	2.436
RQ	.3502	.9401	-1.126	2.261
RL	.2235	.6761	-1.047	1.660
VA	-.1402	.6523	-1.746	.7456

Source: The authors.

Table 3. *Correlation coefficient matrix*

Varia-bles	OFDI	Export	FinI	DCP	DCPB	DCPF	PCMB	Liquid	InsqI	CC	GE	RQ	RL	PS	VA
OFDI	1														
Export	0.794*	1													
FinI	0.603*	0.613*	1												
DCP	0.605*	0.587*	0.963	1											
DCPB	0.623*	0.631*	0.935*	0.990*	1										
DCPF	0.473*	0.382*	0.874*	0.963*	0.948*	1									
PCMB	0.632*	0.654*	0.915*	0.978*	0.965*	0.929*	1								
Liquid	0.808*	0.646*	0.792*	0.738*	0.754*	0.661*	0.785*	1							
InsqI	0.702*	0.884*	0.669*	0.671*	0.701*	0.487*	0.676*	0.572*	1						
CC	0.719*	0.921*	0.644*	0.632*	0.660*	0.430*	0.657*	0.600*	0.979*	1					
GE	0.663*	0.889*	0.690*	0.694*	0.718*	0.518*	0.704*	0.572*	0.977*	0.960*	1				
RQ	0.722*	0.900*	0.705*	0.716*	0.735*	0.541*	0.736*	0.613*	0.983*	0.966*	0.972*	1			
RL	0.686*	0.854*	0.647*	0.606*	0.687*	0.481*	0.659*	0.554*	0.989*	0.961*	0.960*	0.965*	1		
PS	0.633*	0.817*	0.731*	0.711*	0.755*	0.550*	0.709*	0.581*	0.942*	0.917*	0.927*	0.908*	0.912*	1	
VA	0.294*	0.221*	-0.054	-0.027	-0.004	-0.106	-0.079	-0.042	0.436*	0.351*	0.300*	0.378*	0.479*	0.251*	1

Note: * denotes level of significance at below 5%.
Source: The authors.

The first step of this empirical estimation is to identify cross-sectional dependency of the variables. Table 4 shows the findings of Breusch and Pagan's LM test and LM_{adj} test of Pesaran et al. (2008). The null hypothesis is the existence of cross-sectional independence, which is rejected at a 1 percent level of significance. Thus, it is confirmed that there is cross-sectional dependency amongst the countries in the panel time-series data. In this light of results, this study uses first- and second-generation panel unit root tests.

Table 4. *Cross-sectional dependency test*

Test	Statistic	p-value
LM (Breusch and Pagan, 1980)	85.56***	0.003
LM_{adj}# (Pesaran et al., 2008)	4.832***	0.000
LM CD# (Pesaran, 2004)	2.597***	0.009

Note: #two-sided test. *** denotes the level of significance at 1%.
Source: The authors.

Findings of the IPS and CIPS unit root tests present in Table 5. The IPS test results indicate that OFDI, Export, and Financial development index (FinI) variables are integrated of order one, while the institutional quality index (InsqI) is stationary at level.

In order to verify the level of integration by allowing cross-sectional dependency, this study employs a CIPS test (Pesaran, 2007). However, the outcomes of the CIPS test are also similar to the IPS test results. Based on the difference in integration levels this study employs the PMG cointegration test (Pesaran et al., 1999) to measure the short- and long-run associations among the variables.

Table 5. *Panel unit root test*

First Generation		Second Generation
Level	Δ	Level
IPS test		CIPS-test
-0.132	-6.453***	-2.022
0.542	-5.048***	-0.792
-0.638	-4.232***	-1.698
-3.230***	___	-2.472***

Note: *** denotes the level of significance at 1%. I (0) and I (1) denote the order of integration at the level and first difference (Δ) respectively.
Source: The authors.

Table 6. *PMG panel cointegration test*

Variables	Dependent variable: OFDI		
	MG	PMG	Robust-PMG
Long-run Coefficients			
Export	0.092*(0.057)	0.025**(0.032)	0.116***(0.000)
FinI	-0.047**(0.038)	0.011*(0.059)	0.033***(0.000)
InsqI	0.079**(0.038)	-0.010**(0.011)	-0.035***(0.000)
Short-run Coefficients			
ECT(-1)	-0.965***(0.000)	-0.501***(0.000)	-0.656***(0.000)
ΔExport	-0.054(0.133)	-0.009(0.829)	0.053(0.501)
ΔFinI	0.038(0.435)	-0.007(0.795)	-0.085(0.171)
ΔInsqI	-0.010(0.456)	0.017**(0.030)	0.089(0.292)
Constant	-0.108(0.258)	0.016(0.113)	-0.009(0.605)
Hausman test: Chi2(3) (prob>chi2)	1.80(0.615)		

Note: ***, ** and * denote level of significance at 1%, 5% and 10% respectively. The figures in the parenthesis () represent p-value.
Source: The authors.

Table 6 reports the outcome of the PMG cointegration test. Hausman test result demonstrates that the p-value is greater than 5 percent that indicates the PMG estimation is appropriate over the MG model. The error correction term ECT (-1) represents negative and significant values in the model that confirms the presence of the long-run relationship in at least one of the cross-sectional countries. The findings of this study show a positive relationship between export and outward FDI in the long-run. It shows the complementary relation between export and outward FDI in the Asian region. Banga (2008) finds a similarly positive result for the two variables, the author shows that the increasing exports from developing countries induce outflow of FDI because it lowers the uncertainties in foreign investment. While there is a positive relationship between financial development and outward FDI in the long-term and both are significant at the 10 percent level. It is also notable that the short-run result among them brings a negative association, though it is insignificant. Thus, it supports our hypothesis that the initial development of the financial systems relatively less potent to promote the OFDI from

developing countries, but in the long-run, it encourages more FDI outflows. However, in the long-run institutional qualities have a negative effect on OFDI, but in the short-run, there is a positive relationship found. It indicates that improvement in domestic institutional quality discourages more outflow of FDI in a longer time period but immediately promotes the outflow of FDI from developing Asian countries. This finding seems to be similar to that of Klimek (2015). However, the short-run result of export suggests that the variable is not significantly cointegrated with OFDI.

In order to validate the above results, this study also checks the robustness of the PMG estimation by excluding the crisis period 2007-2008. According to the World Investment Report (2010), due to the financial crisis FDI inflows to developing and developed countries reduced by 44 and 24 percent respectively. However, despite the severity is relatively less than in developed countries, FDI outflows from developing countries are affected by 23 percent. Thus, it may be pointed out that the PMG estimations are sensitive to the financial crisis period. It is observed from the robust-PMG results (Table 6) that the long-run estimates are robust and significant at 1 percent level.

Table 7. *Dumitrescu and Hurlin's dynamic panel causality test*

Null hypothesis	W-stat	Z-bar stat	Causality
Export→OFDI	2.213 (0.378)	-0.881	No
OFDI→Export	37.533*** (0.000)	10.287	Yes
FinI→OFDI	12.479** (0.018)	2.365	Yes
OFDI→FinI	6.718 (0.587)	0.543	No
InsqI→OFDI	6.024*** (0.004)	2.816	Yes
OFDI→InsqI	2.875 (0.861)	0.175	No

Note: ***, ** and * denote level of significance at 1%, 5% and 10%, respectively. The figures in the parenthesis () represent p-value.
Source: The authors.

Finally, the current paper verifies the direction of causal relationship among the variables. Table 7 reports the findings of the Granger causality test of Dumitrescu and Hurlin (2012). The significance of the Wald statistics specifies that there are uni-directional causality runs from financial development and institutional quality to OFDI. However, this study finds that more outflow of FDI causes export at a 1 percent level of significance. In contrast to the findings of Banga (2008), the result of this study supports the argument of Potterie and Lichtenberg (2001) that through catch up capacity investors from developing countries learn the managerial skills and new technologies in the foreign market and shift back the knowledge to home country producers. Thus, OFDI leads to more productivity and enhance export competitiveness of the domestic firms. These results make sense that increasing OFDI from developing countries are motivated by learning new techniques and skills in the host countries and transfers that knowledge to the home producers and enhance export competitiveness.

5. Conclusions

Although FDI outflows growing from developing countries, the impact of source country factors on outgoing FDI is still ambiguous for policymakers. The main purpose of the current study is to evaluate the impact of exports, financial development, and institutional quality on OFDI and their direction of causality, for which this study uses a panel of 10 Asian developing countries during the period 2002 to 2016.

The findings of the PMG model indicate that the development of financial structure and exports are positively cointegrated with OFDI in the long-term. Despite the financial development positively related to OFDI, it is less significant to encourage more outgoing foreign investment. Because it is theoretically grounded that investors from developing countries are engaged in cross-border activities due to a lack of credit availability in the domestic market (Donaubauer et al., 2016). On the other hand, improved quality of institutions has a negative impact on OFDI in the long-run, but in the short-run it promotes OFDI. In addition, these results are confirmed by the robustness check and validated the strong long-run relationship among the estimated variables. The results of Granger causality test support that the improvement in the financial system and institutions has a significant causal influence on OFDI. While increasing OFDI induces more exports from Asian regions.

Though this study has limitations that it ignores all other pull and push determinants of OFDI, it has several operational implications for making a decision on FDI outflows from developing countries. The current study supports the argument that increasing foreign investment activities of MNEs enhance their efficiency and productivity at home and abroad and make the possibility of export competitiveness. The findings of financial development and institutional quality have held some practical implications for researchers and policymakers. To understand the effect of these variables, the current paper empirically interprets the existing theories. In this line, to achieve a desired level of OFDI, developing source countries should provide more attention to the development of the domestic financial system and thereby might reduce the possible risks of investment during financial adversity in host countries. On the other hand, to protect the interest of the domestic market, policymakers of these countries should consider improving institutional qualities to discourage the unwanted outflow of FDI. Because, more illicit capital outflows from developing countries has an adverse effect on the efforts to achieve the target of sustainable and inclusive growth (Rahman et al., 2019). Thus, studies on the outflow of FDI from an individual developing source country should be further examined in terms of both source and host country's perspectives for similar determinants.

Notes

(1) There are no strict definitions exists for the classification of developing and emerging countries (Nielsen, 2011). The literature uses the term “Developing countries” and “Emerging countries” interchangeably. The term developing countries are used throughout this study as per United Nations’ classification.

(2) For more details see the product life cycle theory of Vernon (1971) and the OLI paradigm of Dunning (1981).

(3) North (1990) defines institutions as the game of the society, which can be economic, political, or societal constraints that encourage or discourage the interaction among the elements in an economy.

(4) Countries are arranged on the basis of the average growth rate during the study period.

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Are resources a curse or blessings? Evidence from panel ARDL model

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Abstract. *The present study investigates the resource curse hypothesis in mining-rich districts of Odisha by taking variables such as natural resource abundance, economic growth, investment, human resource development, financial development and institutional quality over the period 1995-2015. The panel ARDL model is applied in order to estimate the long-rum relationship among variables based on three alternative estimators such MG, PMG and DFE. The study finds that there is a negative relationship between natural resource abundance and economic growth in the long-run. The results confirm the existence of natural resource curse in Odisha possibly because of weak institutions and lack of appropriate policies.*

Keywords: natural resource abundance, economic growth, panel ARDL, Odisha.

JEL Classification: Q2, O47, C23

1. Introduction

Whether natural resources are curse or blessing for economic development has become a subject of debate over the last two decades (van der Ploeg, 2011). Prior to the late 1980s, most of the economists and geographer advocated a positive relationship between natural resource abundance and economic development. For example, geographer Ginsburg argued that "the procession of a sizeable and diversified natural resource endowment is a major advantage to any country embarking upon a period of rapid economic growth" (Rosser, 2006). According to development theorists Rostow (1961) "the natural resource endowments would enable developing countries to make the transition from underdevelopment to industrial take-off". Similar positive arguments are put forward by neoliberal economists such as Balassa (1980), Krueger (1980) and Drake (1972). However, after the late 1980s, a large number of literatures has challenged this conventional wisdom and demonstrated that natural resource abundance has become a curse rather than a blessing for economic development (Davis and Tilton, 2005).

The concept of resource curse was first introduced by Richard Auty in 1993. Resource curse or the "Paradox of plenty" is a phenomena where the countries well endowed with rich natural resources experience stagnant growth or even negative economic growth. Many African countries such as Angola, Nigeria, Sudan, and the Congo are rich in oil, diamonds and other minerals, yet they have become development failures in terms of per capita income and quality of life. On the other hand, the East Asian economies Japan, Korea, Taiwan, Singapore and Hong Kong have performed well despite their rocky islands and no exportable natural resources (Frankel, 2010). Between 1960 and 1990, the resource poor countries were able to raise their per capita incomes two to three times faster than the per capita income of resource abundant countries (Auty, 2001). The whole OPEC countries have experienced on average 1.3 percent declines in their gross national product per capita from 1965 to 1998. In contrast to it rest of the developing countries have been able to attain on average 2.2 percent per capita growth (Gylfason, 2001).

The distribution of natural resources varies across different Indian states. For example, the states like Odisha, Jharkhand and Chhattisgarh are endowed with rich natural resources that together account for 70 percent of India's coal reserves, 80 percent of high-grade iron ore, 60 percent of bauxite and almost all the chromites reserve (Centre for Science and Environment, 2008). These three states also contribute significantly to the total royalties on minerals in the country. Further, these states are endowed with rich forest resources and ground water. However, it is observed that the resource-rich states have performed less well both in terms of per capita income and rate of growth of state domestic product compared to the resource-poor states like Kerala, Tamil Nadu, Maharashtra, and Punjab (Behera and Mishra, 2012). The extent of poverty is low in many of the resource-poor states whereas the problem is quite alarming in Odisha and Chhattisgarh. Further, it is reported that the benefits from resource extraction are not reaching to all sections of society within a resource-rich state. Half of rural tribal people in Bihar, Chhattisgarh, Madhya Pradesh, Jharkhand and Odisha live below the poverty line and the ratio is higher than the national average.

Odisha is a mineral-rich state which is richly endowed with large varieties of metallic and non-metallic minerals such as chromite, bauxite, graphite, iron ore, manganese ore, coal etc. it is reported that about 93 per cent of Chromite and Nickel, 52 per cent of bauxite, 44 per cent of Manganese, 33 per cent of Iron Ore, 24 per cent of Coal deposits of India are found in Odisha. The contribution of mining and quarrying sector in the Gross State Domestic Product of Odisha is about 6.3 per cent in 2014-2015. In recent years, Odisha ranks highest in India in terms of value of output of minerals. The share of Odisha in total value of mineral output in India is 11.16 per cent (Odisha Economic Survey, 2014-2015).

In spite of all its rich mineral resources Odisha is considered to be one of the most underdeveloped states in India. Though the real per capita Net State Domestic Product for Odisha has increased from 2004-05 to 2014-15, still Odisha lags far behind compared to other faster growing states and national average (Odisha Economic Survey, 2014-2015). Further, in terms of Human Development Index Odisha performs very poorly in comparison to other states (Human Development Report, 2004, Government of Odisha). For example, Odisha has a human development index (HDI) index of 0.404 while Kerala, a resource-poor state has a HDI of 0.638. Most of the mining-rich districts of Odisha such as Jaipur, Keonjhar, Sundergarh, Angul, Koraput, Jharsuguda and Mayurbhanj perform very poorly. Most of them are tribal dominated except Jaipur and Angul. More than 50 per cent of the populations are tribals in Sundergarh, Koraput and Mayurbhanj. Keonjhar alone accounts for more than 44 per cent of the tribal population. Human Development Report of the State shows that between 1993-94 and 199-2000, the poverty ratio has increased in the southern and northern regions of the state that includes mining districts like Koraput, Sundergarh, Keonjhar, Angul and Mayurbhanj. It is reported that 75 per cent of the state's poor live in these southern and northern regions. 62 per cent of the population lives below the poverty line in Keonjhar, the most mined district of Odisha. In Koraput which is known as the bauxite capital of India, the figure is higher at 79 per cent (Centre for Science and Environment, 2008).

The performances of the mining districts in terms of HDI are disappointing. Jaipur, Keonjhar and Koraput have HDI rank of 22, 24 and 27 respectively. However, some of the mining districts have performed well. Jharsuguda ranks 2, Sundergarh ranks 4th and Angul ranks 6th respectively. The reason for these differences in HDI ranking among mining districts is that Angul and Jharsuguda are coal-rich districts and coal mines in the state are under the public sector while in other mining districts mining is in the hands of the private sector. The per capita incomes of these coal-rich districts are higher than other mining districts. All the mineral-rich districts have occupied a place in the list of the 150 most backward districts of the country (Centre for Science and Environment, 2008).

Structuralists, dependency theorists, and some Marxist theories of imperialism have advocated their views on resource-led growth. In the 1940s and 50s, the Structuralists such as Prebish and Singer (1950) argued that the resource-based growth alone would be ineffective because the world prices of primary exports relative to manufacturers show a deep tendency towards secular decline. Further, Hirschman (1958), Seers (1964), and Baldwin (1966) opined that primary exports have small forward and backward linkages to the rest of the economy. According to dependency theorists, if foreign multinationals are

allowed to dominate resource extraction then natural resources will fail to stimulate economic growth. Marxists, such as Paul Baran opined that local elites dominated the governments in poor economics and they joined their hands with foreign multinationals instead of promoting national development (John, 2011).

At the macro/country level Sachs and Warner, 1995 study is considered as the pioneering work that find a negative correlation between resource abundance and GDP growth. Using the similar methodology, Leite and Weidmann (1999); Gylfason et al. (1999); Sala-i-Martin (1997) finds similar results. However, the results are not conclusive. The recent empirical works by Alexeev and Conrad (2011); Alexeev and Conrad (2009); Brunnschweiler and Bulte (2008), Brunnschweiler (2008); van der Pkloeg and Poelhekke (2009) find a positive relationship between growth and resource abundance. The basic difference between these two categories of literature lies in the proxy of natural resource abundance taken by them. Those studies who find resource curse evidence have taken ratio of resource exports to GDP as the proxy while latter studies that do not find resource curse evidence have taken stock-based proxy of resource abundance such as reserve in the ground.

The cross-country studies have several limitations. First problem is related with the export-based proxy of natural resource abundance taken by the previous studies. It is argued that the export-based proxy suffers from the endogeneity problems. When natural resource exports are expressed as shares of GDP, the denominator measures the magnitude of other economic activities in the economy. Therefore the numerator variable is dependent on the economic policies and the institutions that produce them (Brunnschweiler and Bulte, 2008). Second, the empirical work will suffer from omitted variable biases. Different countries are endowed with different history, culture, geography, institutional quality and macroeconomic policies. It is very difficult to measure all these differences. Third reverse causality is another problem suffers by cross-country studies. Any measure with GDP in the denominator is subject to reverse causality. Suppose a country has low GDP due to some reasons that are not related to natural resources. But it would seem that low GDP and other problems related to low GDP are the result of large natural resource wealth while in reality it is the low GDP that causes natural resource wealth to appear to be high (Alexeev and Conrad, 2011). Fourth the impacts of resource abundance at the national level are different to that of local level. For example, the impact of extractive industries demand for inputs can be felt in particular local markets.

In the recent time few studies have focused on the within-country studies. Among the within-country study Papyrakis and Gerlagh (2007) study is considered as the first study. They find that resource abundance put negative effect on growth by lowering levels of investment, schooling, Openness and research and development and increasing corruption in US Employing similar method James and Aadland (2011) find similar negative effects of resource abundance on growth in US countries. Douglas and Walker (2013) again find similar results in US countries by using similar methodology and more disaggregated data. Shuai and Zhongying (2009) examined the relationship between energy exploitation and economic growth in China over 1991-2006. They find that energy exploitation

impeded growth through indirect transmissions channels by lowering human capital input and R & D, and weakening institution. Zuo and Jack (2014) also find the same results in Chinese and tested two transmission channels such as crowding-out and institutional channels. They find resource curse evidence which is transmitted through crowding-out channel rather than institution channel. Education and R & D are two main crowding-out channels. However, the former Chinese 10 western provinces while the latter study focuses on all Chinese provinces.

Black et al., 2005 in US, Marchand, 2012 in Westen Canada, Fleming and Measham, 2014 in Australia, Michaels, 2011 in Southern US find that resources boom generate positive employment spillovers and don't crowed other industries (manufacturing). Recently Jacobsen and Parker, extend Black et al.' study to Western US and Allcott and Keniston, 2013 extend Michaels (2011) study to rural countries in the entire US and find the same results.

The above within country studies suffer from two important limitations. First they provide limited information about the effects on real income or other measures of welfare. Second these studies have focused on developed countries such as the US, Canada, Brazil and Peru. Recent works by Caselli and Michaels, 2013 in Brazil, Aragon and Rud, 2013 in Peru, Brollo et al., 2013, Kotsadam and Toloren, 2014, Loayza et al., 2013 have started to fill up this gap in the literature. Within this literature, the present study is closely related to Zuo and Jack (2014) and Shuai and QI (2009). Thus like the cross-country studies the local recourse curse literature also provide the conflicting results on resource curse.

Most of the resource curse studies have focused on cross-country analysis and comparisons because of better availability of data. However, only a few studies have examined the resource curse hypothesis across states or regions within a country. Whatever within country evidence are available that have concentrated on a few countries, such as the US, Canada, Brazil and Peru. Research in other resource-rich contexts such as Asia is needed to increase the external validity of these results and to better inform policy-makers and practitioners. In India it is still a research question. Although Damania and Gupta (undated) and Behera and Mishra (2012) have tried to examine the resource curse phenomena in Indian states, the methodology, measurement of the variables and coverage of the resource base they have taken require serious scrutiny. Therefore, the present study attempts to fill up these gaps.

4. Modeling framework, methodology and data source

4.1. Testing Pesaran cross section dependence test

In order to test the validity of Resource Curse Hypothesis in the Odisha context, the present study has followed Pesaran (2004). The first empirical work of the present study is to check the cross-sectional dependence among Net District Domestic Product (NDDP), Total Mineral Production (TMP), Investment (INT), Human Resource Development (HRD), Financial Development (FD) and Institutional Quality Index (IQ).

Pesaran (2004) proposed CD test which is based on the average of the pair correlation coefficients $(\rho)_{ij}$ of OLS residuals regressions. Pesaran (2004) considered the following model.

$$y_{it} = \mu_i + \beta_i x_{i,t} + \mathrm{u}_{i,t} \quad (1)$$

where:
μ_i – intercept of the individual district *i;*
β_i – slope coefficient of individual district *i;*
t – 1, 2, 3,…, T is the total time period;
i – 1, 2, 3,…, 16 Corresponding 16 districts;
$x_{i,t}$ is vector of observing time varying regressions;
y_{it} follows íid (0 6_i^2) for all $i\ t$.

Pesaran (2004) proposed following CD statistic

$$CD_p = \sqrt{\frac{2T}{N\ (N-1)}}\ \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{P}_{i,j} \quad (2)$$

Where: e_{it} the OLS are estimates of $u_{i,t}$ $\hat{p}_{i,j}$ is the sample estimate of the pair-wise correlation of residuals.

$$\hat{p}_{i,j} = \hat{p}_{i,j} = \frac{\sum_{t=1}^{T} e_{i,t} e_{j,t}}{\left(\sum_{t=1}^{T} e_{i,t}^2\right)^{1/2}} = \frac{\sum_{t=1}^{T} e_{i,t}\ e_{j,t}}{\left(\sum_{t=1}^{T} e_{i,t}^2\right)^{1/2} \sum_{t=1}^{T} \left(e_{j,t}^2\right)^{1/2}}$$

4.2. Pesaran's cross-sectional augmented Dickey-Fuller (CADF) test

After confirming cross-sectional dependence, in order to understand the stationary properties of the variables we have applied Pesaran CADF test (Pesaran, 2007). The presence of cross sectional dependence among the variables can be solved by augmenting the standard Dickey-fuller regression with cross sectional average of lagged levels and first differences of the individual series (Pesaran, 2007). The main Pesaran CADF equation follows as

$$\Delta\ y_{i,t} = \alpha_i + \beta_i y_{i,t-1} + y_i \bar{y}_{t-1} + Q_i\ \Delta \bar{y}_t \varepsilon_{i,t} \quad (3)$$

where the unit root test hypothesis will be tested based on the OLS results derived from Eq. (3) with t ratio by $t_i(N,T)$. The Pesaran CADF test is

$$\text{CADF} = t_i(N,T) = \frac{\Delta y_i' \bar{M}_w y_{i-1}}{\hat{\delta}\left(y_{i,-1}' \bar{M}_w y_{i-1}\right)^{1/2}} \quad (4)$$

Where:

$\Delta y_i = \left(\Delta y_{i,1} \Delta y_{i,2}, \ldots, \Delta y_{i,2}, \ldots, \Delta y_{i,T}\right)'$, $y_{i-1} = \left(y_{i,0} y_{i,1}, \ldots, y_{i,T-1}\right)'$, $\tau_T = (1,1 \ldots .1)'$,

$M_w = I_T - \bar{W}(W'\bar{W})^{-1}\bar{W}', \bar{W} = \tau(\Delta\bar{y}), \bar{y}_{-1}$

$\Delta\bar{y} = (\Delta\bar{y}_1, \bar{y}_2, \ldots, \Delta\bar{y}_T)', \bar{y}_{-1} = (\bar{y}_0, \bar{y}_1, \ldots \bar{y}_{t-1})'$

$\widehat{6}_i^2\ \frac{\Delta y_i' M_{i,w} \Delta y_i}{T-4}\ M_{i,w} = I_t$ - $\left(G_i (G_i' G_i)\right)^{-1} G_i'$ and $G_i = (\bar{W}, y_{i-1})$

4.3. Panel Autoregressive Distributed Lag Model (P-ARDL)

The present study has applied panel autoregressive distributed lag model in order to estimate the long-rum relationship among variables based on three alternative estimators such mean group estimator (MG), pooled mean group estimator (PMG) and dynamic fixed effects (DFE). According to Pesaran et al. (1999), an ARDL dynamic heterogeneous panel regression can be written by using ARDL (p, q) approach where "p" is the lags of dependent variable and "q" is the lags of independent variables. The equation can be written as

$$PNDDP_{it} = \sum_{j=1}^{p} \lambda_{ij} PNDDP_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} TMP_{i,t-j} + \sum_{j=0}^{q} \alpha'_{ij} PNT_{i,t-j} \sum_{j=0}^{q} \beta'_{ij} HRD_{i,t-j} + \sum_{j=0}^{q} \Psi'_{ij} FD_{i,t-j} + \sum_{j=0}^{q} \Phi'_{ij} IQ_{i,t-j} + \mu_i + \varepsilon_{it} \quad (5)$$

Where: i = 1, 2, 3,…, N number of cross sectional (Here i = N = 16);

t = 1, 2, 3,..., T total time period (T = 17);

$TMP_{i,t}$, $PNT_{i,t}$, $HRD_{i,t}$, $FD_{i,t}$, $IQ_{i,t}$ are $k \times 1$ vector of the explanatory variables; δ'_{ij}, α'_{ij}, β'_{ij}, Ψ'_{ij}, Φ'_{ij} are the $k \times 1$ coefficient variables; λ_{ij} are the scalars; and μ_i is the cross-section effects. If the variables in Eq. (5) are $I(1)$ and cointegrated, then the error term should follow $I\,(0)$ order in all cross-sections to have long-run equilibrium relationship between the variables. The principal feature of cointegrated variables is that their time paths are influenced by the extent of any deviation from long-run equilibrium. This explain that an error correction model in which the short-run dynamics of the variables in the system can be influenced by the deviation from equilibrium. Here it is necessary to reparametrize Eq. (5) into an error correction equation.

$$\Delta PNNDDP_{it} = \phi_i\left(PNDDP_{i,t-1} - \theta'_t PMT_{it}\right) + \sum_{j=1}^{p-1} \lambda^*_{ij}\, \Delta PNDDP_{i,t-j} + \sum_{j=0}^{q-1} \delta'^*_{ij}\, \Delta TMP_{i,t-j} + \sum_{j=0}^{q-1} \Psi'^*_{ij}\, \Delta PNT_{i,t-j} \sum_{j=0}^{q-1} \alpha'^*_{ij}\, \Delta HRD_{i,t-j} + \sum_{j=0}^{q-1} \beta'^*_{ij}\, \Delta FD_{i,t-j} + \sum_{j=0}^{q-1} \Omega'^*_{ij}\, \Delta IQ_{i,t-j} \quad (6)$$

Where:

$\Phi = -\left(1 - \sum_{j=1}^{p} \lambda_{ij}\right)$, $\theta_i = \frac{\sum_{j=0}^{q} \delta_{ij}}{(1 - \Sigma k \lambda_{ik})}$

$\lambda^*_{ij} = -\sum_{m=j+1}^{p} \lambda_{im}$,

j = 1, 2,…, $p - j$

$\delta^*_{ij} = -\sum_{m=j+1}^{q} \delta_{im} \qquad j = 1, 2, 3, \ldots, q-1$

$\Psi^*_{ij} = -\sum_{m=j+1}^{q} \delta_{im} \qquad j = 1, 2, 3, \ldots, q-1$

$\alpha^*_{ij} = -\sum_{m=j+1}^{q} \alpha_{im} \qquad j = 1, 2, 3, \ldots, q-1$

$\beta^*_{ij} = -\sum_{m=j+1}^{q} \alpha_{im} \qquad j = 1, 2, 3, \ldots, q-1$

$\Omega^*_{ij} = -\sum_{m=j+1}^{q} \Omega_{im} \qquad j = 1, 2, 3, \ldots, q-1.$

The ϕ_i is speed of adjustment parameter. The speed of adjustment parameter must be non-zero. If $\theta_i = 0$, then there would be no long-run relationship. This parameter is expected to be negative sigh with statistical significance under the assumption of bringing back the variables to the long-run equilibrium. But more recently Pesaran, Shin and Smith (1997, 1999) propose a PMG estimator which combines both averaging and polling the residuals. This test incorporates the intercept, short-run coefficients, and different error variances across the groups (like the MG estimator). However, it holds the long-run coefficients to be equal across the groups (like FE estimators).

$$\hat{\phi} = N^{-1} \sum_{i=1}^{N} \hat{\phi}_i \quad (7)$$

With the variance

$$\hat{\Delta}_{\hat{\phi}} = \frac{1}{N(N-1)} \sum_{i=1}^{N} \left(\hat{\phi}_i \hat{\phi}\right)^2 \quad (8)$$

The Eq. (6) can be estimated by three different estimators such as mean group estimator of Pesaran and Smith (1995), pooled mean group estimator developed by Pesaran et al. (1999) and dynamic fixed effects estimator. According to Pesaran and Shin (1999), Panel ARDL can be applied even if the variables follow different order of integration, i.e. $I(0)$ and $I(1)$ or a mixture of both.

The present study has collected annual data covering the period 1995-2015 for 16 districts of Odisha. Data on Net District Domestic Product (NDDP) has been collected from the income cell department of the Directorate of Economics and Statistics Odisha. Data on total mineral production (TMP) has been collected from the Directorate of Mine Odisha. Data on human capital investment (HRD), financial development (FD), investment (INV), and institutional quality (IQ) have been collected from the various publication of District Statistical handbook of the Directorate of Economics and Statistics Odisha, Bhubaneswar. An institutional quality index is constructed as the proxy of institutional quality by taking incidence of crimes such as murder, dacoity, robbery, burglary, theft, rioting, swindling and cheating, rap, kidnapping and miscellaneous through Principal Component Analysis. Data on all variables are available up to 2015. All the variables are transferred into natural logarithm.

5. Results and discussions

The traditional unit root tests do not address the cross sectional dependence which might lead to an incorrect interpretation towards the stationary properties large panel data. To address this problem, the present study has applied CD (Pesaran, 2004) test to check cross section interdependence between Net District Domestic Product (NDDP), Total Mineral Production (TMP), Investment (INT), Human Resource Development (HRD) Financial Development (FD) and Institutional Quality Index (IQ). The CD test is based on the average of the pair correction coefficients of OLS residuals regression. CD test result is reported in Table 1 which rejects the null hypothesis of no cross-dependence between the variables. It means there is high dependence between Net District Domestic Product (NDDP), Total Mineral Production (TMP), Investment (INT), Human Resource Development (HRD), Financial Development (FD) and Institutional Quality Index (IQ) in the districts of Odisha.

Table 1. *Pesaran Cross-section Dependency tests*

Test	Statistics	P-value
CD	32.457	0.0000

After confirming cross sectional dependence among the variables, the present study has employed Pesaran Cross Sectional Augmented Dickey-Fuller (PCADF) unit root tests to check stationary properties of variables. In order to test the panel cointegration among variables, the first step is to examine the unit roots properties of the data, because the variables must be integrated of the same order. The PCADF test results are reported in Table 2. The results show that NDDP, TMP, INT, HRD, FD, and IQ follow I (0) and I (1) orders respectively.

Table 2. *Pesaran's Cross-sectional Augmented Dickey-Fuller (CADF) test results*

variables	Constant		Constant & Trend	
	T Bar	P-value	T Bar	P-value
lnNDDP	-1.489	0.859	-2.416	0.324
lnTMP	-2.714	0.000***	-3.078	0.000***
lnINT	-2.330	0.008**	-2.639	0.079
lnHRD	-2.121	0.063	-2.147	0.759
lnFD	-3.825	0.000***	-4.437	0.000***
lnIQ	-1.766	0.474	-2.035	0.882
ΔlnNDDP	-3.088	0.000***	-3.062	0.001**
ΔlnTMP	-4.057	0.000***	-4.332	0.000***
ΔlnINT	-3.103	0.000***	-3.135	0.000***
ΔlnHRD	-3.034	0.000***	-3.087	0.001**
ΔlnFD	-4.525	0.000***	-4.266	0.000***
ΔlnIQ	-2.860	0.000***	-3.115	0.000***

Note: The critical values are -2.340, -2.170, and 2.070 at 1%, 5%, and 10% respectively with constant. 2.880, -2.690, and -2.590 at 1%, 5%, and 10% respectively with constant and trend. The ***, **, and * indicate 1%, 5%, and 10% level of significance.

The results of the pooled mean group (PMG), mean group (MG) and dynamic fixed effects (DFE) are reported in Table 3.

Table 3. *Panel ARDL Model Results (Pooled Mean Group and Mean Group Estimates) (Dependent Variable: ΔlnNDDP)*

	Pool Mean Group		Mean Group		Dynamic Fixed Effects	
Variables	Coefficients	Std. error	Coefficients	Std. error	Coefficients	Std. error
Long-run						
lnTMP	-0.217**	0.084	0.009	0.069	-0.016	0.025
lnINT	0.200	0.121	0.466**	0.248	0.213**	0.070
lnHRD	-0.435	0.597	-0.663	0.538	0.371	0.291
lnFD	-0.022	0.0683	0.005	0.234	0.017	0.021
lnIQ	0.106	0.141	0.807	0.424	0.173	0.066
Error Correction	0.011	0.058	0.323***	0.089	0.396	0.214
Short-run Coefficients						
ΔlnTMP	-0.010	0.008	-0.065	0.056	-0.010	0.007
ΔlnINT	0.115	0.091	0.113	0.089	0.049	0.035
ΔlnHRD	0.048	0.312	0.000	0.108	0.041	0.105
ΔlnFD	0.001	0.010	0.089	0.100	-0.003	0.009
ΔlnIQ	-0.023	0.022	0.184	0.203	0.015	0.026
Intercept						
No. of Districts	16					
Observations	320					

Note: Δ is first difference operator; ***, **, and * indicate 1%, 5%, and 10% level of significance; PMG means pooled mean group; MG means mean group; EC is error correction term.

According to PMG estimator, TMP has a negative and significant impact on NDDP in the long-run. However, in the short-run, although TMP has a negative coefficient but it is not statistically significant. According to MG estimator, TMP has a positive coefficient, but it is not significant. INT has positive impact on NDDP in the long-run. In the short-run, although TMP has negative coefficient but it is not statistically significant. DFE estimators do not support any short-run and long-run causality between variables. INT has positive and significant impact on NDDP.

However, in order to measure efficiency and consistency among the estimators (PMG, MG and DFE) the Hausman test has been applied. The results of the Hausman test are reported in Table 4.

Table 4. *Hausman Test*
(Dependent Variable: lnNDDP)

	MG	PMG			MG	DFE		
	Coefficients	Coefficients	Difference	S.E	Coefficients	Coefficients	Difference	S.E
lnTMP	0.009	-0.217	0.227	0.083	0.009	-0.016	0.025	0.832
lnINT	0.466	0.200	0.266	0.409	0.466	0.213	0.252	2.999
lnHRD	-0.663	-0.435	-0.227	0.704	-0.663	0.371	-1.034	6.487
lnFD	0.005	-0.022	0.027	0.397	0.005	0.017	-0.012	2.832
lnIQ	0.807	0.106	0.701	0.715	0.807	0.173	0.633	5.123
Chi-2	47.38	P-Value	0.0000		Chi-2	0.11	P-value	0.9998

The Hausman test results accept the null hypothesis of homogeneity restrictions on the long-run regressors. This indicates that PMG is a more efficient estimator than MG or DFE. From the overall panel ARDL model, we found that there is a negative relationship between natural resource abundance and economic growth in the long-run. However, in the short-run, although TMP has a negative coefficient but it is not statistically significant. The results confirm the existence of natural resource curse in the mineral-rich districts of Odisha.

6. Conclusion and policy implications

This study investigates the presence of resource curse hypothesis in mineral-rich districts of Odisha, India. Pesaran (2004) CD test has been employed by the present study to check the cross-sectional dependence among variables and the results of this test shows that there is high dependence among variables. After confirming cross sectional dependence among the variables, the next step is to check stationary properties of variables and for this the present study has employed Pesaran Cross Sectional Augmented Dickey-Fuller (PCADF) unit root test. The results show that NDDP, TMP, INT, HRD, FD, and IQ follow I (0) and I (1) orders respectively.

After that the ARDL model has been applied in order to estimate the long-rum relationship among variables based on three alternative estimators such mean group estimator (MG), pooled mean group estimator (PMG) and dynamic fixed effects (DFE). The study finds that there is a negative relationship between natural resource abundance and economic growth in the long-run. The results confirm the existence of natural resource curse in the mineral-rich districts of Odisha. Government should launch

environmental friendly policies to explore natural resources & attain maximum benefit. Financial development and trade openness should be used as policy tools to exploit natural resources which in turn, will enhance domestic production and hence economic growth.

The study suggests that further in depth research is needed to understand the relationship between natural resource abundance and economic growth at the micro level. Further, a deeper understanding of determinants of the relationship or the so-called transmission channels with adequate focus on policies and institutions is required. In this regard as suggested by Behera and Mishra (2012) the development of a more comprehensive index of natural resource abundance that can adequately capture the various proxies such as, share of mining production in GDP, land per capita, share of natural resources export in GDP, share of labour force in the primary sector and mining employment might be a problem. To avoid this problem the future research can take into consideration of all the proxies which are used to measure natural resource abundance in a principal component analysis to make a single comprehensive index of natural resource abundance.

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Investigating factors affecting cooperative and non-cooperative behavior: An experimental game in the classroom(1)

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Abstract. *Cooperative/non-cooperative behavior of individuals is one of the factors affecting the welfare of society. The prisoner's dilemma is a strategic game that demonstrates the common problem of cooperation in many areas of economic and social life. The basis of the problem of cooperation in this game is that the players in the game follow a worse equilibrium strategy while there is a better equilibrium (Pareto Efficiency) for them. This study aims to examine the cooperative/non-cooperative behavior of the students who are in an exam process by creating a similar situation with the prisoner's dilemma with a question. With this experiment, the possibility of gaining additional points to the exam points was presented to attract the students. These points represent the "pay off" in the prisoner's dilemma game. As a result, it is seen that students act in a similar way to the resulting equilibrium in the prisoner's dilemma game. In addition to these findings, it is determined that cooperative/non-cooperative behaviors of students are significantly affected by gender and course success factors.*

Keywords: game theory, cooperative behavior, non-cooperative behavior, design of experiments

JEL Classification: C70, C71, C72, C90.

Introduction

In the literature, Neumann and Morgenstern's (1944) study is considered to be the first mathematical expression of the concept of "conflict" between individuals. By the development of "Prisoner's Dilemma" concept which formed by Flood and Dresher (1950) and enhanced by Tucker and John Nash's definition of equilibrium with modern non-cooperative games (later called Nash equilibrium), the foundations of game theory are laid.

Game theory plays an important role in understanding economic problems and strategic behaviors in economics science (Gintis, 2000). The concept of the game here can be expressed as the basis of strategic interaction that expresses the constraints defined by the players (economic units) moves and the benefits they will receive as a result of these moves. Game theory is a discipline that proposes analytical and intuitive solutions (equilibrium) and examines the properties of these solutions for these games (Yılmaz, 2009). The Prisoner's dilemma is one of the classic examples of game theory. In the classic form, the prisoners' dilemma scenario is as follows: Two suspects were taken into custody because that they had committed a crime. The police do not have sufficient evidence to arrest them unless at least one of the suspects confesses. Thus, the police put both suspects in two different cells and offer them an agreement. According to the agreement, if both suspects remain silent and do not confess, both of them will be sentenced to one month's imprisonment. If both confess, both suspects will be sentenced to six months' imprisonment. Finally, if one of the suspects confesses and the other remains silent, the confessor will be released and the one who chooses to remain silent will be sentenced to 9 months' imprisonment.

The problem of prisoners is represented by a matrix of 2 × 2 dimensions as follows.

Figure 1. *Prisoner's Pay-Off Matrix*

		Prisoner 2	
		Remain Silent	*Confess*
Prisoner 1	*Remain Silent*	-1,-1	-9,0
	Confess	0,-9	**-6,-6**

So both suspects have to choose between strategies to admit or remain silent. Both suspects are not able to communicate with each other (cooperation is impossible). According to this, the player who is unaware of the other's move will not remain silent and will choose a confession strategy by considering the possibility of serving a 9-month imprisonment. By confessing the crime, he will either accept a prison sentence of less than 1 month or be released. The player here aims to minimize his loss (maximize his pay-off). This means that the player's "admit strategy" is the dominant strategy. Since the pay-off values in the game are the same, in the other word the game is symmetrical; the other side will inevitably confess by acting rationally under the same conditions. Therefore, the equilibrium of the game is the strategy profile of the players' moves (confess, confess) and as a result (-6, -6) the situation also reflects the Nash equilibrium of the game. Thus, the decisions taken by the two sides who do not communicate with each other have increased the imprisonment that they may have less by acting rationally, not in good faith. If both suspects had the

opportunity to communicate with each other, they would cooperate and remain silent and sentenced to less imprisonment (Gibbons, 1992). The importance of the prisoner's dilemma game is that it is a strategic game that demonstrates the common problem of cooperation in many areas of economic and social life. For the players in this game there is a better equilibrium (Pareto efficiency), while they follow a worse equilibrium strategy.

Game theory makes it easy to explain some concepts that seem difficult to understand in strategic interaction between economic agents. In this respect, some games in the game theory have become classic in terms of the situation they describe. Prisoner's dilemma is one of them. The situation described by the prisoner's dilemma is used to analyze the strategic behavior of oligopolistic firms that are aiming at profit maximization. Besides, it is used to discuss a wide range of issues such as the causes of corruption, defence spending decisions of countries etc. (Kofman and Lawarree, 1996).

In order to see the practical examples of classical games used in game theory such as the prisoner's dilemma game, classroom experimental analyses are made in the literature (Nelson and Beil, 1994; Hemestah, 1994; Cooper et al., 1996; Eckel and Grossman, 1998; Holt and Capra, 2000; Alba-Fernandes et al., 2006; Marks et al., 2006; Innocetti and Pazienza, 2006; Nagatsuka and Kawamura, 2016 and Nieswiadomy, 2012). However, not only the prisoner's dilemma game, but also the classic games such as dictator game, trust game, battle of sex, cooperation game, chicken game, bargaining game are applied in the classroom. Players are students in these games. The strategies, goals and constraints of the players are also designed according to the students' classroom environment. For example, Alba-Fernandes et al. (2006) designed a complex classroom environment game for students to understand Nash equilibrium in their classroom experimental study. Eckel and Grossman (1998) made an application of dictator play in their classroom experimental study. In this game, they evaluated student decisions based on the gender factor. They concluded that women were more generous than men. Innocetti and Pazienza (2006) concluded that women exhibit a higher degree of altruism than men for both trust and trustworthiness in the design of classroom play, which was modelled on the gender factor. In the experimental studies of the prisoner's dilemma game, the behaviors (strategies) of the students were evaluated in terms of many factors such as gender, nationality, class and age. Hemestah (1994), in his study between American and Russian students, found that in the case of prisoners' dilemma, Russian students behaved in cooperative rather than acting rationally compared to American students. McPherson and Nieswiadomy (2012) evaluated the prisoner's dilemma status in terms of gender, nationality, class and age factors. According to the findings of the study, it was concluded that female students were more likely to behave in cooperative than male students.

This study aims to examine the students' cooperative/non-cooperative behaviors and the factors affecting these behaviors by creating a similar situation to the prisoner's dilemma with a question asked to the students during the exam process. However, although the literature is extensively vast so far, to the best of our knowledge, no studies have evaluated the cooperative/non-cooperative behavior of individuals (students) during the exam process based on the prisoner's dilemma. Moreover, the design of the game in this study is thought to be original in terms of the method of application of the experiment, also.

The following section includes design and solution of the game (experiment) and Section 3 provides the experimental results and discussion, while Section 4 concludes.

1. Strategic game design and solution (equilibrium)

In the classroom design of the prisoner's dilemma game, the players used as a substitute for the prisoners are students as indicated in the above section. In this study, the designed method of the game is not applied to the students in the classroom environment and with a questionnaire as in the studies in the literature. In the study, the game was designed and implemented in the classroom environment only in the form of the status of students in the midterm exam.

In the mid-term exam, which consists of 22 multiple-choice questions, the students were asked one additional question (question 23) as follows[(2)]:

Figure 2. *Question designed for strategic game*

> **23)** You can get extra points for your exam by marking the question below. **You can get 5 points by marking option A) or 15 points by marking option B).** But I have a small condition. *If more than 10% of the class marking to option B), you will not get any points* (Only I will see your answer, the rest of class will not see what you answer).
> **A)** 5 points
> **B)** 15 points

With this question, students have the possibility of additional points for exams. So, if the students answer the question, they can get a real pay-off. As a result, the student's interest in the game is expected to increase and will make more realistic decisions. Evaluating the problem of students in the game with a simple 2×2 dimensional matrix can simplify the solution of the game. The matrix in Figure 3 is considered for any student (for example, student-1).[(3)]

Figure 3. *Pay off matrix of students*[(4)]

Other Students ($N < \%10$ **)**

Student-1		*Option A)*	*Option B)*
	Option A)	**5 point,** 5 point	**0 point,** 0 point
	Option B)	0 point, 5 point	**0 point,** 0 point

Other Students ($N \geq 10$ **)**

Student-1		*Option A)*	*Option B)*
	Option A)	5 point, 5 point	**0 point,** 0 point
	Option B)	**15 point,** 5 point	**0 point,** 0 point

According to the design of the game, student's strategies and payoffs at the end of the game are as follows:

- If other students mark option A), and if student-1 mark option A), all students in the class will receive 5 additional points *(regardless of the number of students).*
- If only student-1 marks option B) and other students mark option A), if the number of students is greater than 10, student-1 will receive 15 additional points and all other students will receive 5 additional points. If the number of students is less than 10, student-1, 0 additional points other students will receive 5 additional points.
- If other students mark option B), if student-1 marks option A), student-1 appears to receive 5 additional points and the other students will receive 15 additional points. However, since more than 10% of the class in such a case marks option B, all students will receive 0 additional points *(regardless of the number of students).*
- Finally, it seems that if student-1 and other students select B), they will get 15 additional points. However, as this rate reflects the fact that more than 10% of the class marks the option B), all students will receive 0 additional points as a result *(regardless of the number of students).*

In this game, students are forced to choose between strategies A) marking (Cooperative behavior) or B) marking (Non-cooperative behavior). Using the exam environment as an experimental environment prevents students from communicating with each other. Thus, it is thought that this created an experimental environment similar to the situation where the players in the prisoner's dilemma could not communicate.

Student's behaviors can be analyzed in the framework of the prisoner's dilemma game as follows:

First of all, all students know that the number of students taking the exam is greater than 10 ($N \geq \%10$). Therefore, it is not necessary to evaluate the first matrix in Figure 3. Student 1 (any student) who is unaware of the moves of other students will mark option B) considering the possibility of 15 additional points. Thus, he will get 15 additional points with a 10% probability. Here the student aims to maximize her/his pay offs. This means that the student's strategy to marks option B) is a weak dominant strategy. Since the game is symmetrical, there is a possibility that other students will be able to mark option B) by acting rationally under the same conditions. Therefore, the Nash equilibrium in this game can be expressed mathematically as follows. In a class that is supposed to be 100 students, after 11 students marked option B) and 89 students marked option A, every situation where the number of markings of option B) increases, is the Nash Equilibrium. That is, 12B)-89A), 13B)-88A),…, 99B)-1A), 100B)-0A). All of these situations represent the Nash equilibrium. So there is multiple Nash equilibrium in the designed game. Consequently, the Nash equilibrium of the game for $N \geq \%10$ is the strategy profile in which students' moves are [B), B)], and pay offs (0 points, 0 points). Thus, all students who cannot communicate with each other will receive 0 additional points by exhibiting non-cooperative behavior (in a one respect, they make rational decisions). If they had exhibited cooperative behavior, they would have received 5 additional points.

With the implementation of the experiment, we will see which equilibrium strategy the students follow. Also, we will divide the students into different categories with the

equilibrium that will occur in the game and evaluate their balance strategies within the framework of cooperative/non-cooperative behavior.

2. Findings

The experiment was conducted with the students who took the introduction to the Economics midterm exam in the 2016-2017 spring semester of Uşak University School of Applied Sciences. A total of 407 students participated in the experiment but 33 students were not included in the experiment because they left this question blank. Therefore, it was assumed that the experiment was performed with 374 subjects. Cooperative/non-cooperative behaviors of the students included in the experiment were evaluated in 6 different categories. The information about success, gender, nationality, degree, department, and education variables are given in the table.(5)

Table 1. *Descriptive statistics*

Variable	Categories		Min=0	Max=1	Obs.
success	Fail=0	Success=1	154	220	374
gender	Male=0	Female=1	194	180	374
nationality	Domestic=0	International=1	328	46	374
degree	Junior=0	Senior=1	267	107	374
department	IT=0	BF=1	108	266	374
education	Evening=0	Normal=1	171	203	374

When Table 1 is examined, it is seen that 220 out of 374 students who participated in the experiment were successful in the Introduction to Economics course. It is seen that 180 of these 374 students are girls, 46 of them are foreign nationals, 107 of them take courses again, 266 of them are studying in the department of Banking and Finance (BF) and 108 of them are studying in the department of International Trade (IT). Finally, it is understood that 203 of these students are studying in normal education. With the application of the experiment together with the exam, the statistics of the answers given to the 23rd question representing the cooperative/non-cooperative behaviors of the students are shown in Table 2. Table 2 can also be said to represent the equilibrium profile of the designed strategic game.

Table 2. *Equilibrium profile of the game*

Cooperate/Non-cooperate	N	%
Option B) (0)	171	45.72
Option (A) (1)	203	54.28
Total	374	100

According to Table 2, 45.72% of the students marked option B). In other words, 45.72% of the students showed non-cooperative behavior. 54% of the students marked option A). In other words, 54% of the students chose to accept 5 additional points by showing cooperative behavior. However, as stated in the design of the game, no player will receive additional points if more than 10% of the players mark option B). In this case; As a result of the students 'strategies, the students fell into a situation where the prisoners in the prisoner's dilemma game fell. As a result of the experiment, the Nash equilibrium strategy profile of the game is provided, That is, (0 points, 0 points). In other words, while in this

game have a better equilibrium strategy for students (5 points, 5 points), they followed a worse equilibrium strategy (0 points, 0 points).

Evaluating students' cooperative/non-cooperative behaviors in different categories is seen as a separate contribution of this study to the literature. The two main analysis tools that come to the fore are the Probit and Logit models. Probit and Logit models are generally applied when the dependent variable is categorical (Peel et al., 1998). Probit analysis is a model used to find the effect of one or more explanatory variables on a categorical response variable as an alternative to the logit model (Long and Freese, 2006; Dey and Astin, 1993). In this study, the Probit regression model was used to evaluate the student's equilibrium strategies with different categories. Probit Analysis results are shown in Table 3.

Table 3. *Probit analysis results*

Variable	Coefficient	dy/dx	z
success	0.949***	0.037	6.42
gender	0.344**	0.013	2.5
nationality	-0.002	-0.088	0.09
degree	0.134	0.053	0.81
department	0.207	0.082	1.27
education	0.005	0.002	0.04
constant	-0.208		-0.96
	Obs.	374	
	Log likelihood	-256.46284	
	LR chi2 (6)	0.8326	
	Pseudo-R2	0.054	

Note: Dependent variable is the cooperate/non-cooperate variable. ***, **, * reflect the 1%, 5%, 10% level of significance respectively.

According to Table 3, there is a statistically significant relationship between the success variable and cooperative/non-cooperative strategy. The coefficient of the variable is positive, so it is possible to say that those who are successful in the economics course are more likely to choose a cooperative behavior strategy than those who fail. When we look at the marginal effect, it is seen that this ratio is 3.7%.

Again, according to Table 3, another significant variable is the gender variable. There is a statistically significant relationship between gender and cooperative behavior strategy. The coefficient of this variable is positive, also. Thus, it is possible to say that girls are 1.3% more likely to choose a cooperative behavior strategy in gender variable than boys. This result is consistent with the fact that women are more generous, altruistic, gentle, and reliable than men in the experimental economics literature (McPherson and Nieswiadomy, 2012). Since the probability value of other variables is greater than 0.05, it can be said that these variables do not have a significant relationship with cooperative/non-cooperative behavior strategies.

3. Conclusion

This study is a classroom experimental analysis of the prisoner's dilemma game which is one of the classic games in game theory. The importance of the prisoner's dilemma game; in the equilibrium of the game, the situation in which the prisoners fall is to follow a worse equilibrium strategy by acting rationally while there is a better equilibrium for them if they

follow a cooperative strategy for the prisoners. The results obtained from the experimental classroom analysis; 45.72% of the players (students) exhibited non-cooperative behavior (rational) and this means that more than 10% of students marked option B) as stated in the design of the game. In this way, no student could get additional points and they behaved into a situation as in the prisoner's dilemma game. This shows us that the Nash equilibrium strategy profile of the game designed with the experimental findings is similar. In other words, they have followed a worse equilibrium strategy while there is a better equilibrium for students. Along with this equilibrium in the game, the students' equilibrium strategies were evaluated according to different categories such as success, gender, department, degree, nationality, and type of education.

According to the findings; it is concluded that those who are successful in the introduction to economics course are 3.7% more likely to choose a cooperative behavior strategy than those who fail. Another find; It is concluded that girls are 1.3% more likely to choose a cooperative behavior strategy than men. It is seen that this result is consistent with the fact that women are more generous, altruistic, gentle, and trustworthy than men in the experimental economics literature. Other factors were not found to have a significant relationship with cooperative/non-cooperative behavior strategy.

Notes

(1) Abstract version of this paper was presented at SCF Conference, 22-23 September 2016, Turkey.
(2) A copy of the exam paper, including the experiment question, can be seen in Appendix 1. The duration of the exam is 40 minutes. The language of the exam is Turkish. However, only the experimental question was translated into English for this study.
(3) We cannot represent strategic situations with more than two players in matrix form. We do this completely to simplify understanding the game.
(4) The underlined pay off indicate the pay off the student-1 has obtained as a result of her/his best response.
(5) This information is provided from Uşak University Student Information System.
(6) Only the back side of the exam paper, which was asked the experimental question, was added.

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Appendix 1. EXAM PAPER[6]

13) TCBM'nin para arzını azaltarak ekonominin büyümesini yavaşlattığını düşünün. Böyle bir durumda ortaya çıkacak işsizlik türü nedir?

A) friksiyonel işsizlik
B) yapısal işsizlik
C) konjonktürel işsizlik
D doğal işsizlik

14) Hangi ekonomik durumda enflasyon oranlarının düşme, işsizlik oranları artma eğilimlindedir?

A) hiperenflasyon
B) resesyon
C) stagflasyon
D genişleme

15) Türkiye ekonomisnde ölçülen şubat 2015 yılındaki tüketici fiyat endeksi(TÜFE-CPI) 255'tir. Şubat 2016 yılındaki tüketici fiyat endeksi 274'tür. Buna göre Türkiye'nin şubat ayı 2015-2016 yılındaki enflasyon oranı nedir?
A) 7.4%.
B) 12.7%.
C) 8.3%.
D) 6.3%.

Devletin uluslararası sektörün olmadığı keynesyen model çerçevesinde; Megadeth Cumhuriyeti'nin ekonomisi Denklem-1 ile karakterize edilmiştir.

DENKLEM-1:
$C = 500 + 0.9Y$
$I = 300$

16) Denklem-1 'e göre Megadeth Cumhuriyetinin denge gelir(GDP) seviyesi nedir?

A) 10000.
B) 9600.
C) 11200.
D) 8000.

17) Denklem-1 'e göre Megadeth Cumhuriyeti'nin makro ekonomik dengede(*keynesian cross*) sırası ile denge tüketim ve denge tasarruf seviyesi nedir?

A) 7700;300
B) 8700;400
C) 9700;300
D) 6700;400

18) Denklem 1'e göre; Megadeth Cumhuriyetinde çarpan katsayısı nedir?
A) 8
B) 4
C) 6
D) 10

19) Denklem 1'e göre; Megadeth Cumhuriyetinde otonom yatırımlar 350$'a çıkarsa yeni denge çıktı seviyesi ne kadar artar?
A) $100.
B) $200.
C) $500.
D) $800.

20) Sadece özel sektörün olduğu Megadeth Cumhuriyeti'nin çarpan katsayısını etkileyen parametre nedir?

A) beklentiler
B) gelir vergisi oranı
C) marjinal tüketim eğilimi
D) faiz oranları

BONUS: 21 ve 22 soruların sırası ile doğru Türkçe ve İngilizce karşılıklarını bulunuz.

21) Growth-depreciation-interest-employment-output

A) büyüme-dalgalanma- faiz -işsizlik-çıktı
B) aşınma- dalgalanma- faiz -istihdam-üretim
C büyüme-aşınma-faiz-işsizlik-üretim
D) büyüme-aşınma-faiz-istihdam-çıktı

22) daralma- nüfus- milli gelir- genişleme- harcama

A) expansion- population -average income-recession-consumption
B) recession- population -national income-expansion-consumption
C) recession- population -national income-expansion-expenditure
D) expansion- population -average income-recession-expenditure

23) Aşağıdaki soruyu işaretleyerek finalinize ekstra puan alabilirsiniz. İster A) şıkkını işaretleyerek 5 puan, ister B) şıkkını işaretlerek 15 puan alabilirsiniz. Ancak küçük bir koşulum var. Eğer sınıfın %10'undan fazlası B) şıkkı 15 puanı işaretlerse hiçbir puan alamayacaksınız(cevabınızı sadece ben göreceğim sınıfın geri kalanı ne cevap verdiğinizi görmeyecektir.

A) 5 puan
B) 15 puan

Süre 40dk.
Öğr. Gör. Metin TETİK
Başarılar
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Impact of exchange rate regimes on inflation: An empirical analysis of BRICS countries

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Abstract. *Emerging market economies (EMEs) are increasingly important drivers of global economic growth, as witnessed by the substantial increases in their share of world output during the last four decades. The choice of an exchange rate regime is a recurring issue in international macroeconomics. Recently, the currency crisis in Asia, Russia, Brazil and Argentina has increased interest in this area and the effects of exchange rate regimes become even more important in developing countries. Hence, the purpose of this study is to revisit the effects of exchange rate regimes on inflation in BRICS countries. The data used for this research covers over the period from 1970 to 2012. This study finds that BRICS countries under the Pegged exchange rate regime have lower inflation rate compare to those under the non-Pegged exchange rate regime. The analysis in this study proposes that exchange rate regimes choice and money supply influence the inflation dynamics in the BRICS countries. In addition, the empirical results attained from the analysis of inflation show that the real depreciation resulting from a nominal depreciation will be unwound in a short-time which will reduce the advantages of a flexible exchange rate regime. The analysis in this study also shows that there is a positive relationship between monetary expansion and inflation in the BRICS countries.*

Keywords: exchange rate regimes, inflation models, pegged and non-pegged exchange rates, price stability, macroeconomic variables, financial crisis.

JEL Classification: E52, F33, F43, E6, F439, G010.

1. Introduction

In the current competitive economic world, the exchange rate regime plays a major role to determine and improve the country's economic activities and growth performance and acts as the fundamental macroeconomic policy choice for small and developing countries.

There are debates on the exchange rate regimes which have been prevalent in many policy circles. They have infrequently been independent of the regulations of international financial markets. According to the study of Calvo and Vegh (1994), the emphasis on issues in academic literature has been changed since 1980. The economists in the 1980s have tried to study the best stabilization instruments to implement the exchange rate regimes. Their debate focuses on, in what way different regimes will act as absorbers of external shocks or provide a shield against speculative attacks. The lack of consensus on the subject has been running parallel due to the recent developments in the real world. The debate on the exchange rate regime is questionable due to its differentiation in its categorization.

The influence of exchange rate regimes in developing countries has been a debatable issue and it is one of the most important arguments in the international economies. For the last four decades, there are many small and developing countries have been facing these types of issues. They are Mexican economic crisis (1982 and 1995), Crisis in East Asia (1997), Argentina's Great Depression (1998-2002) and Turkey crisis (2001). These issues have become a big challenge to the global economy since the great depression and provided a severe "stress test" for the global economic performance. Change in exchange rate regime has led to the high inflation rates and low or negative growth rates. There is an ongoing discussion in many countries over the years about the choice of countries' exchange rate regimes. Their main focus is how the regimes have contributed to macroeconomic instability; and how the choice of exchange rate regimes might fix that macroeconomic turmoil and economic performance in developing countries. On the basis of these questions, this study is focusing only on BRICS countries to study the impact of exchange rate regimes on inflation in BRICS countries.

This study is organized as follows: Data and definitions of variables and sample period and data frequency are explained in section 1.2. The exchange rate regime classification procedure and coding are covered in section 1.3. Section 1.4 briefly discussed the econometric issues and methodology, the theoretical framework of inflation model and methodology. Empirical analysis and results, empirical findings of inflation performance are discussed in section 1.5. Section 1.6 tells the summary and conclusion.

2. Data and definitions

The study delves into the annual observations of economic variables of BRICS' countries from 1993 to 2012.

2.1. Variables

Table 1. *Definitions and sources*

Variables	Definitions and Sources
%ΔGDP	Rate of growth of real GDP (WDI)
π	Annual percentage change in the Consumer Price Index (WDI)
%ΔMS	Rate of growth of Money Supply (WDI)
TOP	Openness: it is ratio of sum of the Exports and Imports to real GDP (WDI)
TI	Terms of Trade; the ratio of the price exports to price of imports (WDI)
PEGGED	A binary variable. It takes the value 1 when a country has a pegged regime; takes the value 0 when a country has a non-pegged regime.
π_{t-1}	One year lagged value of inflation rate.

2.2. Sample period and data frequency

The annual sample period covers from the year 1993 to 2012. The data frequency is determined according to the variable with the lowest frequency published, as a result, is expected with a strong relationship between Exchange rate regimes on inflation affected variables included in this study.

3. Exchange rate regime classification procedure and coding

There are different methods to classify exchange rate regimes to different countries. The IMF uses De Jure classification system to give coding for the countries that have fixed exchange rates for many years. There are few countries which have declared their regime choice whereas some other countries are not able to declare their regimes choice.

De Facto classification is a kind of coding that is based on the exchange rate movements and interest rate differentials. Some of these countries can use intervention data and direct intervention of currency markets. The changes in domestic interests ensure that the government is actively managing the exchange rate.

By using these annual classifications, it is determined that the exchange rate stayed within ± 2% bands against base currency. Technically, it is testified that if the month end maximum and a minimum value of exchange stay within 0.4, this can be considered as pegged exchange rate regime. If it exceeds 0.04, it can be categorized as non-pegged. In order to prevent breaks in the peg status due to one-time realignments, if an exchange rate possesses the value of zero in eleven out of twelve months is considered to be a fixed entity. By using the annual data of BRICS countries from 1993 to 2012, out of 200 country/year observations with exchange rate data 87 are coded as Pegged, 101 as Non-Pegged and 12 do not have any data.

4. Econometric issues and methodology

The following section deals with the theoretical framework and model building.

4.1. Theoretical framework of inflation model

The earlier studies prove that the Inflation is mostly affected by the following variables like exchange rate, money supply, government consumption, real GDP, population, Terms of Trade and Trade openness. Based on these variables' relationship we present a functional form of these variables' impact of exchange rate regimes on inflation of BRICS countries.

The most typical association of fixed exchange rates with lower inflation rates is based primarily on the belief that a peg may play the role of a commitment mechanism for monetary authorities. On that basis, this effect works entirely through the behavior of the monetary aggregates in the case of BRICS countries. The very important issues are that a credible peg may also lead to higher money demand and low inflation expectations and reduce the sensitivity of prices with respect to upward changes in money growth.

According to its supporters, many of suggested that lower inflation rates are associated because of following pegged exchange rate regime system. As mentioned above, a pegged regime may play a role as an anti-inflationary tool for developing countries. In addition, the literature focuses on a credibility effect of a pegged rate expectations on inflation that may soothe the velocity of money and price fluctuations in the developing world. In theory, a pegged exchange rate regime is expected to have an impact on the link between money and prices. Since a pegged regime is expected to affect the relationship between prices and money. This study uses a standard money demand theory as the core model to explain inflation performance. Therefore, the base model takes the form of a simple demand function in a time series model as the following:

$$\frac{M_t V_t}{P_t} = Y_t^{\alpha}\, i_t^{-\beta} \quad \alpha, \beta > 0 \tag{1}$$

where M_t is broad money, V_t is residual velocity controlling for interest and income effect,$P_t$is the price level, Y_t is the real income, and i_t is the nominal interest rate at time t. Money demand increases with real income and decreases with nominal interest rate. Nominal interest rate can be formed by the Fisher equation, as the following:

$$i_t = r_t + \pi_t^e \tag{2}$$

Where $r_t$is, the real interest rate and $\pi_t^e$is the expected rate of inflation, which can be defined as:

$$\pi_t^e = \ln(P_{t+1}^e) - \ln(P_t) \tag{3}$$

In money market equilibrium it requires that money demand equals money supply; hence, money supply and money demand are denoted byM_t. By taking the natural logarithm and representing all variables but the real interest rate by lower case letters (i.e. ln Z=z), this study uses the following equation:

$$m_t + v_t = p_t + \alpha y_t - \beta(i_t) \tag{4}$$

This can be formed and expressed as a percentage of change terms by taking the first difference of each variable. After rearranging the equation and using the Fisher equation in the equation (4), the study finds that inflation ($\pi_{i,t}$), is the percentage change in prices, and

it's a function of the percentage change of money supply ($\%\Delta m_{i,t}$), the percentage change of income ($\%\Delta yi,t$), and the expected inflation rate ($\pi^{e}_{i,t}$), which is the lagged dependent variable, "inflation", to bring out the effect of past policies on present expectations. Therefore, a core regression equation is based on:

$$\pi_{i,t} = \emptyset\%m_{i,t} + \beta\pi^{e}_{i,t} - \alpha\%\Delta y_{i,t} + \in_{i,t} \quad (5)$$

$\in_{i,t}$ is a regression error term defined as the sum of the unobservable change in the real interest rate (Δrt) and the change in the money shock (Δvt).

Finally, we come to the main regression model to bring out the effects of exchange rate regime policies on inflation; this study includes a regime of dummy variable (PEGGED). It shows, PEGGED takes the value of 1 when a country is categorized as a pegged and takes the value of 0 when a country is categorized as a non-pegged. Lastly, a dummy variable PEGGED is measured by using the Jay C. Shambaugh de facto scheme. Thus, the regression framework for inflation performance is the following:

$$\pi_{i,t} = \beta_0 + \beta_1\%\Delta MS_{i,t} + \beta_2\pi_{i,t-1} + \beta_3\%\Delta GDP_{i,t} + \beta_4 PEGGED_{i,t} + \beta_5 TOP_{i,t} + \beta_6 TI_{i,t} + \epsilon_{i,t} \quad (6)$$

Based on the equation (6), the annual percentage change in inflation for country *i* (*I* = 1, 2… 5) over time period *t*, with *t* = 1993, 1994- …-, 2012, depends on upon other explanatory variables. TOP is the openness to trade; it is the ratio of the sum of exports and imports to real GDP. TOP is included to capture the effect of international trade on inflation in BRICS countries. TOP is predictable to be associated with lower rates of inflation because greater openness to trade creates incentives for adopting stable macroeconomic policies. Stable macroeconomic policies reduce fluctuation in prices. Moreover, an increase in openness to trade leads to a great variety in consumption, which could also reduce price volatility in BRICS economies. Another explanatory variable in the inflation model is the Terms of trade (TI). TI is the ratio of a country's price of exports to its price of imports. TI is contained within in the model to control the effect of outward shocks. TI is predictable to be a negative relation to inflation as long as the terms of trade rising for a country. Finally, to bring out the effect of past policies of inflation on present expectations, the lagged variable of the dependent variable is also used (π_{t-1}) in this model.

4.2. Methodology

The study uses econometric models to explain the effects of currency policies on inflation. The country fixed effects model is used to control unobserved or difficult to measure country characteristics in panel data when such variables differ crosswise countries but do not change over time in inflation model. For instance, cultural or historical ties could also play a role the choice of currency policies that do not change dramatically over time, but it differs across developing countries. Therefore, by using the country fixed effects model, the study can capture the effects of these unobserved omitted variables on inflation and eliminate the omitted variable bias in analysis part. Moreover, clustered standard errors are used in country fixed effects regressions. Clustered standard errors allow for heteroskedasticity and for autocorrelation within a country, but are uncorrelated across entities. Therefore, clustered standard errors are valid whether or not there are issues on heteroskedasticity, autocorrelation or both.

Additionally, time dummies are also used in inflation model. The reason is that common shocks from corner to corner countries (such as spikes in oil prices or fluctuations in the U.S dollar) influence all economies beyond the effects focused through the observed variables. Therefore, the time dummies can control for unobserved or difficult to measure variables that are constant across countries but evolve over time.

5. Empirical analysis and results

The following section divided into two sub-sections. Section 5.1 explains the Unit root test analysis. Section 5.3. Explains the empirical analysis and discussion of the results.

5.1. Unit root test analysis

The following tables 2 and 3 briefly shows the unit root results and discussion as follows.

Table 2. *Unit root test results at level*

Variables	LLC	IPS	Fisher-ADF	Fisher PP
INF	-4.16961(0.0000)	-4.20007(0.0000)	35.6489(0.0000)	31.8379(0.0001)
%ΔMS	-3.43076(0.0003)	-4.54052(0.0000)	37.2691(0.0000)	51.4209(0.0000)
%ΔGDP	-6.51825(0.0000)	-5.84321(0.0000)	49.1617(0.0000)	61.3495(0.0000)

Source: Author's calculations.

Table 3. *Unit root test results with 1st difference*

Variables	LLC	IPS	Fisher-ADF	Fisher PP
TI	-0.85367(0.1966)	-3.46002(0.0003)	41.9743(0.0000)	45.4341(0.0000)
TI (2nd)	-12.1019(0.0000)	-13.4656(0.0000)	124.250(0.0000)	86.5067(0.0000)
TOP	-6.86453(0.0000)	-6.44938(0.0000)	54.8049(0.0000)	111.932(0.0000)

Source: Author's calculations.

Unit root test statistics of Fisher-ADF, Fisher-PP, IPS and LLC, test statistics in Table 2, includes two stages viz, first, at level and second, with a1st difference. The above tests have been applied to test stationarity property of the variables used in the present study. A regression using non-stationary variables may provide a spurious result (Granger and Newbold, 1974). Table 2 shows the stationarity at a level for the INF, %ΔMS and %ΔGDP variables and remaining got all non-stationary variables at level. Other variables like, TI and TOP got stationary at the difference. In direction to apply co-integration technique, all non-stationary variables must have the same level factor of integration. But, our results show that non-stationary variables have mixed pattern level of integration. For, this reason co-integration analysis doesn't apply here. These estimated results are showed in Table 4.

5.3. Empirical analysis and discussion of the results

Table 4. *Estimates Fixed-effects GLS regression (Dependent Variable INFL) Dependent variable Inf*

Infl.	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
%Δmsl	0.7678	0.1662	4.62	0.000	0.4376	1.0981
Linfl	0.4373	0.0753	5.81	0.000	0.2876	0.5869
%Δgdp	0.0584	0.1064	0.55	0.584	-0.1530	0.2699
Pegged	-0.2004	0.0812	-2.47	0.016	-0.3618	-0.0389
Topl	0.7350	0.4513	1.63	0.107	-0.1613	1.6323
Til	-0.5127	0.2776	-1.85	0.068	-1.0644	0.3897
_cons	5.9868	2.9384	2.04	0.045	0.1482	11.825
sigma_u	0.3502			Prob > F = 0.000		
sigma_e	0.3023			R-sq: 0.5407		

Source: Authors' calculation.

Table 5. *Random-effects GLS regression*

Dependent variable Infl

Infl.	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
%Δmsl	.845	.150	5.64	0.000	.551	1.14
Linfl	.485	.069	6.95	0.000	.348	.622
%Δgdp	.071	.081	0.88	0.379	-.087	.230
Pegged	-.190	.075	-2.51	0.012	-.338	-.042
Topl	.398	.239	1.66	0.097	-.071	.868
Til	-.084	.065	-1.29	0.197	-.214	.044
_cons	1.32	.643	2.06	0.040	.062	2.58
sigma_u	0			Prob > F = 0.000		
sigma_e	0.302			R-sq: 0.7470		

Source: Authors' calculation.

Table 6. *Hausman Fixed Random*

	(b)	(B)	(b-B)	Sqrt (diag(v_b-v_B))
	Fixed	Random	Difference	S.E
%ΔMsl	0.767	0.845	-0.077	0.071
Linfl	0.437	0.048	-0.048	0.028
%Δgdpl	0.058	0.071	-0.012	0.068
Pegged	-0.2	-0.19	-0.01	0.029
Topl	0.735	0.398	0.337	0.382
Til	-0.512	-0.084	-0.427	0.269
Chi2 (6)= 6.39		Prob >Chi2= 0.380		

Source: Authors' calculation.

5.3.1. Empirical findings of inflation performance

Most importantly we have to see before analysing the regression results in the inflation model, one might suspect that the variable " inflation" has a unit-root since time series are more likely to have unit-roots and are non-stationary (i.e. lagged value of inflation is used as an independent variable). Based on the Fisher test for using of panel root an Augmented Dickey-Fuller Test with one lag, the null hypothesis (that "inflation" has a unit root) is rejected, since the probability of Chi2 is less than 1%. Therefore, the variable "inflation" do not have a unit root and is also at stationary.

Table 6 reports the regression results. As mentioned, time dummy variables are used in all the regressions to control the effects of common unobservable shocks across countries. Table 6 explains the BRICS countries analysis. This chapter empirically analyses inflation models across all BRICS nations, to see the differences of regime impact on inflation.

The above table explains the regression results. Results indicate under a pegged exchange rate regime rate of inflation is negatively associated. Coefficients of other variables like Change in money supply (%ΔMS) would have a progressive impact on inflation ($\alpha > 0$), as it is given that any increase in money supply is expected to increase the price rise. It is significant and positively related to inflation and on other hand GDP growth also should have positive impact ($\beta > 0$) as it is seen in the Philips curve, as we assume that a high growth rates are expected to cause economic activity to heat up the wages and rise of prices. Here, our results show that the %ΔGDP is positively related to inflation but it is not significant. %ΔGDP is positively impacted on inflation rate. The trade openness (TOP) is significant with a positive coefficient. Trade openness increases the costs of a monetary expansion, which is logically have to imply lower inflation in open economies. On the other

hand, the terms of trade (TI) is significant and with a negative coefficient. Finally the PEGGED has played a negative effect on the inflation performance. It implies that the countries following PEGGED regimes have witnessed lower inflation rate when compared with non-pegged exchange rate regimes.

6. Summary and conclusion

This study analyzed the effects of exchange rate regimes on inflation of BRICS countries, with 20 years of yearly data from 1993-2012. A brief literature review of the theoretical and empirical literature on inflation of BRICS economies specified the importance of theories of inflation in explaining the issues on inflation.

This study examined the impact of exchange rate regimes on inflation on BRICS. It mainly examined the role of exchange rate regimes in the inflation performance and more specifically, on choosing what type of regimes will help for the BRICS countries to control the inflation.

The panel co-integration tests were not run due to stationarity test results not satisfying the prerequisites. In the consumption basket there was a high content of imports in the consumption basket (both way indirectly as inputs to services and goods, and directly as consumption goods) and the incapability to inspiration prices in the importing countries, domestic prices are extremely approachable to the changes in foreign prices but suggest some price stickiness in the short run. Conferring to the variance analysis, shocks to inflation are explained mostly by its own past values, suggestive of inflation inertia. The second most key source to foreign prices is Shockwave of the variation in domestic prices, followed by the nominal exchange rates and exchange rate policies. The anticipated long-run relationship based on the monetary theory of inflation indicated that an increase in money supply is inflationary, feasible due to structural bottlenecks.

The analysis in this chapter proposes that exchange rate regimes choice and money supply influence the inflation dynamics in the BRICS countries. In addition, the empirical results attained from the analysis of inflation show that the real depreciation resulting from a nominal depreciation will be unwound in a short-time which will reduce the advantages of a flexible exchange rate regime. The analysis in this chapter also shows that there is a positive relationship between monetary expansion and inflation in the BRICS countries.

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Tax structure and economic growth in general category states in India: A panel auto regressive distributed lag approach

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Abstract. *The study empirically investigates the impact of tax structure on economic growth in fourteen general category states in India using panel data covering the period from 1980 to 2016. The use of panel ARDL model and different residual cross dependence tests confirms the distortionary effect of State's Own Direct Tax Revenue on economic growth. And also the study finds positive relationship between State's Own Indirect Taxes and economic growth. Therefore, it is suggested that the states should collect more revenue from indirect taxes with due consideration to its regressive nature, and reduce revenue collection from direct taxes in order to achieve higher growth.*

Keywords: tax structure, state taxation, state expenditure, economic growth, panel ARDL.

JEL Classification: H21, H71, H72, O47, C23.

1. Introduction

Endeavour in examining the relationship between tax level and economic growth as well as tax structure and economic growth has grown in recent decades because of the potentiality of the taxation in influencing the economic growth in the eve of high fiscal deficit resulting from ever increasing public spending. Being an indispensable part of budgetary activities, the taxation may affect economic growth through many channels like labour supply, human capital, physical capital, total factor productivity, change in price ratios, crowding out of private investment through making financing costlier etc. Now question arises: how does taxation relate to economic growth? Economic theory finds the negative relationship between taxation and economic growth. The theory claims that a fall in tax rate would lead to higher economic growth. On the other hand, the reduction in tax rate would create income inequality by benefitting ricer more. Nevertheless, this would limit the government's potential to spend on the productive activities and to increase productive capacity of the economy. Hence the effect of change in tax rate or tax level, without having understanding of tax system or tax structure, on economic growth is inconclusive and incomplete.

The study of tax structure with respect to economic growth is essential if the goal is to find an overall relationship between taxation and economic growth. Because, distinct effect on economic growth may be noticed from different kinds of taxation. For Instance, personal income tax is supposed to have a negative association with economic growth. Because, a rise in personal income tax reduces individuals disposable income and savings. The increment of the tax rate would incentivize the people to prefer less work to leisure (Mendoza et al., 1997; Arnold et al., 2011), and to engage in tax malpractices like tax evasion and tax avoidance. Hence, the combined effect of fall in productivity and tax evasion reduce economic growth. Corporation income tax, further, has inverse impact on economic growth (Lee and Gordon, 2005; Arnold, 2008). A fall in corporate income tax rate boosts corporate incentives to invest in physical & human capital, research and development (R&D), increases firm's profitability and ability to compete in both domestic and overseas market. Nevertheless, it also attracts foreign companies to settle down in those countries where low corporate tax is prevalent. All these factors in together affect economic growth positively. Comparison between corporate tax rate and income tax rate explore a new dimension of the study of analysing risk taking appetite of the self-employed individual (Schumpeter, 1942; Cullen and Gordon, 2002). The lower the former to later would encourage self-employed persons to undertake entrepreneurial activities of innovation beneficial to economic growth. Besides, Consumption taxes like sales tax, customs duties etc. have mixed impact on economic growth. In short run, a rise in sales tax instantly raises the price of the product and acts as an incentive for the producers to produce more (Munir and Sulatn, 2016; Eugene and Abigail, 2016). But, in long run, it creates distortion in the factor prices and reduces returns to the factors of the production. Thus, the impact of tax composition on economic growth is ambiguous and inconclusive. Hence, the present study not only finds out the relationship between tax structure and economic growth, but also tries to calculate the extent of influence of different kinds of tax on growth both in short run and long run by employing Panel **Auto Regressive Distributed Lag** (PARDL) model proposed by, Pesaran, Shin, and Smith (1997, 1999).

In India, tax structure at union level is quite different from state level. The contribution of tax revenue collected from state's own taxes is very significant in shaping state's economy. So is in case of states' non tax revenue. Again, contribution of central tax to the state's treasury is though minimal rather significant. Available literatures confining the study to the union level do not explore the real picture of the state taxation system and their economic growth nexus. This study, according to our knowledge, is the first state level study in India in the context of tax structure and economic growth. The present study classifies tax structure of fourteen general category states into three categories like, state's own direct taxes, state's own indirect taxes, and central tax share and analyse the growth effects of these three categories with the help of PARDL model for a panel of fourteen general category states out of eighteen general category states in India during the period from 1980 to 2016.

The organisation of the paper is as follows. In the next section, the paper discusses both theoretical and empirical evidence on the link between tax and economic growth. Section 3 describes the data and methodology used in this study. Section 4 presents the empirical results. In section 5, the paper concludes with findings.

2. Literature review

In the context of tax and growth association, most of the studies are available form USA, European countries, and OECD countries. In comparison to those studies, the number is less in India. So, there is much scope for the researchers to do work on this topic for India and to add productive work to the existing literature.

2.1. Theoretical literatures

Many economic theories have diverse opinion on controversial relationship between tax structure and economic growth and have also put forwarded different mechanisms by which the former influences later. As per the neoclassical growth models advocated by Solow, 1956; Swan, 1956, the changes in the tax rates can bring changes in intercept of the steady state growth rate as the taxation is taken as the exogenous variable in the growth model. Hence its impact on the long run growth rate is transitory in nature. Oppose to the neoclassical model, Barro (1990) noticed the permanent and positive impact of the government expenditure on the marginal productivity of physical capital in his endogenous growth model where fiscal policy is incorporated in the production function endogenously. However, the model of Barro (1990) had little explanation for the nexus between tax structure and economic growth. The two sector endogenous growth model of Lucas (1990) where human capital and time is considered as internal factors concluded that growth rate is invariant to the changes in capital tax rates given fixed labour supply. By using one sector endogenous growth model with only human capital in the production function for US economy, Kim (1998) investigated the ascendancy of the several types of taxes and their rates on the long run economic growth rate. He advocated the removal of all kind of taxes as the removal would increase the growth rate by 0.85 percent. The endogenous growth model attributed by Mendoza et al., 1997 investigated the effect of the marginal tax rate of human capital, physical capital and consumption on economic growth. The model noticed indirect effect of consumption tax (for instance VAT) on growth with an alteration in

capital to labour ratio through changes in labour-leisure choices. However, direct effect of taxation of physical and human capital on growth is predicted in the model. Supporting the predictive model of Mendoza et al. (1997), Arnold et al. (2011) were of opinion that the higher the consumption tax would make the consumer goods more expensive. This can reduce labour supply as the reward of the labours will be lesser. Cullen and Gordon (2002) incorporated the effect of tax structure on growth with help of the idea of Schumpeter (1942) which emphasized the entrepreneurial activities of innovation beneficial to economic growth. According to the literature of Cullen and Gordon (2002), there is a tax stimulus to being self-employed (risk taking behavior) when the effective tax rate on business income is less than the tax rate on wage and salary income. This would occur when the corporate tax rate is below marginal personal tax rates. Therefore, economic theory on the present context would conclude that tax structure including all kind of taxes and tax finances has the distortionary effect on growth. However, the extent of effect hinges on the many factors. But, one of the lacunas in these theoretical models is that the estimated long-run equation is actually a production function and not a long-run growth equation Rao (2006). Hence, the fundamental relationship between tax structure and economic growth has been neglected. That's why; our paper has addressed this issue by incorporating the growth variables (GSDP and PCGSDP) in the estimating equations and has analysed the said relationship empirically.

2.2. Empirical literatures

2.2.1. State level studies

Helms (1985) examines the impact of state and local taxes on economic growth by using a pooled cross-sectional data from 48 states. He finds that an increase in the state and local taxes significantly retard economic growth when the revenue is used for transfer payments. On the other hand, when the revenue is utilized for public services such as education, highways, public health, and law and administration, a favourable impact falls on location and production decisions which counterbalance the bad effects of associated taxes. Ferete and Dhalby (2012) examine the impact of the provincial government's tax rates on economic growth in Canada. The study uses panel data covering the period 1977-2006. The authors view that a higher provincial statutory corporate income tax rate lowers the private investment and then the economic growth. The study also finds that provincial investment and growth increase when the government switches over from a retail sales tax to a sales tax that is harmonized with the federal value-added sales tax.

2.2.2. Studies on developed countries

Widmalm (2001), studying 23 OECD countries during 1965-1990, remarks that revenue raised from taxing personal income is negatively related to growth, whereas consumption tax is growth-enhancing. Similarly, Lee and Gordon (2005) examine the link between statutory corporate tax and growth using cross-country data from 70 countries during the period 1970-1997 and find that there is a significant negative relationship between these two. Arnold (2008) uses panel growth regression for 21 OECD countries during 1971-2004 to investigate the relationship between tax structure and economic growth. He opines that corporate income tax has negative link with growth. He also documents a significant

positive effect of consumption and property taxes on economic growth. By using AK model with public expenditure and elasticity of labour supply for US economy, Turnovsky (2000) noticed that an increase in capital and income tax rate of 12 percentage points could diminish growth by around 0.5 percentage points, while a reduction of capital and income tax rates each by 8 percentage points could increase the growth by 0.4 percentage points.

2.2.3. Studies on developing countries

Venkataraman and Urmi (2017) examine the impact of tax structure on economic growth in India by using disaggregated time series data during 1977-2015 and ARDL Bounds test approach. They find that, in the long run, personal income tax has no impact on economic growth, while there is significant positive effect of corporate income tax on economic growth. They further mention that excise duty has no statistically significant effect on economic growth in the long run, while customs duty has a significant positive impact on growth. Eugene and Abigail (2016) analyse the effect of tax policy on economic growth in Nigeria by using time series data spanning from 1994 to 2013 and view that there is significant positive relationship between indirect tax and economic growth. Ahmad et al. (2016) empirically investigate the relationship between total tax revenue and economic growth in Pakistan. They state that total tax revenue have significant negative effect on economic growth in long run, and direct taxes have positive effect on growth. Munir and Sulatn (2016) analyse the impact of taxes on economic growth in Pakistan during the period from 1976 to 2014. The results show that direct tax, sales tax, and tax on international trade are pro-growth taxes, while excise-duty negatively affects growth of Pakistan.

From the above studies on tax structure and economic growth, one difference is apparent between developed countries and developing countries and the difference is that, direct taxes such as corporation income tax exert positive impact on economic growth in developing countries, while they have negative effect on economic growth in developed countries. There is no empirical state level study available on the nexus between tax structure and economic growth in India. The present study is a preliminary attempt to address this issue.

3. Data and methodology

The present study uses panel data from fourteen general category states, namely Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamilnadu, Uttar Pradesh, and West Bengal in India covering the period 1980-2016. The data have been brought from Handbook of Statistics on Indian States published by Reserve Bank of India, Indian Public Finance Statistics published by Ministry of Finance under Government of India, and Economic and Political Weekly Research Foundation[1].Econometric techniques such as panel unit root test methods and panel ARDL model have been used for the estimation.

3.1. Depiction of the variables

Eight variables are used in the study, which are:

3.1.1 LNGSDP (Nominal Gross State Domestic Product) is dependent variable for the 1stmodel which plays as a proxy for economic growth.

3.1.2 LNPCGSDP (Per Capita Gross State Domestic Product) is dependent variable for the 2nd model which is taken as a proxy for economic growth.

3.1.3 LNPOP (Population) is the first independent variable. It is included in the model because of its plausible impact on economic growth. According to various finance commissions, population is a vital indicator for allocation of grants to the states which then influences economic growth of states. Population is positively related to growth.

3.1.4 LNCOTE (Capital Outlay) is the second independent variable which depicts how much proportion of total expenditure is devoted to asset creation of the state. It has positive impact on growth.

3.1.5 LNGFDR (Gross Fiscal Deficit) is the third independent variable. It has been incorporated in the model because of its use as a parameter in FRBM act, which is a milestone fiscal policy in India. Gross fiscal deficit is inversely related to economic growth.

To examine the impact of tax structure on economic growth, the paper has clubbed all direct and indirect taxes into three categories for the present study. These categories are:

3.1.6 LNSODTRR (State's Own Direct Tax Revenue) is the fourth independent variable of our model. It includes all the direct taxes under the state's jurisdiction. It has negative effect on economic growth.

3.1.7 LNSOITR (State's Own Indirect Tax Revenue) is taken as fifth independent variable of our model. It includes all the indirect taxes under the state's jurisdiction. It has positive effect on economic growth.

3.1.8 LNCTS (Central Tax Share) is the last independent variable which refers to the share that a state gets from the central taxes such as corporation tax and personal income tax. It has negative effect on economic growth.

3.2 . Model specification

With a view to finding out relationship between tax structure and economic growth of 14 states over the period from 1980-81 to 2016-17, a plethora of panel or longitudinal techniques have been applied in this paper. This paper uses cross-section dependency tests, panel unit root tests both for homogeneous and heterogeneous cross sections, and finally panel ARDL model.

3.2.1. Panel cross-section dependence test

It is evidenced that addition of cross section dimension to the time series dimension gives an advantage of testing for stationarity, spurious regression, and cointegration by increasing the number of observations applied to the tests and thereby, improving the power of the test. Even so, the cross section dimension, however, raises some issues such as presence of the cross section dependency, ignoring which could lead to serious statistical consequences such as biased estimation, estimator efficiency loss, and invalid test statistics (Pesaran, 2004).Though it is typically assumed that errors in panel data model are cross-sectionally independent, especially when the cross section dimension (N) is large. There is, however, considerable evidence that cross-sectional dependence is often present in panel regression settings (Pesaran, 2004).Therefore, checking of cross dependency among the disturbance terms is inevitable since this study has low cross-sectional dimension.

Suppose a panel model is given as

$y_{it} = \beta'_{it} x_{it} + u_{it}$ (3.1)

For i = 1, 2, …, N

t = 1, 2, …, T

Where:
x_{it} is K dimensional column vector of regressors.β_i is cross section specific vectors of parameters.

The general null hypothesis is the presence of no cross-sectional dependence in error terms. Symbolically,

H_0: ρ_{ij} = cor (u_{it}, u_{jt}) = 0 for i≠j (3.2)

Where ρ_{ij} = pairwise correlation coefficients of OLS residuals.

3.2.1.1. Breusch-Pagan (B-P) (1980) LM test

In the Seemingly Unrelated Regression Equation (SURE) with N fixed and as T→ ∞, B-P (1980) suggest the Lagrange Multiplier (LM) test statistic for testing the null hypothesis specified in equation-3.2. The LM test statistics is

$$LM = \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} T_{ij} \hat{\rho}_{ij}^2 \rightarrow \chi^2 \frac{N(N-1)}{2} \quad (3.3)$$

where ρ_{ij} is the vector of estimated correlation coefficient obtained from errors of the equation (3.1). The LM test follows asymptotic χ^2 distribution and does not require a particular ordering of cross section units. However, the test is not independent of shortcomings because the test is inappropriate in case of N→ ∞.

3.2.1.2. Pesaran (2004) scaled LM tests

Pesaran (2004) proposes a standardised version of the LM statistics which is applicable in large cross section dimension.

$$LM_S = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T_{ij} \hat{\rho}_{ij}^2 - 1) \quad (3.4)$$

LM_s is asymptotically standard normal as firstT_{ij} →∞ and N→ ∞ irrespective of orders. But the major lacuna of the present test is that it has size distortion for small T_{ij}, and the distortion gets worse for larger N.

3.2.1.3. Pesaran (2004) CD test

In order to address the problems of size distortion, Pesaran (2004) put forwarded an alternative statistic namely Pesaran (2004) CD test. The CD test is applicable to a variety of panel models including stationarity and unit root dynamic heterogeneous panels with short T and large N. The proposed test is based on an average of pairwise correlation coefficients of OLS residuals from the individual regressions in the panel rather that their squares as in B-P (1980) LM test and Pesaran (2004) scaled LM test.

$$LM_{BC} = \sqrt{\frac{1}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}(T_{ij}\,\hat{\rho}_{ij}^{2} - 1) - \frac{N}{2(T-1)} \rightarrow \mathrm{N}\,(0, 1) \qquad (3.5)$$

Further, Pesaran (2004) points out that for a wide array of panel data models, the mean of CD is exactly equal to zero for all $T_{ij} >$ K+1 and for all N. As a result, the CD test is supposed to have good properties for both small N and T_{ij}.

3.2.1.4. Baltagi, Feng, and Kao (2012)

Baltagi, Feng, and Kao (2012) offer a simple asymptotic bias correction for the scaled LM test statistic:

$$CD_P = \sqrt{\frac{2}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N} T_{ij}\,\hat{\rho}_{ij} \rightarrow \mathrm{N}\,(0, 1) \qquad (3.6)$$

For a fixed effects homogeneous panel data model with $T_{ij} \rightarrow \infty$, N $\rightarrow \infty$ and N / $T_{ij} \rightarrow C_{ij} \in (0, \infty)$, Baltagi et al. (2012) show that the scaled LM has an asymptotic bias term of N / (2(T-1)), resulting from the incidental parameters problem. Because, for small T_{ij}, the within residuals are estimated imprecisely.

3.3 . Panel unit root tests allowing for cross-sectional dependence

A vast number of panel unit root tests have been proposed in the literature in order to test unit root in the presence of cross section dependence. All these tests use orthogonalization kind procedure to do away with the cross dependency of the series asymptotically prior to the use of standard unit root tests to transferred series. However, Pesaran (2007) suggests a simpler way of eliminating cross-sectional dependence. He applies the usual Augmented Dickey Fuller (ADF) test with addition of the cross-section averages of lagged levels and first-differences of the individual series. The Pesaran CADF test can be written as

$$\Delta y_{it} = \alpha_i + \rho_i^{*} y_{i,t-1} + d_0 \bar{y}_{t-1} + d_1 \Delta \bar{y}_t + \epsilon_{it} \qquad (3.7)$$

Where, $\bar{y}_t$ is the average at time t of all N observations. The cross-sectional dependence is justified through a factor structure by the presence of the lagged cross-sectional average and its first difference. The Pesaran CADF test is

$$\mathrm{CADF} = t_i\,(\mathrm{N}, \mathrm{T}) = \frac{\Delta y_i'\, \bar{M}_w y_{i,-1}}{\hat{\delta}_j\,(y_{i,-1}'\, \bar{M}_w y_{i,-1})} \qquad (3.8)$$

Where

$\Delta y_i = (\Delta y_{i,1}, \Delta y_{i,2}, \ldots, \Delta y_{i,T})'$, $y_{i,-1} = (y_{i,0}, y_{i,1}, \ldots, y_{i,T-1})'$, $\tau_T = (1, 1, \ldots, 1)$

$M_w = I_T - \bar{W}\,(\bar{W}'\bar{W})^{-1}\bar{W}'$, $\bar{W} = (\tau, \Delta\bar{y}, \bar{y}_{-1})$

$\Delta\bar{y} = (\Delta\bar{y}_1, \Delta\bar{y}_2, \ldots, \Delta\bar{y}_T)'$, $\bar{y}_{-1} = (\bar{y}_0, \bar{y}_1, \ldots, \bar{y}_{T-1})'$

$\hat{\sigma}_i^2 = \frac{\Delta y_i'\, M_{i,w}\, \Delta y_i}{T-4}$

And $M_{i,w} = I_T - G_i\,(G_i' G_i)^{-1} G_i'$, and $G_i = (\bar{W}, y_{i-1})$.

3.3.2. Specification of Panel ARDL Model

This paper uses panel autoregressive distributed lag model (PARDL) for estimating long run as well as short run relationship between the variables of interest. The panel data analysis involves model having large time span (T) and large cross sections (N) for analysis, due to availability of data with greater frequency. However, the asymptotic large N and large T dynamics panel data are different from traditional asymptotic small T and large N panel data. Usually, panel data with small T and large N is contingent upon fixed and random effect estimation or generalised method of moments (GMM) for its estimation. These estimators involve pooling individual groups and allowing only the intercept to differ across the groups. If the slope coefficients are in fact not identical, these estimators produce inconsistent and potentially misleading results. With an increase in time series dimension T in cross section N, Pesaran, Shin, and Smith (1997, 1999) propose two important techniques to estimate non-stationary dynamic panels in which the parameters are heterogeneous across the groups. The techniques are the mean group (MG) and pooled mean-group (PGM) estimators.

An ARDL model with ARDL (p,q_s) approach, where P being lags of dependent variable and q being lags of independent variable can unrestrictedly be specified as

$$Y_{it} = \sum_{j=1}^{p} \lambda_{ij} Y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} X_{i,t-j} + \mu_i + \epsilon_{it} \quad (3.9)$$

Where i = 1, 2, 3..., N (no. of groups), T = 1, 2, 3,..., T (no. of periods)

X_{it} is a k×1 vector of explanatory variables. δ_{it} are the k×1 coefficients of vector λ_{ij} are the scalars, μ_i is group specific effect.

T must be large enough so that it can be fitted to each group separately. Moreover, time and other fixed regressors can be included. So far as the empirical analysis of the paper concerned here, LNGSDP and LNPCGSDP are used in place of Y separately. LNPOP, LNCOTE, LNGFDR are used as controlled variables. X_i represents LNSODTRR, LNSOITRR, and LNCTR that are used as explanatory variables. They are used individually in order to avoid multicollinearity effect among them.

If the variables in equation (3.7) are I (1) and cointegrated, the error term should follow I (0) order in all cross-sections to have long-run equilibrium relationship between the variables. The principal feature of cointegrated variables is that their time paths are influenced by the extent of any deviation from long-run equilibrium. This explains that an error correction model in the short-run dynamics of the variables in the system can be influenced by the deviation from equilibrium. Hence, it is necessary to reparametrize equation (3.7) into an error correction equation.

$$\Delta y_{it} = \phi_i(y_{i,t-1} - \theta_i' X_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{i,t-1} + \sum_{j=0}^{q-1} \delta_{ij}^{'*} \Delta X_{i,t-j} + \mu_i + \epsilon_{it} \quad (3.10)$$

The parameter ϕi is the coefficient of error-correcting term resembling the speed of adjustment from short run dynamics to long run equilibrium. If ϕi = 0, there would be no evidence for a long-run relationship. The term is supposed to be statistically negative.

3.3.2.1. Mean Group (MG) estimators

In case of dynamic heterogeneous panel estimation in which there is large N and large T, two extreme approaches have been used. One is fixed effect estimators in which the time series data for each group are pooled and only intercept terms are allowed to vary across N. However, the estimator seldom produces invalid estimation results. On the Other extreme, MG estimator proposed by Pesaran and Smith (1995) advocates that the model could be fitted separately for each group and simple arithmetic average of the coefficients could be calculated. Hence, MG removes any restriction and allows to vary in both short and long run coefficient. However, the necessary condition for the consistency and validity of this approach is to have large T.

3.3.2.2. Pooled Mean Group (PMG) estimator

The main feature of the PMG proposed by Pesaran, Smith, and Shin (1947, 1999)is that it allows short run coefficients, including the intercepts, the error correction term, and error variances to become heterogeneous across N. However, the long run coefficients are restricted to become homogeneous across countries. This approach is particularly used when there is the expectation of similar long run equilibrium between variables across N. The PMG combines both pooling and averaging. Since the equation is non-linear in the parameters, Pesaran, Shin, and Smith (1999) develop maximum likelihood method to estimate parameter.

However, in order to measure efficiency and consistency among the estimators (PMG and MG), Hausman Test would be followed. The null hypothesis of Hausman Test is that the PMG estimator is more efficient and consistent than that of MG estimator.

4. Empirical results

4.1. Preliminary analysis

Table 1. *Results of the compound annual growth rate (numbers are expressed in percentage)*

Variable	1980-1991 (1st period)	1992-2005 (2nd period)	2006-2016 (3rd period)
GSDP	13.09	10.87	13.50
PCGSDP	11.10	09.41	12.27
SODTR	1.83	2.02	-2.52
SOITR	0.42	0.07	-0.16
CTS	-1.20	-0.73	0.90

Source: Author's calculation.

In a view to have the preliminary understanding about tax composition and economic growth, this paper estimates compound annual growth rate of the concerned variables for three periods. One thing is to be noted here that the classification of the periods on the basis of economic reforms (1991) and Fiscal responsibility Act (2005) is for better preliminary analysis. Comparing 1st period (1980-1991) and 2nd period (1992-2005), the Table 1 shows that when the revenue collection from the state's own direct taxes increases from 1.83 to 2.02, the compound annual growth rate of both GSDP and per capita GSDP decline from 13.09 to 10.87 and from 11.10 to 09.41 respectively. Hence, it establishes an inverse

relationship between direct taxes and GSDP and between direct taxes and per capita GSDP. Again, there exists a similar link between central tax share and GSDP and between central tax share and per capita GSDP because as the central tax share rise from -1.20 to -0.73, the compound annual growth rate of both GSDP and per capita GSDP decline. However, a direct relationship exists between indirect tax and both dependent variables i.e. GSDP and per capita GSDP. On the other hand, comparing 2nd period (1992-2005) and 3rd period (2006-2016) the study finds contrasting results between independent and dependent variable. When the revenue collection from state's indirect taxes drops from 0.07 to -0.16, the compound annual growth rate both GSDP and per capita GSDP increase from 10.87 to 13.50 and from 09.41 to 12.27 respectively. Similarly, there is a contrasting relationship between central tax share and two dependent variables because when central tax share rises, both GSDP and PCGSDP increase, which is theoretically invalid. Yet, relationship between direct tax and economic growth proxied as both GSDP and per capita GSDP remain intact. When the direct tax falls from 2.02 to -2.52, both GSDP and per capita GSDP increase. Therefore, the table finds that relationship between economic growth and three tax variables is theoretically consistent in the 2nd period (1992-2005). But, it is conflicting to some extent in the 3rd period (2006-2016). That's why the study goes for the further empirical investigation of relationship between tax structure and economic growth through panel ARDL technique.

4.2. Result of residual cross-section dependence tests

The Table 2 displaying the result of residual cross-section dependence test informs that the B-P LM statistics, Pesaran LM statistic, Bias-corrected statistics, and Pesaran CD test are statistically significant at 1% level of significance. As a result, the tests fail to accept the pairwise correlation coefficient of OLS residuals which are zero. Hence, the existence of cross sections dependency makes the relationship between the variables in question not independent across the states.

Table 2. *Result of residual cross-section dependence tests*

Test	Statistics	Probability
B-P LM	1064.149	0.000
Pesaran LM	71.096	0.000
Bias-Corrected	70.902	0.000
Pesaran CD	10.288	0.000

Note: The test employs centred correlations computed from pairwise samples. Total d.f is 91.
Source: Author's calculation.

4.3. Result of Pesaran CADF Test

Table 3. *Result of Pesaran CADF Test*

	Constant		Constant + Trend	
Variables	T bar	P value	T bar	P value
LNGSDP	-1.877	0.335	-1.979	0.937
ΔLNGSDP	-3.365***	0.000	-3.569***	0.000
LNPCGSDP	-1.835	0.397	-1.765	0.993
ΔLNPCGSDP	-3.309***	0.000	-3.581***	0.000
LNSODTRR	-2.882***	0.000	-2.860**	0.014
LNSOITRR	-1.956	0.230	-2.471	0.289
ΔLNSOITRR	-3.738***	0.000	-3.734***	0.000
LNCTSR	-1.926	0.268	-2.335	0.508
ΔLNCTSR	-4.025***	0.000	-3.996***	0.000

Variables	Constant		Constant + Trend	
	T bar	P value	T bar	P value
LNPOP	-1.459	0.892	-1.224	1.000
ΔLNPOP	-2.228**	0.034	-2.912***	0.007
LNCOTE	-2.162*	0.059	-2.407	0.338
ΔLNCOTE	-	-	-3.588***	0.000
LNGFDR	-2.762***	0.000	-2.947***	0.005

Note: CADF equation with constant has the critical value of -2.440, -2.250, and -2.140 at 1%, 5%, and 10% level of significance respectively. Again, CADF equation with constant and trend has the critical value of -2.930, -2.760, and -2.660 at 1%, 5%, and 10% level of significance respectively. ***, ** and * indicate 1%, 5%, and 10% level of significance respectively. Δ indicates first difference.
Source: Author's calculation.

The Table 3 shows that the null of existence of unit root in the series is not statistically accepted at the first difference for the variables of LNGSDP, LNPCGSDP, LNSOITRR, LNCTSR, and LNPOP. Hence, these said variables are integrated of order one i.e. I (1). On the other hand, the variables such as LNSODTRR and LNGFDR are stationary at level. LNCOTE is integrated at level in model with constant while it is stationary in its first difference in model with constant and trend. The major conclusion from Pesaran CADF test is that all the variables are either integrated at level or its first difference, and none of the variables is of order two or more. Hence, all the series satisfy the precondition of the Panel ARDL model.

4.4. Result of Panel ARDL model

The conclusion drawn from the panel unit root tests depicts that all the variables are stationary either at level or at first difference i.e. I (1). But none of the variables are integrated at either second difference or more than that. Hence, the variables included in the model satisfy the criteria of panel ARDL model. Endogenously, selection of optimal model with Hannan-Quinn criteria makes the ARDL model self-reliant to lag selection bias. The model which carries the lowest value of the H-Q criteria would be selected as the best model for the concerned test. In the present study, ARDL (2, 1, 1, 1, 1) is the optimal model for all the ARDL models.

4.4.1. The result of Panel ARDL model (economic growth and state own direct tax revenue)

In Table 4, it is noticed that the error correction term i.e. ECT(-1) is negative and significant with an amount of 0.042 in both the models. It connotes the convergence tendency of the model towards the long-run equilibrium with a speed of 4 percent correction in each year. In these models, all the variables bring out expected impact on economic growth. The population and capital outlay has positive association with economic growth in long run. Increase in population growth would add the labours in the productive supply chain and thereby create value addition for economic growth. The capital outlay creates asset which fetches regular income to the economy. Moreover, capital outlay to total expenditure shows the quality of public expenditure. A higher capital outlay would stimulate the tempo of economic growth. The relationship between gross fiscal deficit and economic growth is found negative and significant at 1%level of significance since high fiscal deficit would limit the loanable fund for private sector. Hence, this drives out private players out of the economic system without commensurate investment from public sector. Finally, the

state-owned direct tax revenue has positive and negative impact on economic growth in short run and in long run respectively. This interesting result is due to the fact that, in short run, an increase in revenue from state-owned direct taxes can be invested for productive purposes. However, this revenue driven growth would not last for longer period because higher direct taxes create distortionary effects on labour supply, saving rate, and investment rate thereby impinging economic growth (Engen and Skinner, 1996; Kesner-Skreb, 2002). Hence, the models detect both positive and negative relation of the state-owned direct tax revenue with economic growth.

Table 4. *Result of panel ARDL Model (LNSODTR as independent variable)*

	Model-1: Dependent Variable: D(LNGSDP)		Model-2: Dependent Variable: D(LNPCGSDP)	
Regressors	Coefficient	Standard Error	Coefficient	Standard Error
Long Run Equation				
LNSODTR	-0.790***	0.141	-0.788***	0.143
LNPOP	9.672***	0.395	8.679***	0.398
LNCOTE	0.378***	0.066	0.382***	0.067
LNGFDR	-1.075***	0.156	-1.074***	0.158
Short Run Equation				
ECT (-1)	-0.042***	0.014	-0.042***	0.014
D(LNGSDP(-1))	-0.068	0.075	-0.067	0.075
D (LNSODTR)	0.069***	0.018	0.069***	0.018
D (LNPOP)	0.373	1.079	-0.638	1.080
D (LNCOTE)	-0.020	0.013	-0.020	0.013
D (LNGFDR)	0.009	0.012	0.009	0.012
C	-0.824**	0.322	-0.830**	0.321

Note: *** and ** show 1% and 5% level of significance respectively.
Source: Author's calculation.

4.4.2. The result of Panel ARDL model (economic growth and state own indirect tax revenue)

The negative and significant (-0.030) error correction term demonstrates that the short-run dynamics gets corrected at the rate of about 3% towards long-run equilibrium. In both the models, the impact of population, capital outlay, and fiscal deficit on economic growth is at par with the theoretical analysis and is found to be statistically significant at 1% level of significance in the long run. The impact of state-owned indirect tax revenue on economic growth is positive and significant with the value of 3.457 (in model-3) and of 3.488 (in model-4). It implies that responsiveness of state indirect tax to economic growth is elastic one because indirect taxes are non-distortionary taxes, which neither discourage saving rates nor investment in physical/ human capital (Jens Arnold, 2008). Moreover, being a major source of revenue for Indian states, the corpus is utilized for economic growth-enhancing factors. In short run, the coefficient of LNSOITRR is found to be insignificant.

Table 5. *Result of panel ARDL Model (LNSOITRR as independent variable)*

	Model-3 Dependent Variable: D(LNGSDP)		Model-4 Dependent Variable: D(LNPCGSDP)	
Regressors	Coefficient	Standard Error	Coefficient	Standard Error
Long Run Equation				
LNSOITRR	3.457***	1.333	3.488***	1.329
LNPOP	6.558***	0.668	5.612***	0.663
LNCOTE	0.495**	0.193	0.505***	0.193
LNGFDR	-1.920***	0.524	-1.921***	0.525

	Model-3 Dependent Variable: D(LNGSDP)		Model-4 Dependent Variable: D(LNPCGSDP)	
Regressors	Coefficient	Standard Error	Coefficient	Standard Error
Short Run Equation				
ECT (-1)	-0.030***	0.005	-0.030***	0.005
D(LNGSDP(-1))	-0.115	0.083	-0.113	0.083
D (LNSOITRR)	-0.027	0.035	-0.028	0.035
D (LNPOP)	-0.628	0.760	-1.641**	0.757
D (LNCOTE)	-0.017	0.013	-0.017	0.013
D (LNGFDR)	0.013	0.010	0.013	0.010
C	-0.622***	0.139	-0.638***	0.140

Note: *** and ** show 1% and 5% level of significance respectively.
Source: Author's calculation.

4.4.3. The result of Panel ARDL model (economic growth and central transfer to states)

The relationship between central tax share to the states and economic growth is found negative and insignificant both in short run and long run in both the models. The share that states receive from central taxes come from most of the direct taxes such as corporation tax, personal income tax, wealth tax, property tax, etc. which fetch distortionary and negative effect on labour supply and rate of investment in the economy. The impact is insignificant as it constitutes lesser share in total revenue of the concerned state (31.31% of total tax revenue).Other variables such as LNPOP and LNCOTE are significant and positive whereas the LNGFDR has negative significant impact on economic growth in the long run. The coefficient of ECT is negative and significant implying that the model converges to long run equilibrium.

Table 6. *Result of Panel ARDL model between growth and CTSR*

	Model-5 Dependent variable- D(LNGSDP)		Model-6 Dependent variable- D(LNPCGSDP)	
Regressors	Coefficient	Standard Error	Coefficient	Standard Error
Long-run Equation				
LNCTSR	-0.065	0.744	-0.062	0.743
LNPOP	6.204***	0.929	5.286***	0.917
LNCOTE	0.730**	0.288	0.732**	0.286
LNGFDR	-2.109	0.727	-2.102***	0.722
Short-run Equation				
ECT (-1)	-0.024***	0.004	-0.024***	0.004
D(LNGSDP(-1))	-0.108	0.078	-0.107	0.078
D (LNCTSR)	-0.048	0.032	-0.048	0.032
D (LNPOP)	-0.674	0.713	-1.684**	0.720
D (LNCOTE)	-0.019	0.013	-0.019	0.013
D (LNGFDR)	0.006	0.010	0.006	0.010
C	-0.091***	0.042	-0.103**	0.044

Note: *** and ** show 1% and 5% level of significance respectively.
Source: Author's calculation.

5. Conclusion

The present study examines the impact of tax structure on economic growth in fourteen general category states of India during 1980-81 to 2016-17. The study uses the panel ARDL model to investigate the short-run and long-run relationship between tax structure and economic growth. The study finds that different taxes have different growth effects. State's

own direct taxes are negatively and significantly associated to economic growth. Due to distortionary nature of direct taxes, variables such as labour supply, saving rate, and investment rate were adversely affected and thereby reduced economic growth. State's own indirect taxes positively influence economic growth because of its non-distortionary effects on economic system and productive use on physical and human capital. Therefore, the results are consistent with some of the previous studies viz. Widmalm (2001), Arnold (2008), Ferete and Dhalby (2012), and Venkataraman and Urmi (2017). Further, no relationship between central tax share and economic growth has been revealed by the paper. The paper, therefore, concludes that the state governments should focus more on indirect taxes in lieu of direct taxes as far as economic growth is concerned. Further, the policymakers must be circumspect at the time of framing tax policies for long-term economic growth.

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Note

(1) The study has incorporated the latest actual data available on important macro and fiscal variables in India up to 2016-17. Information on the required data after 2016-17 is either revised estimates or provisional estimates and experience shows that they vary substantially from actual figures, and hence their incorporation will be misleading.

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Banking Sector Reforms and the Goals of Nationalised Commercial Banks in India

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Abstract. *The main aim of the study is to analyse the role of Nationalised Commercial Bank (NCB) on economic growth and development in India during pre and post-reform periods (Restrictive and liberalised regime). The study also aims to analyse the performances and associations of nationalised commercial banks with the RBI in the same period. For this purpose, the study first uses Augmented-Dickey Fuller unit root test. After assessing stationary conditions, the study uses Engel-Granger Causality test and Trend line analysis. Based on the empirical results, the study found that the role of NCB on economic growth is higher in the post-reform period compared to the pre-reform period. But their role in poverty eradication and employment generation is less in the post-reform period even though the average GDP growth rate is high in the post-reform period. Similarly, the performances of NCBs are also declining due to the increasing trend in their NPAs. The study also found that the monetary policy is not much effective in India, especially after 2000 where fall in the interest rate failed to influence GDP. So the study strongly recommended frequent interference and instructions of RBI to enhance the performances of NCBs and the effectiveness of monetary policy to achieve macroeconomic goals.*

Keywords: monetary policy, non-performing asset, money supply, granger causality, poverty, unemployment, GDP growth.

JEL Classification: E31, E51, E52, E58, O11.

1. Introduction

For the past seven decades, Indian Economy experienced radical changes on almost all spheres. Among all the changes, policy's relating to inwardness to openness occupies significance not only in social science research also on the operation and functions of various sectors of the economy. Of which, the banking sector plays a network role in impelling all the sectors of the economy and promoting overall economic growth (GDP) and development (standard of living) of the nation.

Structural changes and gradual improvements take place in the banking sector since the nationalisation of the Reserve Bank of India in 1949. Next two decades until 1969, the role of commercial banks in economic growth and development were too limited, less focused and neglected the objectives of the planning commission. From 1949 to 69, most of the banks were controlled by big business houses and politicians. The agriculture sector, small-scale industries, rural and semi-urban areas were totally neglected. Banks were operated neither focusing on growth nor on economic development.

To achieve the objectives of the planning commission and to promote balanced development, sixteen banks were nationalised in 1969 and six more were nationalised in 1980. Since then, the nationalised banks were controlled and regulated by the RBI in accordance with the objectives of the planning commission. Due to which, the performances of the overall banking system were dropped down and many banks were eroded. This downfall in the banking system continues until the faced BOP crisis in 1991.

To come out from the economic crisis, the government of India had initiated reforms in almost all the sectors in 1991, so-called structural adjustment measures popularly known as Liberalisation, Privatisation, and Globalisation (LPG). Even though the reform measures emphasised on all the sectors, the GOI mainly focused on four major grounds, namely; Industrial Sector Reforms, Financial Sector Reforms (incl., Banking sector Reforms), Reforms in Foreign Investment and Reforms in Foreign Trade.

A substantial part of the agenda for reforms of the Indian financial sector since 1991 has related to the problems facing the public sector banks, which have dominated commercial banking in India for the past several decades. Despite impressive widening and deepening of the financial system, there was no denying fact that the banks had not grown into sound, vibrant financial institutions, so much so that by 1990 there was serious concern about the poor financial condition of public sector banks most of which had become unprofitable, under-capitalised and burdened with unsustainable levels of non-performing advances on their book (Patel, 1997).

To promote and strengthen banking institution in India, a lot of initiatives were taken under economic reforms. Especially Government of India set up a committee under the Chairmanship of Narasimham in 1991 (The Committee on Financial System) and 1998 (Banking Sector Reforms). Narasimham Committee on financial system submitted its report to the finance ministry in 1991 and most of the recommendations are implemented under financial sector reforms. Again in 1998, the government of India set up a committee on Banking Sector Reforms under the Chairmanship of Narasimham. To review the outcome of financial sector reforms and recommended further improvements

in the banking system. Major recommendations of both the committees to the government are to:

- Develop two or more banks to be international in character.
- Reduce SLR and CRR as less as possible.
- Provide more autonomy and flexibility to commercial banks.
- Deregulate interest rate and removal of concessional interest rate.
- Reduce priority lending from 40 percent to 10 percent.
- Diverse banking activities into non-banking functions.
- Liberalise Banking License.
- Access to raise funds from capital markets.
- Merge strong banks and closing weak banks and unviable banks.
- Introduce new and higher norms for capital adequacy.
- Strengthen the legal framework for recovery.
- Abandon budgetary support.
- Permit foreign banks for competitive service.

To promote profitability, efficiency and competitiveness in the banking system, Government of India (GOI) has accepted almost all the above recommendations and was implemented in 1991 and 1998. Against these background, the present study attempts to analyse the role and performances of nationalised commercial banks in India on three major grounds. Firstly, Role of nationalised banks on economic growth and development during pre (before 1991) and post banking/financial sector reforms (after 1991). Secondly, Assessing the performances of nationalised commercial banks during pre and post banking sector reforms using three major indicators like NPAs, profitability and loans and advances. Finally, exploring the effectiveness of monetary policy in achieving the goals of RBI during pre and post banking sector reforms.

2. Literature review

It is observed from the background that there are two main issues needs to be addressed in the literature review. One is the trends in NPA and performances of nationalised commercial banks during pre and post financial sector reforms in India. The other is the effectiveness of monetary policy and the banking system in India after banking sector reforms, especially after adequate autonomy was given to public sector banks in India since the 90s.

Many of the well-established nationalised banks suffer from a severe identity crisis and require business, not restructuring or just financial support from the government. Finance ministry must ascertain the best use of public money and also they have to clarify the role and purpose of nationalised public sector banks (Roy et al., 2018). Over the last few years, the asset situation of nationalised banks in India was totally distressed and the NPA levels have reached an all-time high.

Bhattacharya and Sivasubramanian (2001) examined the consequences of the banking sector reforms in India which were an integral part of the liberalisation process of the economy in 1991. The study observed that, in the post-reform period, investment in

government securities by banks has remained persistently high and there has been a significant reduction in the flow of credit (as a proportion of deposits) to the real sectors of the economy. The study also found that the significant changes in the flow of credit to various groups and sectors within the economy, some of which might be thought not to be in conformity with the stated social goals of the government.

Rajeshwari and Harsh Vardhan (2017) compared the banking crisis in India during the 90s with the global financial crisis in 2008. They found that the delay in recognition and late action to control NPA and credit boom causes the financial crisis. The study suggested appropriate legal framework and good governance can solve the problem of nonperforming assets in India.

Roy and Samantha (2017) examined the causes and consequences of NPA in public sector banks in India. The study found an inverse relationship between NPA and profit of PSBs. Due to which, the PSBs are not interested to offer credit for priority lending purposes. For stability of PSBs, the study suggested careful consideration before granting loans through adequate repayment capabilities of the borrowers.

Rathore, Sangeetha and Sunitha (2016) analysed the impact of NPA in the Indian Economy. The main aim of this study was to observe the causes of NPA of scheduled commercial banks in India and suggest suitable policies to resolve the issues in the banking system. The study observed that the ineffective recovery methods, failure in recognising the growth of NPA and failure in prompt action against the defaulters aggravated NPAs in India. To resolve this issue, the study strongly recommended compromise proposal, technical write off, one-time settlement scheme and setting proper dispute recovery tribunals.

Oliver Wyman (2017) observed that the extent of NPAs of nationalised banks in India is worse than those seen in Italy, Greece and Portugal at the height of the global financial crisis of 2008-10. The annualised growth rate of NPAs over the last six years has been nearly 30 percent. NPAs have been mostly concentrated in the nationalised banks whose gross non-performing assets have grown from 1 trillion Rupees in 2012 to 6.2 trillion in 2017.

Public sector banks are investing disproportionately huge sums of their investment in government securities, which is more than the requirements of SLR. This steered to misuse of banking sector resource to crowd out investors in the real sector. This also created an accumulation of liquidity in the banking system, stagnation in the real sector and starvation in credit creation (Majumdar, 1998). Since the 1990s, India has experienced severe problems in the financial system. In India, it is the fiscal budgetary system that is locked in a debt-trap and inflexible commitments that lay large claims on the funds of the banking system (Swamy, 2005).

Saibal Ghosh (2006) gave two important implications from his empirical analysis of monetary policy and bank behavior in India. The first implication pointed out that the prudential role in influencing the lending decisions of the bank. Specifically, the capital adequacy ratios have made banks more focus on the risk-return profile of loans, since additional lending permits additional capital to adhere to the stipulated capital adequacy

norms. The implication indicated that the bigger banks are able to protect their loan portfolio from monetary contraction. The flip side of banking sector reforms has overstated its impact by neglecting unfair practices of banking services. Only strong and high net worth corporates in the organised sector are good enough for raising funds from nationalised banks at low-interest rates and the small borrowers are neglected in the liberalised investment. There is no doubt that the banking sector reforms gave more autonomy of nationalised banks, also it creates deficiencies in terms of productivity, proper staging, controlling over dues and NPAs. So the aims and the larger objectives of commercial banking in India appear to have gone haywire (Joshi, 1999).

Hutchison, Rajeswari and Nirvikar (2010) investigated the applicability of the discretionary monetary rule of the Reserve Bank of India in relation to Taylor-type rule. The study estimated an exchange-rate-augmented Taylor rule for India for a period of 28 years from 1980 to 2008. The study compares monetary policy effects during the pre- and post-liberalisation periods in order to capture the potential impact of macroeconomic structural changes on the RBI's monetary policy conduct. The study found that the output gap appears to be important to RBI rather than consumer price inflation and exchange rate changes.

Ray, Joshi and Saggar (1998) explored the monetary transmission mechanism in the liberalisational era in the context of financial sector reforms. The study tried to examine the role of interest rate and exchange rate in the conduct of monetary policy. The long-run relationship between money, prices, output, and the exchange rate is observed. The study found that the Interest rates and exchange rates are seen to be endogenously determined since financial sector reforms and it increases the possibility of the change in transmission mechanism following the advent of financial sector reforms.

Numerous measures were taken to enhance the effectiveness of monetary policy in India under economic reforms and these include improvement in the payment and settlement systems, improvement of a secondary market in government securities with portfolio diversification in the interest of the investor, reduction in non-performing assets and reduction in the overall transactions costs. In recent times, the RBI initiated several steps to develop the money market. Financial sector reforms and banking sector reforms may not have the desired results with commendable fiscal adjustment (Reddy, 1999)

Kanagasabapathy (2001) observed monetary policy underpinnings in India over several decades. He also points out the limitations and constraints in pursuing monetary policy objectives and throws light on current mainstream economic thinking and perspective in the context of the changing economic environment worldwide. The study found that the emergence of the interest rate as an efficient variable in the transmission mechanism, the RBI has begun placing greater reliance on Liquidity Adjustment Facility (LAF), especially OMO, Repo, Bank rate, etc., instead of the dependence on CRR alone. Another issue debated in the context of Central Bank autonomy is the separation of debt management and monetary management functions. At the same time, it would require a co-ordinated operation with monetary management to achieve a stable interest rate environment and market condition.

Monetary policy is increasingly focused on Dreze and Sen's view of growth mediated security helps to achieve monetary objectives including price stability and GDP growth will lead to alleviate poverty indirectly. Monetary and financial sector policies in India should perhaps be focusing increasingly on both inflation and GDP growth (Reddy, 2002).

Acharya, Shankar (2002) witnessed that the practice of monetary policy has clearly undergone a sea change during the nineties but it was more sophisticated later by giving further autonomy to money market institutions. However, several earlier problems and dilemmas were persisted even after the 90s. In particular, the effectiveness of monetary policy continued to be defective due to expansionary fiscal policy as well as an insufficiently responsive financial system.

Fathima and Iqbal (2003) tested the effectiveness of monetary policy and fiscal policy for economic growth in five Asian economies which includes India, Pakistan, Thailand, Malaysia and Indonesia. The study found unidirectional causality between monetary policy and economic growth in India.

Finally, the study has observed from the literature that almost all the scholastic work recommended several criteria's and rigidities to offer loans to their customers. Similarly, the majority of the studies recommended a strong legal framework to recover NPAs in India which is against the objectives of nationalised banks whose main aim is to enhance national welfare. The second part of the literature focuses on the effectiveness of monetary policy and the performances of banks after adequate autonomy via financial sector reforms in 1991 and banking sector reforms in 1998. It is also observed from the literature that there is no evidence that supports nationalised banks eradicated poverty, unemployment or GDP enhancement which are the prime objectives of nationalised banks in India. So the present study tries to fill the gap by analysing the role of nationalised commercial banks on economic growth and development during pre and post banking sector reforms in India. The study also tries to differentiate the effectiveness of monetary policy in achieving monetary goals during pre and post-reforms in the banking sector. The reason is to analyse how nationalised banks performed during restrictive and liberalised regime; how they contribute to the development and how effective the monetary policy in both the periods.

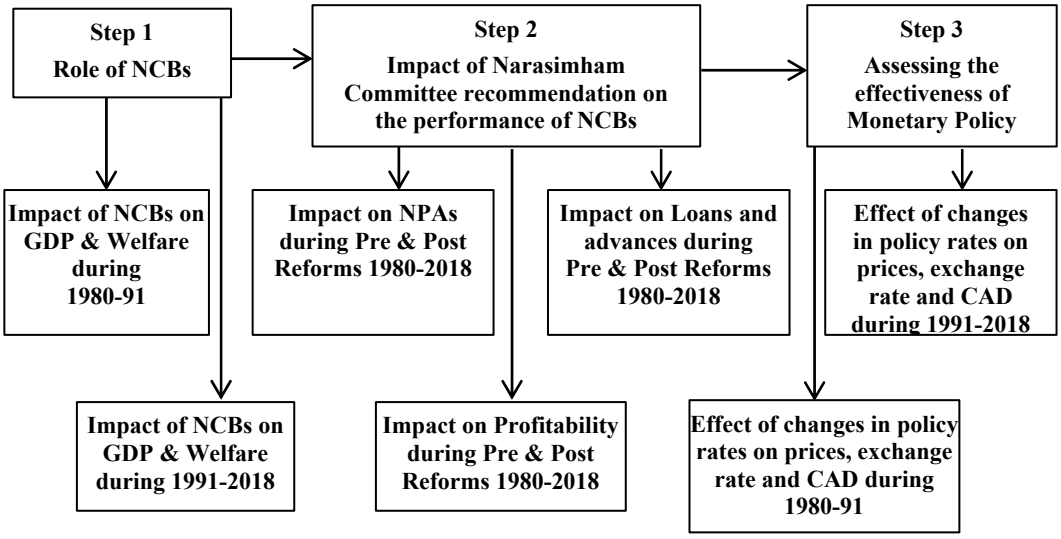
2.1. Significance of the study

Observation from oodles of past studies and present incidences, it is clear that the performance and operation of nationalised commercial banks in India failed to achieve the major objectives of neither monetary policy nor the fiscal policy. Recent studies and debates among the academicians raised doubts on the progressive role of nationalised commercial banks in influencing economic growth, economic development (domestic welfare) and achieving the objectives of the Central bank. Therefore, it is necessary to evaluate the impact of banking sector reforms on the performances of nationalised commercial banks in optimising their efficiency (reducing over dues and NPAs) and achieving social goals like reduction in unemployment, poverty, inequality and other welfare measures which are the prime objectives of nationalisation of commercial banks in India.

3. Conceptual framework

The conceptual framework of the present study focuses on three major grounds. First, the study will analyse the impact of nationalisation of commercial bank on economic growth and Standard of Living during pre-reform period (since nationalisation of commercial bank to before banking sector reforms were all the banks are controlled and regulated by the RBI) and post-reform periods (since banking sector reforms where autonomy and flexibility was given to nationalised commercial banks for efficiency). Second, the study will compare the performances of NCBs using NPA, Profitability and loans and advances to the public and banks. Third, the study will evaluate the effectiveness of RBI policies in achieving various monetary goals like price stability, exchange rate stability and Current Account Deficit (CAD).

3.1. Steps involved in the conceptual framework



3.2. Pre-Nationalisation of Commercial Bank (1949-1969)

Before nationalisation, commercial banks were controlled by a few big business houses. It neglects the objectives of RBI and planning commission like eradication of poverty, unemployment, inflation and standard of living. In order to achieve monetary and fiscal goals, the government of India passed Banking companies act in 1969 (Acquisition and transfer of undertakings), popularly known as Nationalisation of commercial banks. During this period, the objective of all the banks was only on a profit motive. They have enjoyed autonomy and flexibility without focusing on domestic welfare or priority lending.

3.3. Nationalisation of Commercial Bank in the pre-reform period (1969-1991)

To increase the role of commercial banks on domestic welfare, fourteen banks were nationalised in 1969 and six more were added in 1980 through the banking company's act

of 1969. Since then, all the nationalised banks were controlled and regulated accord to plan priorities. During this period, the nationalised banks were controlled by the RBI through regulated interest rates, priority lending, licensing for branch expansion and other credit control measures.

3.4. Narasimham Committee on Financial System in 1991

During the initial years of nationalisation, especially between 1969 to1985, the NCBs are directed to work on the objectives of RBI and finance ministry. Due to which, the profitability of NCBs started falling continuously in the 80s and some of them were eroded. To revive their performance and to increase their profitability, the government of India set up a committee under the leadership of former RBI governor Mr. Narasimham. The committee submitted its report to the government in 1990. Reduction in CRR & SLR, removal of priority lending and deregulation of interest rate are the important recommendations of the committee. Most of the recommendations are accepted and implemented by the GOI under economic reforms in 1991.

3.5. Narasimham Committee on Banking Sector Reforms in 1998

In1998, the GOI again set up a committee under the leadership of Narasimham to review the outcome of earlier recommendations and more recommendations for further improvements. The committee submitted its report in 1998 and recommended more focus on capital adequacy, merging big banks to international standard and more legal powers for recovery. This committee also recommends more private and foreign banks with further autonomy and freedom poses several challenges to the effectiveness of the monetary policy.

3.6. NCBs and economic growth & development

No one can deny the fact that the role of commercial banks is essential to enhance economic growth (GDP) and development (Welfare) in the economy, especially the role of NCBs is immense. Generally, all banking institutions have a direct correlation between loans and advances with GDP, which is not true in the case of economic welfare or standard of living. Literature survey shows that the NCBs can have a direct correlation between loans and advances with the standard of living because their loans and advances are controlled by the RBI according to plan priorities.

3.7. NPAs and profitability of NCBs

Most of the Directors of NCBs exposes their unhappiness on the nationalisation policies nation. They argued that the nationalisation policies and objectives are welfare based not on profit motives and it has a direct negative effect on the profitability of banking institutions. Banking statistics also proved that the percentage of NPAs has increased and profitability vanished from 1980 to 1990. Since the 1980s, NCBs constantly demanded more autonomy and flexibility for their revival. For these reasons, GOI formed a committee and implemented their recommendations which are just opposite to the objective of nationalisation of commercial banks.

3.8. The effectiveness of the monetary policy on prices, exchange rate and CAD

GOI has introduced a lot of reforms in the banking system according to Narasimham committee I & II. Since 1991, the NCBs are enjoying more freedom, flexibility and autonomy from RBI policies. Due to which the central bank's monetary policy action is not much effective as it was in the pre-reform period (1969-1990). In order to achieve various monetary and fiscal goals the RBI periodically changes its policy rates and achieves its objectives. Since 1991, after giving freedom and flexibility to banking institutions, the monetary policy is not that effective. For example, RBI has decreased bank rate from 9 percent in 2013 to 6 percent in 2017. But the impact of a fall in the interest rate on investment and GDP was significantly low (Between 6 to7 percent). This study assumes that non-cooperation of NCBs and other commercial banks may lead to the ineffectiveness of monetary policy in India.

From the background of Banking Sector Reforms and Nationalisation of Commercial Banks, the present study has given rise to several policy issues research questions. For instance: What is the role of Nationalised commercial Banks on GDP and domestic welfare during pre and post banking sector reforms? What are the trend and performances of NPAs, Loans and Advances to Public and Banks and the profitability of NCBs during pre and post-reforms? How far is the monetary policy effective in achieving its monetary goals during pre and post banking sector reforms?

It will be academically significant and occupationally useful research to find credible and reasonable answers to the above research questions. The relevance of the answer lays in providing insights from Banking Sector Reforms and NCBs. The motivation of the study is to arrive at these policy implications. In this context the present study attempts to analyse the impact of Nationalisation and Banking Sector Reforms on Economic Growth and Development in India. The study also tries to compare the trends in NPAs, Loans and profitability of NCBs during pre and post-reform periods. The study also aims to evaluate the effectiveness of monetary policy on price stability, exchange rate stability and current account deficit during pre and post banking sector reforms. Finally appropriate suggestions will be recommended to strengthen the profitability of banking institutions with the pronounced focus on GDP and welfare of the community.

4. Empirical model and estimation technique

The present study uses both quantitative and qualitative methods to assess the impact of nationalised Commercial Banks on economic growth, economic development and their performances through NPAs, Loans and profitability.

The second part of the study will analyse the effectiveness of the monetary policy, especially after adequate autonomy was given to scheduled commercial banks since the 90s. For this purpose, the study uses both descriptive statistics and empirical analysis. First, the study uses the Augmented Dickey-Fuller (ADF) test to check whether the data set is stationary or non-stationary. After checking stationary conditions, the study will apply Granger causality test for directional relationships. Simultaneously, trend line analysis will be applied to compare the impact of banks in the economy. All the estimations and analysis will be done by using E-Views software, 8th version.

The study first applies the ADF test for each of the variables by using the following sequential testing procedure.

$$\Delta X_t = \alpha + \beta X_{t-1} + \sum_{i=1}^{p} \varphi_i \Delta X_{t-1} + \lambda t + u_t \quad (1)$$

If β=0, meaning that the selected variable X_t contains unit root and the data is not stationary. Therefore, it is highly necessary to include t (deterministic) into the equation. In this analysis, if the trend is stationary and statistically significant, then only the study can perform the econometric technique for analysis.

In the Granger Causality test, the directional relationships between two variables are very sensitive which can be used efficiently by using an appropriate number of lags in the model. A number of lags for the test will be selected on the basis of AIC and SIC criterion. Inferences will be done on the basis of the results received from the Granger Causality test and trend line analysis. For example, if the beta coefficients become zero or less than the conventional value of 0.05 and the computed F statistic is low for the first hypothesis in the equation (1) indicate that the lagged MS do not possess in the regression (Accepting null hypothesis). This means Money Supply in India does not Granger cause GDP, similarly for other beta coefficients in the first hypothesis of the rest of equations. When we move to the second hypothesis which states that the GDP does not Granger cause Money Supply in India if the computed F statistic is low or P value is less than the conventional value, we can reject the hypothesis and infer that the GDP does not Granger cause Money Supply in India. Similar results can be derived for other beta coefficients in the second hypothesis of the rest of the equations.

Granger causality test is used to check the effectiveness of monetary policy and interest rate pass-through in India. To check causality between the changes in Money Supply in India with GDP, lending rate, exchange rate and BOP variables, the following model developed by Engel and Granger, (1987) will be used. The models are;

Gross Domestic Product (GDP) and Money Supply in India

$$GDP_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} GDP_{t-i} + \sum_{i=1}^{n} \beta_{2i} MS_{t-i} + u_{1t}$$

$$MS_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i} MS_{t-i} + \sum_{i=1}^{n} \beta_{5i} \mathrm{GDP} + u_{2t} \quad (2)$$

(a) Money Supply and CPI (Inflation) in India

$$MS_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} MS_{t-i} + \sum_{i=1}^{n} \beta_{2i} CPI_{t-i} + u_{1t}$$

$$CPI_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i} CPI_{t-i} + \sum_{i=1}^{n} \beta_{5i} MS_{t-i} + u_{2t} \quad (3)$$

(b) Exchange Rate and Current Account Deficit in India

$$ER_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, ER_{t-i} + \sum_{i=1}^{n} \beta_{2i} CAD_{t-i} + u_{1t}$$

$$CAD_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\ CAD + \sum_{i=1}^{n} \beta_{5i} ER_{t-i} + u_{2t} \quad (4)$$

(c) Money Supply and Current Account Deficit in India

$$MS_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, MS_{t-i} + \sum_{i=1}^{n} \beta_{2i} CAD_{t-i} + u_{1t}$$

$$CAD_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\ CAD + \sum_{i=1}^{n} \beta_{5i} MS_{t-i} + u_{2t} \quad (5)$$

(d) GDP and Current Account Deficit in India

$$GDP_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, GDP_{t-i} + \sum_{i=1}^{n} \beta_{2i} CAD_{t-i} + u_{1t}$$

$$CAD_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\ CAD + \sum_{i=1}^{n} \beta_{5i} GDP_{t-i} + u_{2t} \quad (6)$$

(e) Reserve Bank Lending Rate and Commercial Bank Lending Rate in India

$$RBLR_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, RBLR_{t-i} + \sum_{i=1}^{n} \beta_{2i} CBLR_{t-i} + u_{1t}$$

$$CBLR_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\ CBLR + \sum_{i=1}^{n} \beta_{5i} RBLR_{t-i} + u_{2t} \quad (7)$$

(f) Commercial Bank Lending Rate and Money Supply in India

$$CBLR_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, CBLR_{t-i} + \sum_{i=1}^{n} \beta_{2i} MS_{t-i} + u_{1t}$$

$$MS_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\ MS + \sum_{i=1}^{n} \beta_{5i} CBLR_{t-i} + u_{2t} \quad (8)$$

(g) GDP and Non-Performing Asset in India

$$GDP_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, GDP_{t-i} + \sum_{i=1}^{n} \beta_{2i} NPA_{t-i} + u_{1t}$$

$$NPA_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\ NPA + \sum_{i=1}^{n} \beta_{5i} GDP_{t-i} + u_{2t} \quad (9)$$

(h) Profit of Commercial Bank and NPA in India

$$PROFIT\ CB_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\ PROFIT\ CB_{t-i} + \sum_{i=1}^{n} \beta_{2i} NPA_{t-i} + u_{1t}$$

$$NPA_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\ NPA + \sum_{i=1}^{n} \beta_{5i} PROFIT\ CB_{t-i} + u_{2t} \quad (10)$$

Where, MS – Money Supply, CAD – Current Account Deficit, ER – Exchange Rate, CBLR – Commercial Bank Lending Rate, RBLR – Reserve Bank Lending Rate, CPI – Consumer Price Index, NPA – Non-Performing Asset, PROFIT CB – Profit of Commercial Banks.

This study also uses trend line analysis to compare the role and performances of NCBs during pre and post financial and banking sector reforms in India. Trend line analysis will give a more accurate picture for comparative analysis between two time periods.

The Present study tries to find answers for the selected research questions and objectives using quantitative and qualitative methods. Required data will be collected from secondary sources and it will be collected from Handbook of Statistics on Indian Economy, report on currency and Finance, Annual accounts data of Scheduled Commercial Banks and other reports published by the Reserve Bank of India and the Ministry of Finance, Government of India.

5. Empirical results

Analysis of the present study is focused on two grounds. First one is to analyse the role of nationalised commercial banks in India and their performances during pre and post financial sector reforms. The second part of the analysis focuses on the effectiveness of monetary policy in India during pre and post financial sector reforms. For this purpose, the study mainly uses ADF-PP unit root test, Engel-Granger's Causality test and Trend line analysis.

The Augmented Dickey-Fuller and Philips-Perron unit root test are conducted for Money Supply, Current Account Deficit, Inflation, Exchange Rate, Commercial Bank's Lending Rates, Reserve Bank's Lending Rate, GDP, Sectorial GDP, Sectorial Loans, Poverty, Unemployment, NPA, Profit of Nationalised Commercial Bank Growth.

Table 1. *Unit Root Test*

Variables	Augmented Dickey-Fuller Test (Trend & Intercept at first difference)		Phillips-Perron Test (Trend & Intercept at first difference)	
	T Statistic	Prob.	T Statistic	Prob.
Agricultural GDP	-4.89212	0.0014	-6.487701	0.0000
Agricultural Loans	-2.409924	0.3697	-5.563457	0.0002
Industrial GDP	-5.492009	0.0002	-5.405036	0.0003
Medium and Large Scale loan	-4.906436	0.0013	-4.412598	0.0052
Service Sector GDP	-4.807200	0.0017	-4.769194	0.0019
Loans to SSI	-5.367122	0.0003	-5.617204	0.0002
Total GDP	-4.784574	0.0018	-4.805476	0.0017

Variables	Augmented Dickey-Fuller Test (Trend & Intercept at first difference)		Phillips-Perron Test (Trend & Intercept at first difference)	
	T Statistic	Prob.	T Statistic	Prob.
Poverty	-3.594610	0.0437	-13.59398	0.0000
Unemployment	-4.856456	0.0015	-4.882163	0.0014
Money Supply	-6.765146	0.0000	-6.908924	0.0000
CPI	-9.995718	0.0000	-21.58247	0.0000
Exchange Rate	-4.504581	0.0041	-4.467790	0.0045
Current Account Deficit	-5.706741	0.0001	-15.15717	0.0000
NPA (since 1991)	-2.2094	0.2432	-2.609517	0.2799
Profit of nationalised commercial banks (since 1991)	-4.259486	0.0160	-3.488289	0.0617
Reserve Bank Lending Rate (since 1991)	-5.2694	0.0015	-7.5906	0.0000
Commercial Bank Lending Rate (since 1991)	-5.3644	0.0011	-5.3737	0.0011

Source: Computed.

The ADF and PP unit root test results are given in Table 1. Due to space constraint, the study displays the only trend and intercept values at first difference in the table. The study observed that the selected variables are non-stationary at level. But, it is clear from Table 1 that almost all the selected macroeconomic variables are stationary at first difference.

The ADF test result shows that the probability value for all the selected variables is less than 0.05 except a few variables like Agricultural loans and NPA. But the test statistic value for the same variables is less than the critical value at 1 percent, 5 percent and 10 percent lead to the rejection of null hypothesis and infers that the variables have no unit root. Likewise, the PP unit root test is also observed almost similar results with slight variations. The PP test pointed out low probability value (less than 0.05 percent) for all the variables except NPA. Here also the observed test statistic values for NPA are less than the critical value of 1 percent, 5 percent and 10 percent. Due to the non-availability of data for NPA, the maximum number of observations is less than 25 is also the reason for the high probability value. So we reject the null hypothesis and infer that the variables have no unit root. After fulfilling the stationary conditions from Table 1, the study focuses on the application of Engel-Granger's Causality test for a directional relationship between the selected variables.

5.1. Role and the performances of Nationalised Commercial Banks in India

As per the literature survey and debates among the policy makers, it is observed that the role of commercial banks on economic development has decreased drastically since the 90s. From 1969 to 1991 (post nationalisation to pre-financial sector reforms), all the commercial banks are controlled and regulated by the RBI. But, the government of India has introduced financial sector reform in 1991 and banking sector reforms in 1998. Through these measures, adequate autonomy and freedom were given to commercial banks. As a result of this, the commercial banks neither focus on the objectives of nationalisation nor proper priority lending. Also, the commercial banks did not pay proper attention to RBIs rate cut which poses challenges to the effectiveness of the monetary policy. Therefore, the necessity arises to address the above issues in this study. For this purpose, the study uses Granger Causality test results and trend line analysis from Figures 1.1 to 4.1.

Figure 1.1. *Money supply, priority lending and GDP in India during pre-financial sector reforms*

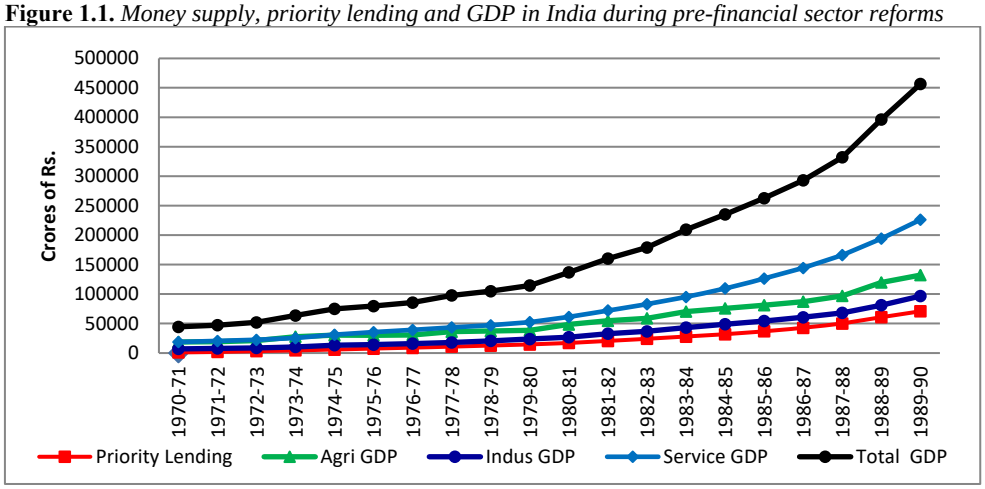


Figure 1.2. *Money Supply, Priority Lending and GDP in India during Post Financial Sector Reforms*

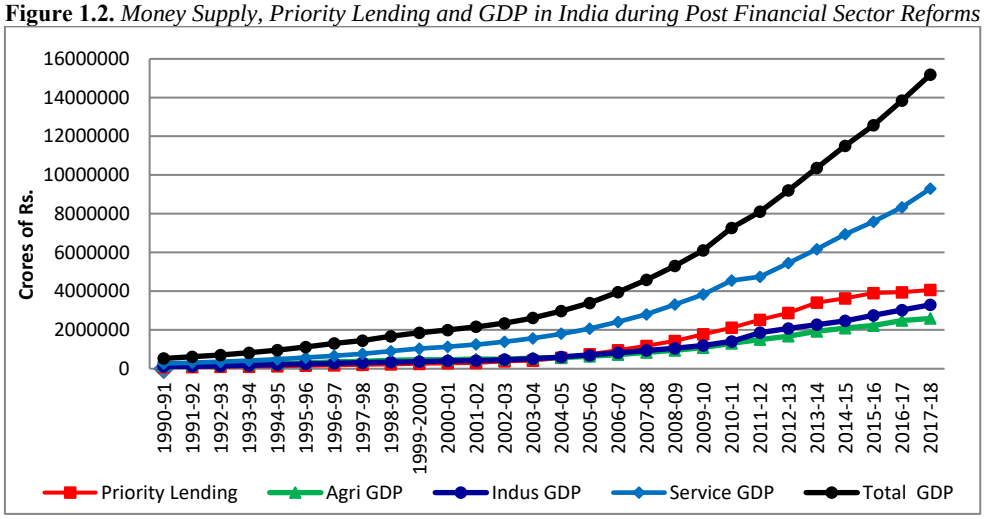
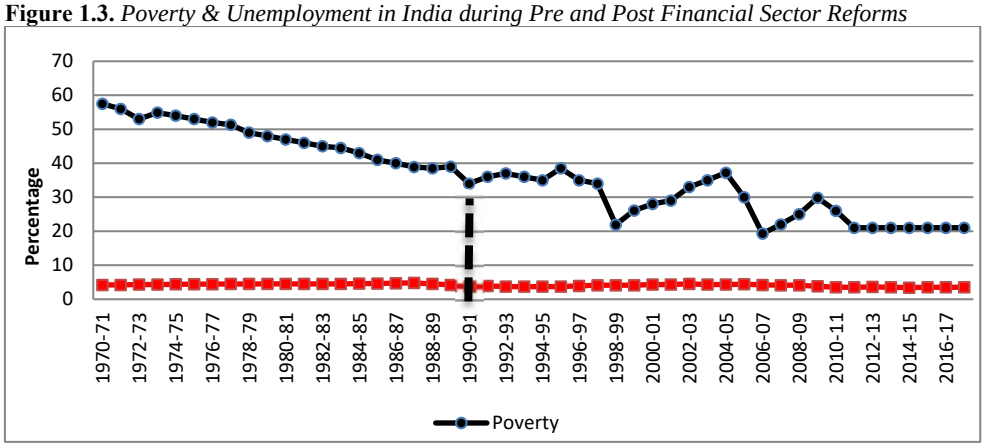


Figure 1.3. *Poverty & Unemployment in India during Pre and Post Financial Sector Reforms*



Using trend line analysis from Figure 1.1, the study observed that there is a positive correlation exists between GDP growth rate and economic development during pre and post financial sector reforms. In both the periods, the growth rate of GDP is continuously increasing and the rate of poverty and unemployment is decreasing. When we compare the progress in both the periods, the study observed some interesting results. In an absolute sense, the overall GDP and sector wise GDP in the post-reform period average is higher than that of the pre-reform period. In the pre-reform period, the average GDP of Agriculture was Rs. 55,687 Crores, Industry GDP was Rs. 34,400 Crores and the service GDP was Rs. 80,625 crores which are very lesser compared to the post-reform period average of Rs. 9,11,975 Crores, Rs. 10,18,399 Crores, Rs. 28,71,288 crores respectively (Agri, Indus, service). Compared to the pre-reform period, the agricultural GDP has increased by 16 times, industrial GDP has increased by 30 times and the service sector GDP has increased by 35 times in the post-reform period (Figures 1.1 and 1.2).

Figure 2.1. *Priority loans in the pre reform period*

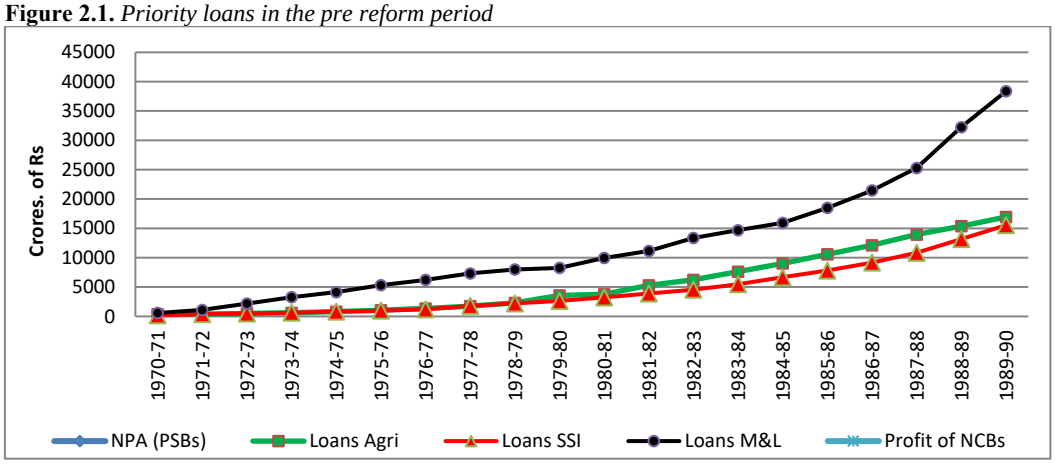
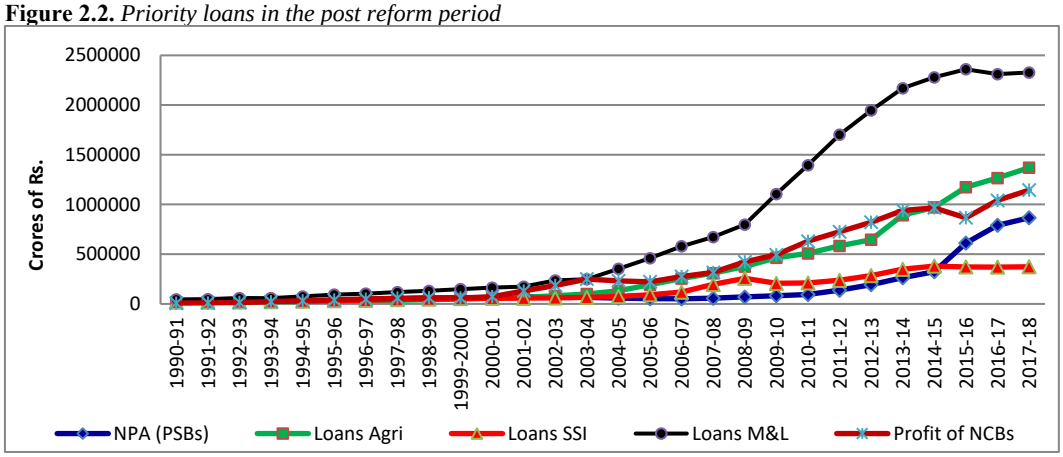


Figure 2.2. *Priority loans in the post reform period*



Now the study tries to correlate GDP growth with priority lending by Nationalised Commercial Banks in India during pre and post-reform periods. Compared pre-reform period, the priority sector lending has increased in the post reform period. Especially, a

loan to the agricultural sector has increased by 60 times, a loan to small scale sector has increased to 30 times and a loan to large scale sector has increased by 65 times (Figures 2.1 and 2.2).

So the study observed that there is a positive correlation between sectorial GDP and priority lending during pre and post-reform periods. Both are inversely related to the trends in poverty and unemployment, which is clearly seen in Figure 1.3. All these results proved that the NCBs has increased its priority lending in the post-reform period. It is reflected positively on sectorial GDP and economic development via a reduction in poverty and unemployment. Simultaneously, the study also observed that the rate of fall in poverty is high in the pre-reform period compared to the post-reform period. Unemployment rate is also almost constant in the post-reform period even though there is considerable growth in GDP and priority lending. This is because the NCBs lending to medium and large scale sector is very high compared to their lending to agriculture and small scale industries (Figures 2.1 and 2.2).

When we look into the performances of NCBs, the study observed mixed implications. From 1991 to till global financial crisis in 2008, the Non-Performing Assets (NPA) of NCBs were under control with a considerable amount of profit. After 2009, since expansionary policy measures, the growth of NPA and profits are increasing faster than ever before. It is clearly observed from the trend line analysis in Figure 2.2 and Granger Causality results from Table 2. The Granger causality test observed unidirectional causality between the profit of NCBs and its NPA. Simultaneously, GDP and NPA are also observed in unidirectional causality. It reveals that an increase in profit of NCBs induces its lending activities and GDP. This, in turn, increases non-performing assets in India. Moreover, since 2011, the union government and various state governments started widening loan waiver schemes. It further increases NPA and poses a severe threat to the sustainability of banking institutions in the country.

Overall result for the first part of the analysis, the study found mixed implications. The role of NCBs on economic growth is very good in the post-reform period but lacks economic development even though the average GDP is significantly high in the post-reform period. This because huge sums of the loan was given to medium and large scale industries compared to loans to agriculture and small scale industries which reflected negatively on poverty eradication and employment generation.

The second part of the study is to test the effectiveness of monetary policy in India since the financial sector reforms in 1991. The purpose is to check how effective the RBIs monetary policy in influencing internal and external sector variables after adequate autonomy was given to NCBs through financial and banking sector reforms. For this purpose, the study uses periodical changes in money supply and its effect on GDP, Inflation, NPA, Current Account Deficit, Exchange Rate, Lending Rate of RBI and Commercial Banks. Usually, these variables have bi-directional and unidirectional relationships. Some variables may not have any associations. For example, an increase in money supply leads to an increase in demand for goods and price level. Similarly, an increase in price level may influence the circulation of money by reducing bond demand is called bidirectional causality. If the increased money supply leads to create only

inflation (price level) and no impact in the bond market is called unidirectional causality. For this purpose, the appropriate model is Engel-Granger's Causality test which is applied in this study for analysis.

Table 2. *Pairwise Granger Causality Tests*

Null Hypothesis:	Obs.	F-Statistic	Prob.	Result
GDP does not Granger Cause MS	43	0.48516	0.7847	Unidirectional Causality
MS does not Granger Cause GDP		4.29607	0.0042	
MS does not Granger Cause CPI	43	0.56776	0.7240	No Causality
CPI does not Granger Cause MS		1.43982	0.2369	
ER does not Granger Cause CAD	43	0.28312	0.9189	
CAD does not Granger Cause ER		1.90522	0.1210	No Causality
MS does not Granger Cause CAD	43	1.29265	0.2915	
CAD does not Granger Cause MS		2.21160	0.0774	No Causality
GDP does not Granger Cause CAD	43	4.00751	0.0062	
CAD does not Granger Cause GDP		1.11329	0.3730	Unidirectional Causality
RBLR does not Granger Cause CBLR	25	5.11693	0.0160	
CBLR does not Granger Cause RBLR		0.93622	0.1703	Unidirectional Causality
CBLR does not Granger Cause MS	25	0.57815	0.5700	
MS does not Granger Cause CBLR		2.70186	0.0915	No Causality
GDP does not Granger Cause NPA	17	4.07205	0.0057	
NPA does not Granger Cause GDP		0.75712	0.5873	Unidirectional Causality
PROFIT CB does not Granger Cause NPA	17	21.5156	0.0009	
NPA does not Granger Cause PROFIT CB		2.15271	0.1889	Unidirectional Causality

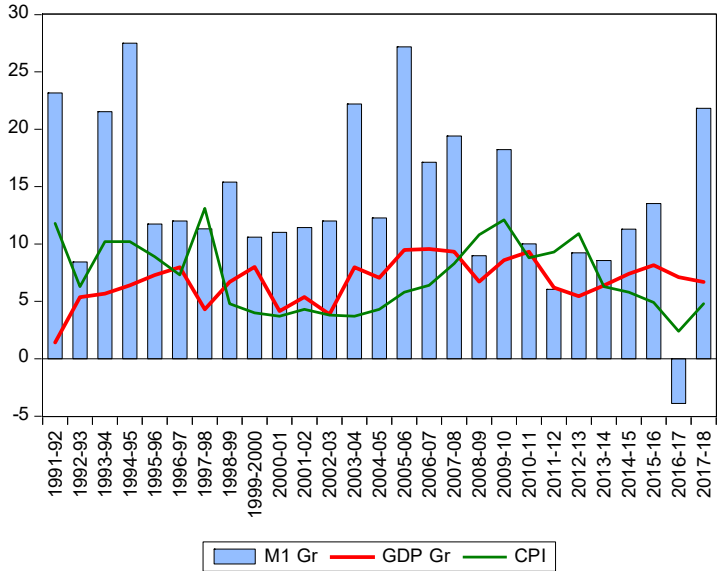
Source: Computed.

Theoretically, the effectiveness of monetary policy can be tested using two methods. The first method deals the internal sector by assessing the effect of changes in money supply on Demand, Employment and GDP without creating inflation in the economy. The second method deals the external sector by assessing the effect of changes in Money Supply on Current Account Deficit, Exchange Rate and Balance of Payments.

Now, the study uses pairwise Granger Causality test results from Table 2 to verify the relevance and effectiveness of the monetary policy. Granger Causality test result from Table 2 gives unidirectional causality between Money Supply and GDP in India. The probability value of 0.004 rejected the null hypothesis of the money supply does not Granger cause GDP. This means the test result validated the theoretical relationship of an increase in money supply leads to increase GDP via aggregate demand.

Figure 3.1 is also supported that there is a positive relationship between the money supply and GDP in India. It can also be inferred from Figure 3.1 that an increase in money supply increases GDP via aggregate demand without creating inflation rate in India. It is evidenced from Figure 3.1 and Granger Causality, both results no causality between money supply and the Inflation rate in India. It reveals that the price level is not only influenced by monetary authorities, fiscal and other government policy plays a major role in influencing inflation rate in India. The test result also reveals that the GDP has no influence on the money supply. Naturally, the money supply is exogenously determined by the central bank.

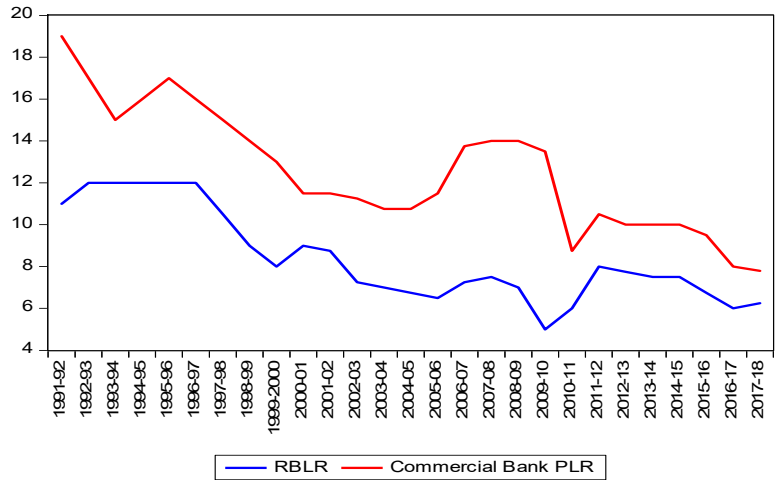
Figure 3.1. *Growth rate of money supply, GDP and inflation*



When we move to the external sector, the study did not found any causality between money supply and the Current Account Deficit (CAD). It means the role of invisible (service trade) play a crucial role in India's current account than that of merchandise account. Unexpectedly, it is found from Table 2 and Figure 3.1 that the change in money supply does not influences CAD, CPI and exchange rate. It reveals that the merchandise trade account is not directly to the money supply in India. This is the reason why the money supply has no causality with a current account deficit. As a result of this observation, the restoration process in Balance of Payments is not feasible for India. From these results, it can be inferred that the monetary policy is effective in influencing major variables in the external sector but it is not effective in restoring the disequilibrium in Balance of Payments account.

Now the study focuses upon the effectiveness of monetary policy using interest rate pass-through in India, especially since financial sector reforms. For this purpose, the study uses Granger causality test result and trend line analysis for the money supply, Reserve Bank's Lending Rate (RBLR), Commercial Bank's Lending Rates (CBLR) and it can be observed from Table 2 and Figure 4.1.

Figure 4.1. *Correlation between the RBI Lending Rate with Commercial Bank Lending Rate*



First, the study tested the relationship between CBLR and money supply. Usually, the money supply is determined exogenously by the central of the country and not by CBLR. The Granger causality test result gives 57 percent p-value for CBLR and money supply proved that the money supply is exogenously determined by the RBI and not by CBLR. When the study tries to estimate another directional relationship between money supply and CBLR, the study detected a 10 percent level of significance. Which means, CBLR not only depends on RBLR, also it responds to changes in the money supply at a 10 percent level of significance, i.e. demand and supply of money also determine CBLR instead only RBLR. Secondly, the Granger causality test result gives unidirectional causality between RBLR and CBLR. It means any change in RBLR will cause changes in CBLR. It is also evidenced in Figure 4 that the RBLR and CBLR move almost in the same direction in the entire study period. From 1991 to 2011, the gap between CBLR and RBLR was high, but in recent years, the gap is also reducing and moving towards the same direction proved the effectiveness of interest rate pass-through in India.

6. Conclusion

Government of India the process of nationalising commercial bank since 1969 for the purpose of enhancing national welfare through priority lending at subsidised rates. Since the 1970s, all the NCBs are directly controlled and regulated by the RBI in order to achieve the objectives of the planning commission. Due to which, many of the commercial banks were eroded and moved towards bankruptcy at the end of the 80s. To solve these issues and to strengthen banking institutions, the government of India set up a committee under the chairmanship of Narasimham. The committee submitted its report in 1991 and the recommendations were implemented under economic reforms. Again in 1998, the GOI set up a committee under the chairmanship of Narasimham to review the old policy and recommend further improvements in the banking industry. The committee submitted its report to the GOI and it was implemented under banking sector reforms in

1998. Both the reform measures gave adequate autonomy and freedom to banking institutions which induce them to move away from the objectives of nationalisation (Welfare motive to profit motive). The purpose of higher autonomy is to enhance the performances of banking institutions in the country. But the statistics show that the majority of the NCBs are not performing well and their NPAs are increasing continuously. So the main purpose of the study is to compare the role of NCBs on economic growth and development during pre and post-reform periods. The study also aims to evaluate the effectiveness of monetary policy in India after reforms in the money market (How commercial banks are responding to RBIs rate cut after adequate autonomy).

First, the study observed that the role of NCBs on economic growth and development is continuously increasing during the pre and post-reform periods. In fact, the NCBs are playing a major role in influencing GDP in the post-reform period compared to pre-reform period. Similarly, there is a significant contribution from NCBs on poverty eradication and employment generation through priority lending. When we compare the role of NCBs on poverty eradication and employment generation, they play a major role in the pre-reform period compared to the post-reform period. This is because adequate autonomy to NCBs lead to less focus on the loans to agriculture and small scale sector compared to their loans to medium and large scale industries. The main objective of autonomy is to enhance the performances of NCBs through high profits. But the study found that the NPA of NCBs is very high and unacceptable in the post-reform period, especially since 2000.

Secondly, the study observed that the commercial banks did not properly respond to the rate cut of RBI on several occasions due to excessive autonomy. As a result, the question arises whether the monetary policy and interest rate pass-through is effective in India or not. For this purpose, the study tries to test the effectiveness of monetary policy and interest rate pass-through in India in the liberalisational era. The study found mixed implications for monetary policy effectiveness and interest rate pass-through in India. First, the study observed that the expansionary monetary policy influences GDP positively without creating inflation in India. It is evidenced from Figure 3 that the GDP growth rate is associated with the growth rate of money supply and inflation is not responding to the money supply (Figure 3). From this observation, the study infers that the monetary policy is an effective tool to achieve internal equilibrium in India. Secondly, the expansionary monetary policy has no causality with CPI, CAD and Exchange rate proved the ineffectiveness of monetary policy in the external sector lacks the significance of monetary policy in the context of an automatic restoration process. Thirdly, the study observed an interesting result for interest rate pass-through. The Granger causality test result provides unidirectional causality between Reserve Bank's Lending Rate and Commercial Bank Lending Rate. It indicates, even though adequate autonomy was given to commercial banks, the commercial banks' lending rates are directly correlated to Reserve Bank's lending rate. This result proved that there is a strong interest rate pass-through takes place in the organised money market in India. Finally, the study concludes by inferring that the monetary policy is effective in India in terms of achieving internal

equilibrium via a strong interest rate pass through. Simultaneously, the monetary policy fails in the process of automatic restoration in the external sector.

Finally, the study concludes that the role of NCBs in enhancing national welfare and improving their performance is not significant in the post-reform period even though they play a major role in GDP growth. Moreover, most of the NCBs are not responding properly to RBIs rate cut poses a severe threat to the objectives of monetary policy. For economic development and effective monetary policy, the study strongly recommended periodical instructions and frequent interference of RBI in the functions of Nationalised Commercial Banks in India.

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Determinants of economic growth in India: A time series perspective

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Abstract. *Indian is one of the fastest growing economies of the world and recent growth rate of the Indian economy has been decelerated. To better understand the growth process, an empirical model using time series approach has been used. The study has used quarterly observations of Real Gross Domestic Product (GDP) at factor cost, Foreign Direct Investment (FDI) inflows to India, Gross Fixed Capital Formation (GFCF), GDP Deflator, Trade Openness and Real Effective Exchange Rate (REER) from 1996-97 to 2017-18 to analyse direction of relationship among these variable. It is observed that the Trade Openness affects GDP positively but Trade Openness is negatively impacted by GDP where as FDI inflow to India has a positive impact on Trade Openness. Further, the REER has negative impact on FDI inflows whereas it is found that GFCF has positive impact on REER. GDP is the major variable that influences the other variables under study. FDI inflow is the outcome of GDP growth. To make the FDI beneficial, the government must improve the absorptive capacity of the country and change the policy related to FDI.*

Keywords: FDI, GDP, exchange rate, trade openness.

JEL Classification: E01, E20, E60, F430.

1. Introduction

At the end of the 20th century it is observed that the more affluent countries were growing robustly while others were growing more slowly or even stagnating. The growing disparities in Economic Growth can be attributed to many factors including determinates of growth. Many factors inhibiting and facilitating economic growth have been suggested by economists. But the fundamental question still persists that why does income grow faster in some countries than others? But researchers disagree on the explanatory variables that are most important a priori, there is usually only partial overlap among the variables considered in different empirical works. It is therefore natural to try and see which of the explanatory variables suggested in emerge as growth determinants when all are treated symmetrically a priori. The idea is to find out in which direction the data guides an agnostic. Many potential explanatory variables have been suggested, which creates lots of confusion and therefore empirical approaches inevitably need to start out with a long list of variables. To better understand the growth process, we develop an empirical model using time series approach, which attempts to explain some of the necessary ingredients for economic growth and to explore the economic relationship among selected macroeconomic variables in India.

Empirical studies are conducted by Bhat (1995), Chandra (2003), Padhan (2004), Pandey (2006), Pradhan (2010), Ray (2007), Kaur and Sidhu (2012) and Devi (2013) to examine the relationship between the growth of exports and the growth of output in India. They used Co-integration technique; Error Correction Modelling and Granger Causality analysis to conclude in support of Export-led Growth hypothesis for India. However, studies conducted by Ghatak and Price (1997), Dhawal and Biswal (1999), Nataraj et al. (2001), Sharma and Panagiotidies (2003) and Mishra (2011) do not substantiate the Export-led Growth hypothesis for India. Almost all of them cited that difference in time periods, variable definitions and methodologies adopted could be the plausible reasons. But the analysis by Kumari and Malhotra (2014) on Export Led Growth in India for the period 1980 to 2012 using Johansen co-integration and Granger causality approach had put forward mixed and inconclusive results. It was found that there is no existence of long run equilibrium relationship between exports and economic growth but Granger causality test exhibited bidirectional causality between the two.

Most of the literature which reflect on the impact of FDI on economic growth showed that FDI stimulated economic growth through transfer of technology and spill over effect (Wei et al., 2001; Bende-Nabende and Ford, 1998). FDI was seen as an important element in the solution to the problem of scarce local capital and overall low productivity in many developing economies (De Mello, 1999; Eller et al., 2005). While some papers reported that FDI enhanced GDP growth, others reported that there was no direct evidence of such a relationship.

Empirical research works carried out on capital formation and economic development has established a critical linkage between the two. Khan and Reinhart (1990); Ghura and Hadji Michael (1996); Ben-David (1998); Collier and Gunning (1999); Hernandez-Cata (2000) and Ndikumana (2000) conducted studies in Africa, Asia and Latin America confirming the aforesaid statement. Ghura and Hadji Michael (1996); Ghura (1997) and

Beddies (1999) used econometric methodologies to reveal that private capital formation has a stronger and more favourable effect on growth rather than government capital formation.

Economic theories reach a variety of conclusions about the responsiveness of output growth to inflation. The inflation-growth relationship has been one of the most debated macroeconomic themes.

There are numerous studies that have assessed the relationship between exchange rate movements and economic growth. Connolly (1983), Gylfason and Schmid (1983), Krueger (1978), and Taylor and Rosensweig (1984) supported that devaluation has expansionary effects on economic growth of the nation. But Gylfason and Radetzki (1985), Atkins (2000), Kamin and Roger (2000), Odusola and Akinlo (2001), Berument and Pasaogullari (2003), El-Ramly and Abdel-Haleim (2008) brought contractionary effects of devaluation on economic growth to picture. A number of studies are witness to mixed results also. Edwards (1986) and Rhodd (1993) found negative output response to devaluation in the short-run but in the long-run the output response to devaluation appeared to be positive. El-Ramly and Abdel-Haleim (2008) revealed negative response of output to devaluation for several years before expansionary effects showed up. Bahmani-Oskooee and Miteza (2006) used a panel of 42 countries to find that in the long-run devaluations are contractionary in non-OECD countries, while for OECD economies the results are mixed.

In the light of the above, we try to study the macroeconomic determinants of economic growth in India and conduct an empirical analysis using quarterly observations of Real Gross Domestic Product (GDP) at factor cost, Foreign Direct Investment (FDI) inflows to India, Gross Fixed Capital Formation (GFCF), GDP Deflator, Trade Openness and Real Effective Exchange Rate (REER) from 1996-97 to 2017-18.

2. Methodology

Time series quarterly data on the selected variable from 1996-97 to 2017-18 are obtained from the RBI web site. The variables considered are:

- Real Gross Domestic Product (GDP) at factor price which is a measure of economic growth or output. Its quarterly estimates are taken at 2004-05 base year prices.
- Trade Openness is taken as ratio of sum up Export Values and Import Values to Real GDP (Export + Import) / Real GDP.
- For foreign direct investment (FDI) inflows to India the quarterly estimates of net FDI inflows to India are considered which include FDI in India – Equity b) FDI in India – Reinvested Earnings and c) FDI in India – Other Capital.
- Real Gross Fixed Capital Formation (GFCF) is another variable considered as an indicator of domestic investment.
- Real Effective Exchange Rate (REER) is used as a measure of India's overall competitiveness where the REER data used for the study is a Trade based Weight adjusted for price differentials between India and its six major trading partners.

- GDP Deflator is used as an indicator of Inflation. GDP Deflator is a ratio obtained by dividing Nominal GDP at factor prices with Real GDP at factor prices.

All the actual values of the six variables in time series data are transformed into log form for reducing the wide variation of data and eliminating the problem of heteroscedasticity. The study employs Real GDP at factor cost as a measure of economic growth where as FDI inflows and GFCF as measures of domestic investment and foreign investment respectively, GDP Deflator as an indicator of inflation, REER as a measure of exchange rate and Trade Openness as a pure ratio measuring the sum of exports and imports to GDP at factor cost. The choice of the control variables is motivated by existing theoretical and empirical work in macroeconomic literature.

Unit root test for stationarity conducted primarily because the time series data considered for the analysis should have mean and variance that do not vary systematically over time rendering it fit for further econometric analysis and forecasting. Stationarity of the data set has been checked by using Dickey-Fuller (1979) Test, Augmented Dickey-Fuller Test and the Phillips-Perron (1988) test. A time series which turns stationary after differencing is known as "integrated time series". If such a time series becomes stationary after differencing once then it is said to be integrated of order one I(1). If it has to be differenced twice to transform to a stationary series, it is said to be integrated of order two I(2). Hence the number of times a time series has to be differenced before it becomes stationary, the time series is integrated of that order. Then Johanssen (1988) proposed the test of Co-integration test for inspection of any existence of long-run association-ship among the variables present in the time series data are performed.

A VECM is a restricted Vector Auto-Regressive Model (VAR) designed for the use with non-stationary series that are known to be co-integrated. The co-integrating equation gives long-run relationship between the two variables. However, co-integrating equation does not shed any light on short-run dynamics although its existence indicates that there must be short-term forces that are responsible for keeping long-run relationship intact. So the VECM is a more comprehensive model which combines short-run and long-run dynamics.

If there are two series X_t and Y_t which are I (1) so that their linear combination is

$$\widehat{\epsilon_t} = Y_t - \hat{a} - \hat{b}X_t \quad (1)$$

Then the long-run equilibrium relationship between the two variables is represented by $\widehat{Y_t} = \hat{a} + \hat{b}X_t \quad (2)$

Corresponding to this long-run equilibrium relationship, the VECM can be written as

$$\widehat{Y_t} = \emptyset + \gamma \Delta X_t + \lambda \widehat{\epsilon_{t-1}} + w_t \quad (3)$$

Where $\widehat{\epsilon_{t-1}} = \left(Y_{t-1} - \widehat{Y_{t-1}}\right) = (Y_{t-1} - \hat{a} - \hat{b}X_{t-1})$ is the lagged value of the error term by one period from the co-integrating regression and W_t is the error term in the ECM. The ECM equation states that ΔY_t depends not only on ΔX_t but also on the equilibrating error term $\widehat{\epsilon_{t-1}}$. Inclusion of $\widehat{\epsilon_{t-1}}$ is unique to ECM. When $\widehat{\epsilon_{t-1}}$ is non-zero (positive or negative), there is disequilibrium in the short-run. However, equilibrium will be restored

in the long-run if and only if $\lambda < 0$. On the other hand, if $\lambda > 0$, then equilibrium errors will be magnified.

Suppose $\Delta X_t = 0$ and Y_{t-1} is positive. In this situation, Y_{t-1} is too high to be in equilibrium, i.e. $Y_{t-1} > \widehat{Y_{t-1}}$. But as $\lambda < 0$, the error term $\lambda\widehat{\epsilon_{t-1}}$ is negative and so ΔY_t will be negative to restore equilibrium. Thus, if Y_{t-1} is above its equilibrium level, it will fall in the next period and the equilibrium error will be corrected in the model. Similarly, if $\widehat{\epsilon_{t-1}}$ is negative, i.e. $Y_{t-1} < \widehat{Y_{t-1}}$, then $\lambda\widehat{\epsilon_{t-1}}$ will be positive, which will cause ΔY_t to be positive, leading $\widehat{Y_{t-1}}$ to rise in the period t.

Thus, the ECM has both long-run and short-run properties built into it. The long-run properties are embedded in the $\widehat{\epsilon_{t-1}}$ term. The short-run behaviour is partially captured by the equilibrium error term, which says that, if Y_t is out of equilibrium, it will be pulled towards it in the next period. Further aspects of short-run behaviour are captured by the inclusion of ΔX_t as an explanatory variable. This term implies that, if X_t changes, the equilibrium value of Y_t will also change and that Y_t will change accordingly. It is clear that γ captures the impact of short-run disturbances of X_t on Y_t, while λ captures the adjustment towards long-run equilibrium. It is to be noted that since X_t are Y_t are co-integrated, the equilibrium error is stationary. Since all the variables in the ECM are stationary, we can estimate the ECM by Ordinary Least Square and conduct tests of significance of estimated coefficients using the usual t-test procedure. The VECM has co-integration relations built into the specification so that it restricts the long-run behaviour of the endogenous variables to encourage their co-integrating relationships while allowing for short-run adjustment dynamics. The ECT shows the speed of adjustment since the deviation from long-run equilibrium is corrected gradually thorough a series of partial short-run equations.

Then we run Granger Causality test between the variables to detect the causal relationship among the variables. The following pairs of equations best capture the concept.

$$X_t = a_2 + \sum_{i=1}^{n}\alpha_i Y_{t-i} + \sum_{i=1}^{m}\beta_j X_{t-1} + \varepsilon_{1t} \quad (3)$$

$$Y_t = a_2 + \sum_{i=1}^{n}\gamma_i Y_{t-i} + \sum_{i=1}^{m}\delta_j X_{t-j} + \varepsilon_{2t} \quad (4)$$

Where ε_{1t} and ε_{2t} are uncorrelated white noise error terms. The equation (3) implies that X at time t depends on past values of itself and that of Y. The equation (4) implies that Y at time t depends on past values of itself and that of X. Four different cases can be visualised in the above context. First, $\widehat{\alpha_i}$s in equation (3) are statistically significantly different from zero (i.e. statistically significant) and the $\hat{\delta}_j$s in equation (4) are not statistically significantly different from zero (not significant). In this case, there is unidirectional causality from Y to X and we say that 'Y (Granger) causes X'. Second, $\widehat{\alpha_i}$s in equation (3) is not statistically significantly different from zero and $\hat{\delta}_j$s in equation (4) is statistically significantly different from zero. This shows unidirectional causality from X to Y and we can say that 'X (Granger) causes Y'. Third, $\widehat{\alpha_i}$s, $\widehat{\beta_j}$s, $\widehat{\gamma_i}$s and $\hat{\delta}_j$s are statistically significantly different from zero (i.e. statistically significant). This represents the case of bilateral or feedback causality. Fourth, $\widehat{\alpha_i}$s, $\widehat{\beta_j}$s, $\widehat{\gamma_i}$s and $\hat{\delta}_j$s are not statistically

significantly different from zero (statistically not significant). This is the situation of independence where X and Y are independent of each other. It is to be noted that both X and Y have to be stationary variables to apply this test. If they are non-stationary, they have to be first differenced to be stationary. The direction of causality may depend critically on the number of lagged terms included. If the disturbance terms $\varepsilon_{1t}$and ε_{2t} are correlated, appropriate transformation of the variables would be required.

Since the individual coefficients in the estimated VAR models are often difficult to interpret, the practitioners of this technique estimate the Impulse Response Function (IRF). The IRF traces out the response of the dependent variable in the VAR system to shocks in the error terms, such as ε_{1t}andε_{2t}.

3. Results and discussion

3.1. Results of stationarity tests

Three stationarity tests such as Dickey-Fuller (DF) unit root test, Augmented Dickey-Fuller (ADF) unit root test and Phillips-Perron (PP) unit root test are conducted to detect the presence of unit-root in all the six variables under study. ADF is used because of its wide usage where as PP is useful in the series containing trends and it is more powerful (Perron, 1988). The results are shown in Table 1.

Table 1. *Unit root test results*

Variables	DF Test		ADF Test		PP Test (rho-test statistic)		PP Test t-test statistic	
	Level values	First order difference	Level values	First order difference	Level values	First order difference	Level values	First order difference
Real GDP	0.956 (0.769)	9.403 (0.000)	1.131 (0.702)	20.688 (0.000)	0.232 (0.908)	46.523 (0.000)	0.412 (0.908)	26.413 (0.000)
Trade Openness	0.956 (0.768)	10.569 (0.000)	0.771 (0.827)	8.536 (0.000)	0.718 (0.791)	71.987 (0.000)	0.889 (0.791)	12.196 (0.000)
FDI inflows	1.282 (0.637)	12.837 (0.000)	0.964 (0.766)	7.972 (0.000)	1.653 (0.782)	96.646 (0.000)	0.915 (0.782)	13.678 (0.000)
GFCF	1.002 (0.752)	12.184 (0.000)	0.969 (0.764)	8.971 (0.000)	0.670 (0.682)	84.470 (0.000)	1.178 (0.682)	14.453 (0.000)
REER	0.898 (0.788)	7.311 (0.000)	1.418 (0.573)	5.183 (0.000)	4.891 (0.652)	63.971 (0.000)	1.249 (0.652)	7.315 (0.000)
GDP Deflator	0.160 (0.943)	9.892 (0.000)	0.038 (0.961)	6.724 (0.000)	0.035 (0.950)	78.549 (0.000)	0.092 (0.950)	10.114 (0.000)

Note: The values in the parentheses are P-values.
Source: Calculated by author.

DF test for stationarity assumes that the values of the error term in the model are uncorrelated which means the error terms are independently and identically distributed. But ADF test statistic adjusts the DF test statistic to take care of the possible serial correlation in the error terms by adding lagged difference terms of the regressand. The PP test uses non-parametric statistical methods to take care of the serial correlation in the

error terms without adding lagged differenced terms. All the three tests of stationarity to find unit root shows that all the variables under consideration are non-stationary in level form but are stationary in their first order difference form. This means that the time series data is integrated of first order i.e. I (1) and the data is subject to a valid co-integration test.

3.2. Co-integration test

The Johanssen Co-integration test is used to find out whether there is any long-run equilibrium relationship amongst the variables or not. Table 2 shows the results of Johanssen Co-integration Test with Trace statistic.

Table 2.*Johanssen co-integration test results*

Co-integrated Equations	Trace Statistic	5% Critical Value
None (π = 0)	152.28	94.15
At most One (π = 1)	77.77	68.52
At most Two (π = 2)	47.19	47.21

The Table 2 shows that there are two co-integrating equations or Error Correction Terms (ECTs) present among the variables as per Johanssen co-integration test. This means that the series are cointegrated and move together in long term and regression analysis performed will not have spurious regression problem.

3.3. Vector Error Correction Model (VECM)

A principal feature of co-integrated variables is that their time paths are influenced by the extent of deviation from long-run equilibrium. The Vector Error Correction Model (VECM) estimates the speed at which the dependent variable returns to equilibrium after any discrepancy from the long-run equilibrium relationship and hence explains relationship between the short-run and long-run coefficients. As the variables are found to be co-integrated, Vector Error Correction Model (VECM) is used to detect the relationship among the variables. Table 3 shows the obtained VECM results.

Table 3. *Results of Vector Error Correction Model (VECM)*

Dependent Variables→	GDP	Trade Openness	FDI inflows	GFCF	REER	GDP Deflator
ECT 1 (Lag1)	-1.039 (0.237) [-4.39***]	2.335 (0.344) [6.78***]	1.813 (2.169) [0.84#]	0.602 (0.313) [1.92#]	0.436 (0.191) [2.28*]	0.320 (0.093) [3.45***]
ECT 2 (Lag1)	0.104 (0.030) [3.42***]	-0.314 (0.044) [-7.10***]	-0.584 (0.279) [-2.09*]	-0.050 (0.040) [-1.48#]	-0.014 (0.025) [-0.59#]	-0.049 (0.012) [-4.14***]
GDP (Lag 1)	0.445 (0.172) [2.59*]	-1.021 (0.249) [-4.09***]	0.204 (1.571) [0.13#]	0.044 (0.227) [0.20#]	-0.213 (0.138) [-1.54#]	-0.213 (0.067) [-3.16***]
GDP (Lag2)	-0.543 (0.147) [-3.70*]	-0.447 (0.214) [-2.09*]	0.804 (1.347) [0.60#]	-0.660 (0.195) [-3.39***]	-0.069 (0.118) [-0.59#]	-0.136 (0.058) [-2.36*]
Trade Openness (Lag 1)	0.031 (0.089) [0.35#]	-0.008 (0.120) [-0.06#]	0.526 (0.818) [0.64#]	0.016 (0.118) [0.13#]	-0.034 (0.072) [-0.47#]	0.060 (0.035) [1.73#]
Trade Openness (Lag 2)	-0.201 (0.080) [-2.24*]	0.083 (0.130) [0.64#]	1.235 (0.822) [1.50#]	-0.078 (0.119) [-0.66#]	0.058 (0.072) [0.81#]	-0.059 (0.035) [-1.69#]
FDI inflows (Lag 1)	-0.021 (0.013)	0.065 (0.010)	-0.354 (0.123)	0.020 (0.018)	-0.000 (0.011)	0.015 (0.005)

Dependent Variables→	GDP	Trade Openness	FDI inflows	GFCF	REER	GDP Deflator
	[-1.59#]	[3.35***]	[-2.88***]	[1.13#]	[-0.06#]	[2.82***]
FDI inflows (Lag 2)	-0.008 (0.012) [-0.58#]	0.040 (0.019) [2.63***]	-0.096 (0.118) [-0.81#]	0.026 (0.017) [1.54#]	-0.014 (0.010) [-1.31#]	0.014 (0.005) [2.73***]
GFCF (Lag 1)	0.069 (0.121) [0.57#]	-0.093 (0.177) [-0.53#]	-1.466 (1.112) [-1.32#]	-0.288 (0.161) [-1.79#]	0.196 (0.098) [2.01*]	0.030 (0.048) [0.63#]
GFCF (Lag 2)	-0.046 (0.114) [-0.40#]	0.067 (0.166) [0.40#]	-2.028 (1.047) [-1.94#]	-0.056 (0.151) [-0.37#]	-0.094 (0.092) [-1.02#]	-0.016 (0.045) [-0.36#]
REER (Lag 1)	0.163 (0.155) [1.06#]	-0.263 (0.224) [-1.17#]	2.154 (1.415) [1.52#]	0.104 (0.204) [0.51#]	0.243 (0.124) [1.96#]	-0.136 (0.061) [-2.24*]
REER (Lag 2)	-0.100 (0.160) [-0.68#]	-0.172 (0.233) [-0.74#]	-3.003 (1.466) [-2.05*]	-0.045 (0.212) [-0.21#]	0.265 (0.129) [2.06*]	-0.044 (0.063) [-0.70#]
GDPD (Lag 1)	-0.036 (0.325) [-0.11#]	1.546 (0.472) [3.27***]	-2.347 (2.975) [-0.79#]	1.240 (0.420) [2.91***]	0.384 (0.262) [1.47#]	0.051 (0.127) [0.40#]
GDPD (Lag 2)	-0.248 (0.343) [-0.72#]	0.051 (0.498) [0.10#]	-4.948 (3.137) [-1.58#]	-0.061 (0.453) [-0.14#]	0.026 (0.276) [0.09#]	0.214 (0.134) [1.60#]
Constant	0.019 (0.008) [2.22*]	-0.003 (0.012) [-0.24#]	0.001 (0.076) [0.02#]	0.025 (0.011) [2.19*]	0.015 (0.007) [2.20**]	0.008 (0.003) [2.46*]
R-Square	0.875	0.790	0.430	0.692	0.353	0.726
Test Statistic (P-value)	405.014 (0.000)	218.731 (0.000)	43.849 (0.000)	130.413 (0.000)	31.616 (0.007)	153.267 (0.000)

Note: The values in parenthesis are Standard Errors and the values in square brackets are z-test statistic.
***, * and # shows significant at 1%, 5% and 10% level.

Table 3 shows that when GDP or real GDP at factor cost is the dependent variable, the first ECT is -1.039 and is statistically significant at 1% critical value which means that 103% of the disequilibrium in the long-run is corrected within a quarter, suggesting a very fast rate of adjustment towards the equilibrium. But the second ECT is positive and statistically significant revealing that divergence from the long-run equilibrium occurred to render the system ultimately unstable. All the short-run coefficients are statistically insignificant except Trade Openness at two lags and the dependent variable itself at both the lags. An intercept value of 0.019 is statistically significant at 5% critical value. The R-square value of the model is 0.875 suggesting that the fitted model is a good one and the p-value of the test statistic shows that it is statistically significant.

When Trade Openness is the dependent variable, the first ECT is positive and statistically significant suggesting that deviation from long-run equilibrium takes place due to any external disturbance in the system. But the second ECT is negative and statistically significant at 1% critical value, i.e. -0.314. This means that 31% of the deviation from long-run equilibrium is corrected within a quarter or in other words the rate of adjustment towards equilibrium is 31%. The statistically significant short-run coefficients of GDP at one lag and two lags are -1.021 and -0.447 respectively which means that when GDP increases, it has a negative impact on Trade Openness. The statistically significant short-run coefficients of FDI inflows at one lag and two lags are 0.065 and 0.040 respectively showing that increase in FDI inflows has a positive impact on Trade Openness. The

statistically significant short-run coefficient of GDP Deflator at one lag is 1.546 showing a highly positive relationship between inflation and Trade Openness. All the other short-run coefficients are statistically not significant. The R-square value of 0.790 shows that the model is properly fitted and the p-value of the test statistic show that the model is significant.

With FDI inflows as the dependent variable, the first ECT is positive and statistically not significant but the second ECT is negative and statistically significant at 5% critical value. The 58.4% of the deviation from long-run equilibrium is corrected within a quarter. All the short-run coefficients are statistically not significant except FDI inflows at one lag and REER at two lags. The R-square of the model is 0.430 and the p-value of the test statistic is significant. With GFCF as the dependent variable, the first ECT is positive and statistically not significant but the second ECT is negative and statistically also not significant. All the short-run coefficients are statistically not significant except GDP at two lags and GDP Deflator at one lag. The R-square of the model is 0.692 showing that the model captures two third effects with the p-value of the test statistically significant.

When REER is considered as the dependent variable, the first ECT is positive and statistically significant (at 5%) which means that divergence from long-run occurred to render the system unstable. The second ECT is negative and statistically not significant. Further, all the short-run coefficients are statistically not significant except GFCF at one lag and REER at two lags. This means that rise in GFCF at one lag and REER at two lags has positive effect on REER as a whole in the short-run. With GDP Deflator as the dependent variable, the first ECT is positive and statistically significant (at 1%) which means that disequilibrium in the long-run occurred due to some external disturbance in the system. The second ECT is negative and also statistically significant (at 1%). The short-run coefficients of GDP at both the lags, FDI inflows at both the lags and REER at one lag are statistically significant. The R-square of the model is found to be 0.726 with the p-value of the test statistic significant.

3.4. Granger causality test

For the empirical investigations of cause-effect relationships, the Granger causality test has been used. The results of causality among the variables and its direction as determined by Granger causality test is shown in Table 4.

Table 4. *Granger causality results*

Sl. No.	Null Hypothesis (Ho)	Test Statistic	P-value	Decision
1	GDP does not Granger cause Trade Openness	44.411	0.000	Reject H_0
2	Trade Openness does not Granger cause GDP	7.498	0.058	Reject H_0
3	GDP does not Granger cause FDI inflows	7.659	0.054	Reject H_0
4	FDI inflows does not Granger cause GDP	2.824	0.420	Accept H_0
5	GDP does not Granger cause GFCF	24.804	0.000	Reject H_0
6	GFCF does not Granger cause GDP	20.636	0.000	Reject H_0
7	GDP does not Granger cause REER	3.625	0.305	Accept H_0
8	REER does not Granger cause GDP	4.073	0.254	Accept H_0
9	GDP does not Granger cause GDP Deflator	7.358	0.061	Reject H_0
10	GDP Deflator does not Granger cause GDP	15.128	0.002	Reject H_0

Sl. No.	Null Hypothesis (Ho)	Test Statistic	P-value	Decision
11	Trade Openness does not Granger cause FDI inflows	5.083	0.166	Accept H_O
12	FDI inflows does not Granger cause Trade Openness	22.098	0.000	Reject H_O
13	Trade Openness does not Granger cause GFCF	1.954	0.582	Accept H_O
14	GFCF does not Granger cause Trade Openness	5.148	0.161	Accept H_O
15	Trade Openness does not Granger cause REER	2.178	0.536	Accept H_O
16	REER does not Granger cause Trade Openness	2.237	0.525	Accept H_O
17	Trade Openness does not Granger cause GDP Deflator	16.084	0.001	Reject H_O
18	GDP Deflator does not Granger cause Trade openness	24.769	0.000	Reject H_O
19	FDI inflows does not Granger cause GFCF	5.073	0.167	Accept H_O
20	GFCF does not Granger cause FDI inflows	3.806	0.283	Accept H_O
21	FDI inflows does not Granger cause REER	4.745	0.191	Accept H_O
22	REER does not Granger cause FDI inflows	14.693	0.002	Reject H_O
23	FDI inflows does not Granger cause GDP Deflator	8.293	0.040	Reject H_O
24	GDP Deflator does not Granger cause FDI inflows	16.38	0.001	Reject H_O
25	REER does not Granger cause GFCF	1.755	0.625	Accept H_O
26	GFCF does not Granger cause REER	8.353	0.039	Reject H_O
27	GDP Deflator does not Granger cause REER	3.277	0.351	Accept H_O
28	REER does not Granger cause GDP Deflator	4.591	0.204	Accept H_O
29	GDP Deflator does not Granger cause GFCF	15.084	0.002	Reject H_O
30	GFCF does not Granger cause GDP Deflator	1.379	0.710	Accept H_O

Source: Calculated by author.

The Table 4 shows that there exist bidirectional causality between Real GDP at factor cost and trade openness; Gross Fixed Capital Formation and GDP; GDP deflator and GDP at Factor cost; Trade Openness and GDP Deflator; and FDI inflows and GDP Deflator. Further unidirectional causality exists from Real GDP at factor cost to FDI inflows; from FDI inflows to Trade Openness; from GDP Deflator to Real GDP at factor cost; from FDI inflows to Trade Openness; from Real Effective Exchange Rate to FDI inflows; Gross Fixed Capital Formation to Real Effective Exchange Rate; from GFCF to ERRR and from GDP Deflator to Gross Fixed Capital Formation. It is evident from the above that GDP cause inflow of FDI but not vice-versa. So with the growth of Indian economy we can expect more FDI inflow to the country. Similarly the trade openness of the country is expected to grow with the growth of the size of the economy. But one concern is that the growth of the GDP will cause rise in price level causing inflation spiral as it is evident GDP growth causes higher value of GDP deflator. Thus appropriate policy measures will be required to grip the inflation with the increasing size of the economy caused by rise in GDP.

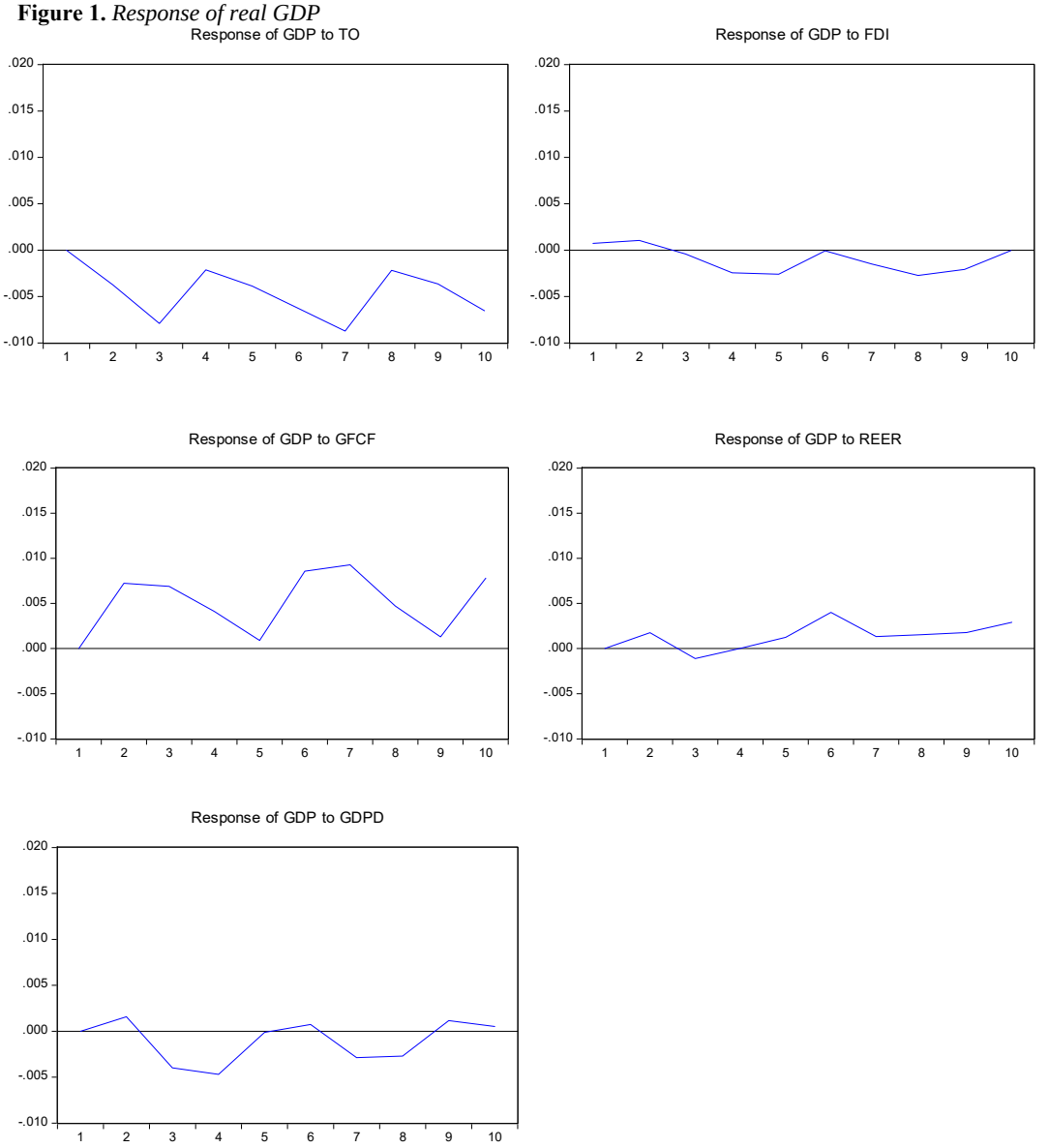
3.5. Impulse response function

The Impulse Response Function identifies the responsiveness of each of the dependent variable in the VECM when a unit shock or innovation is applied to the independent variables involved in the model. The reaction of the dependent variable is shown for the future time horizon. For this analysis 10 time periods are taken into consideration (values of 10 quarters).

Figure 1 shows the response of Real GDP as a dependent variable when one standard deviation shock is given to the other independent variables. When one unit of innovation or shock is given to FDI inflows, the GDP follows an increasingly negative path for most of the time period after being positive for only the first two quarters. GDP responds in a

peculiarly fluctuating manner when one unit shock is given to domestic investment (GFCF). It remains positive and increases continuously till third quarter but then decreases till fifth quarter to recover in an increasing trend till it falls again in the ninth quarter. GDP is predicted to remain largely negative in an increasing rate in response to innovation or shock in Trade Openness. GDP mostly remains around scale of origin but majorly in the negative region in response to one unit shock in GDP Deflator. GDP also hovers around the scale of origin in response to one unit shock in REER but remains in the positive region.

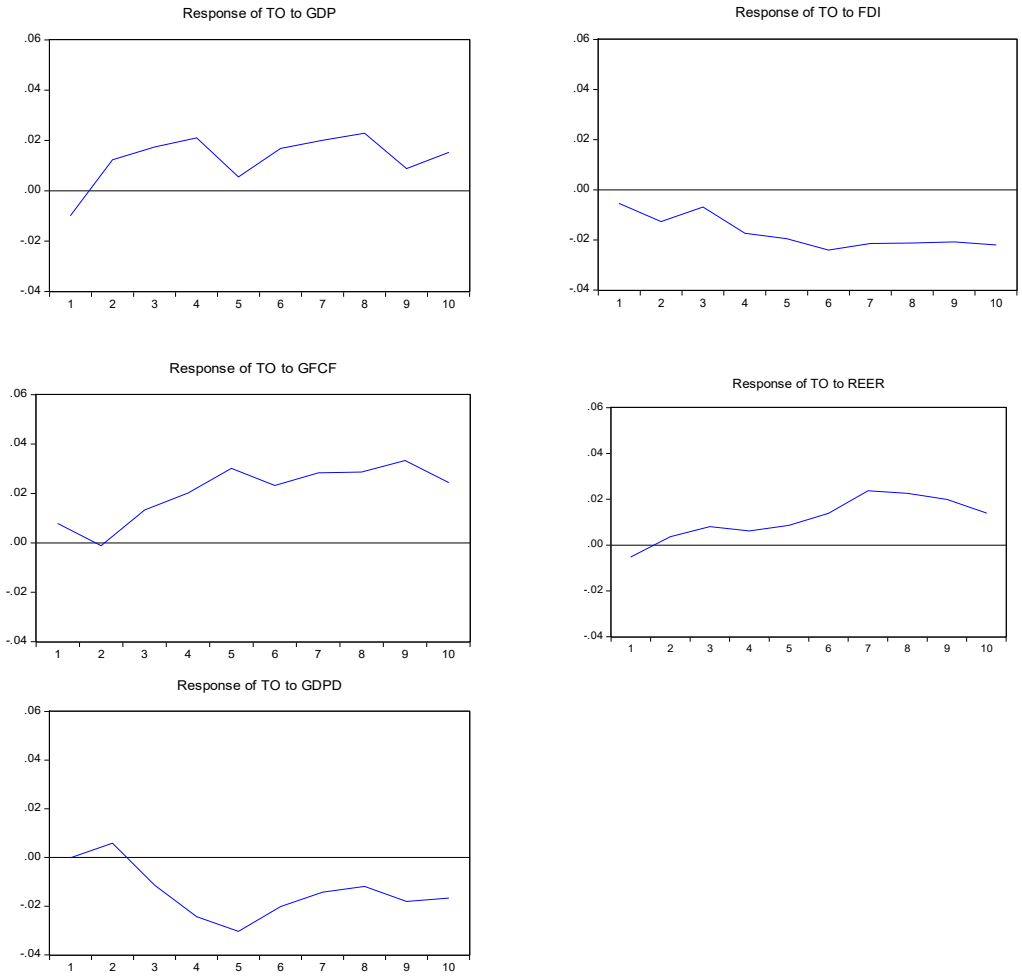
Figure 1. *Response of real GDP*



Source: Calculated by author.

Figure 2 shows the response of Trade Openness to one unit shock or innovation in the other independent variables. When one unit shock or innovation in is given to FDI and GDP Deflator, Trade Openness follows an increasingly positive path over the time period. When one unit shock or innovation is given to GDP the Trade Openness follows a severely fluctuating path in the positive scale within the value of 0.02 throughout the over the time period.

Figure 2. *Response of trade openness*

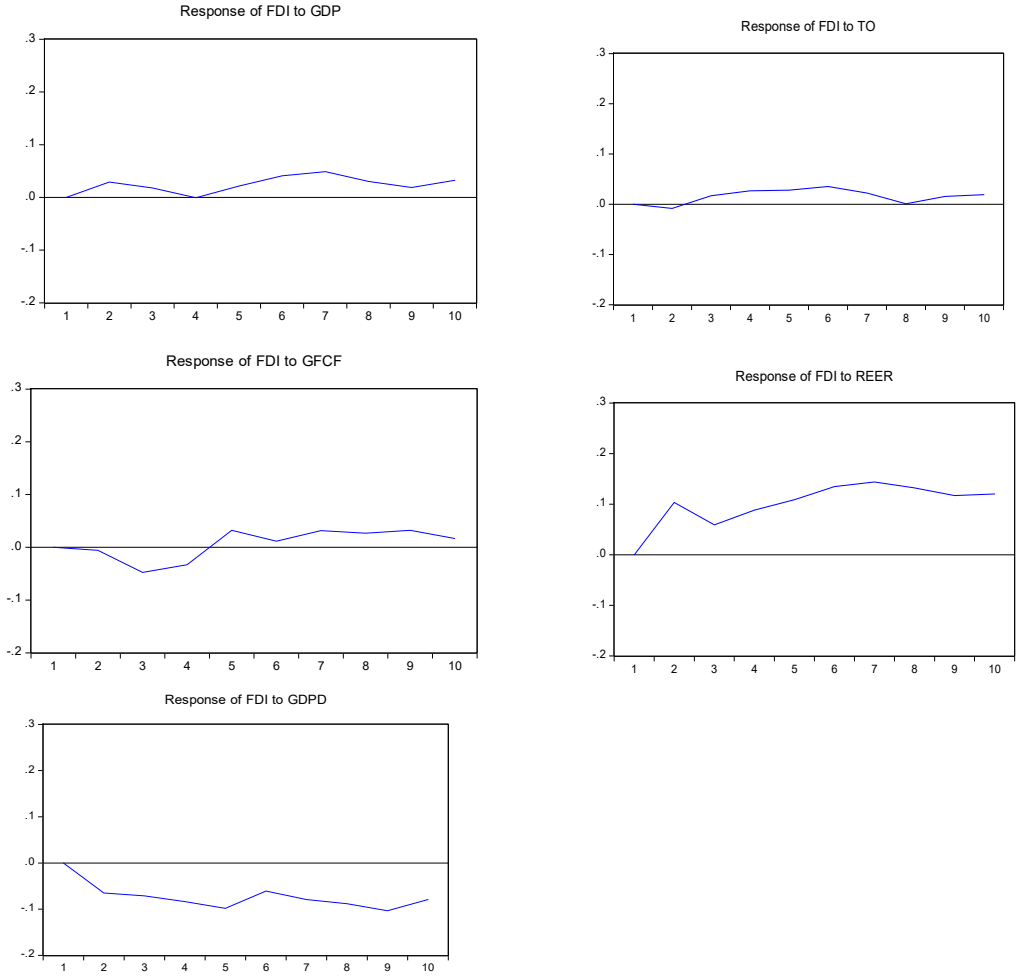


Source: Calculated by author.

Figure 3 shows the response of FDI inflows as a dependent variable when one standard deviation shock is given to each of the other independent variables. When one standard deviation innovation or shock is given to Real GDP at factor prices, then FDI inflows remains positive for the next 10 quarters but hovers around the neutral bar i.e. scale of origin or zero. But when one standard deviation innovation or shock is given to the inflation measure i.e. GDP Deflator, FDI inflows follows an increasingly negative trend

throughout the next ten quarters. On the other hand, when the same unit of shock is given to domestic investment or Gross Fixed Capital Formation, FDI inflows is predicted to be negative for the first four quarters and then rises to positive levels for the next six quarters. The response of FDI inflows follows an increasingly positive trend when one standard deviation innovation is given to Real Effective Exchange Rate. The predicted path of FDI inflows for the next 10 quarters hovers around zero but remains strictly positive after being negligibly negative in the first two quarters.

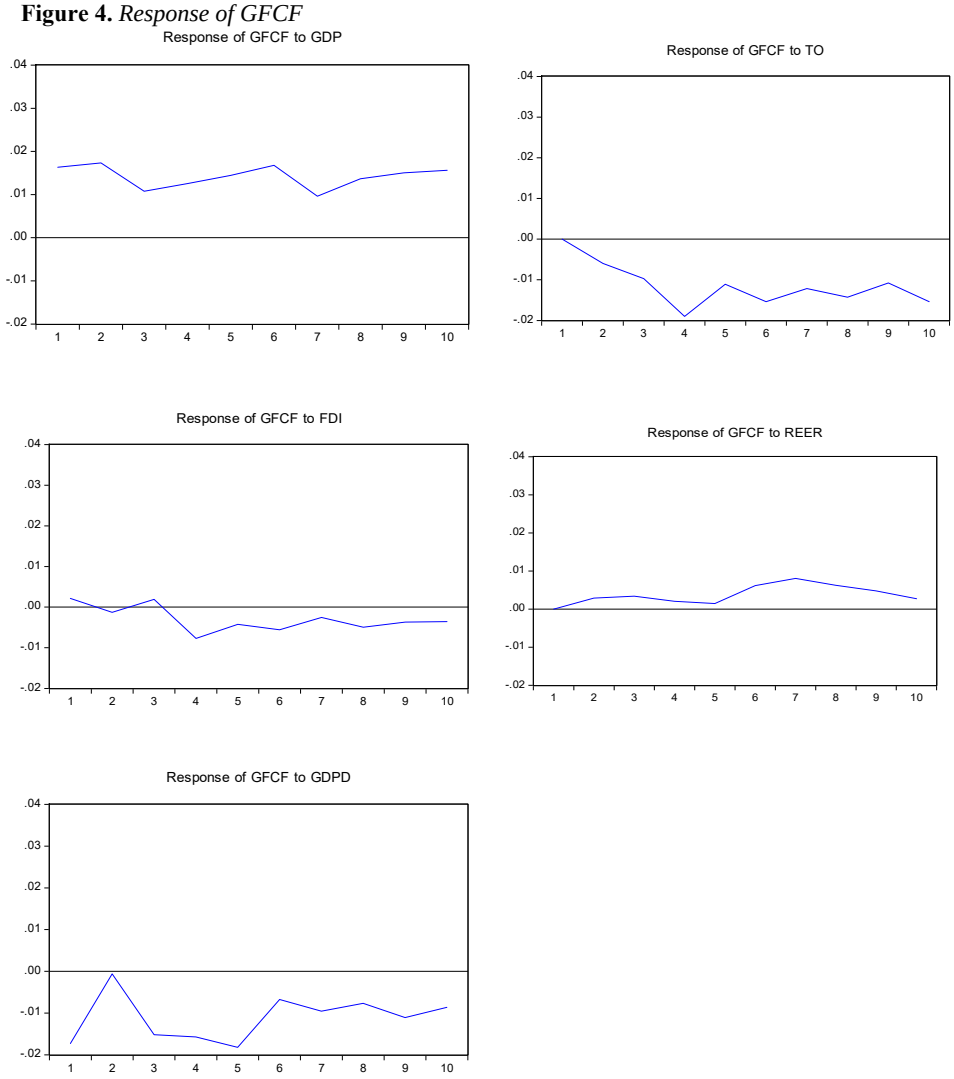
Figure 3. *Response of FDI inflows*



Source: Calculated by author.

Figure 4 shows the response of GFCF to one unit shock or innovation in the other independent variables. GFCF is predicted to be increasingly negative to one unit innovation in GDP deflator, Trade Openness and FDI inflows whereas it follows a positive path hovering around 0.01 to 0.02 in reaction to one unit innovation in REER and GDP.

Figure 4. *Response of GFCF*



Source: Calculated by author.

Figure 5 shows the response of REER to one unit of shock or innovation in the other independent variables. When one unit shock or innovation is given to FDI, REER is negative for the first five quarters and positive for the last five quarters but it hovers around the neutral value of zero. When one unit of shock or innovation is given to GDP Deflator, REER remains positive throughout the ten quarters but hovers around the zero neutral value. When one unit shock or innovation is given to GFCF, REER remains at high figures in the positive scale in the first five quarters but at low figures in the same positive scale in the last five quarters. When one unit shock or innovation is given to GDP, REER is positive for the first five quarters and negative for the last five quarters but it hovers around the

neutral value of zero. When one unit shock is given to Trade Openness, REER follows an increasing path with flatter slope throughout the next ten quarters.

Figure 5. *Response of REER*

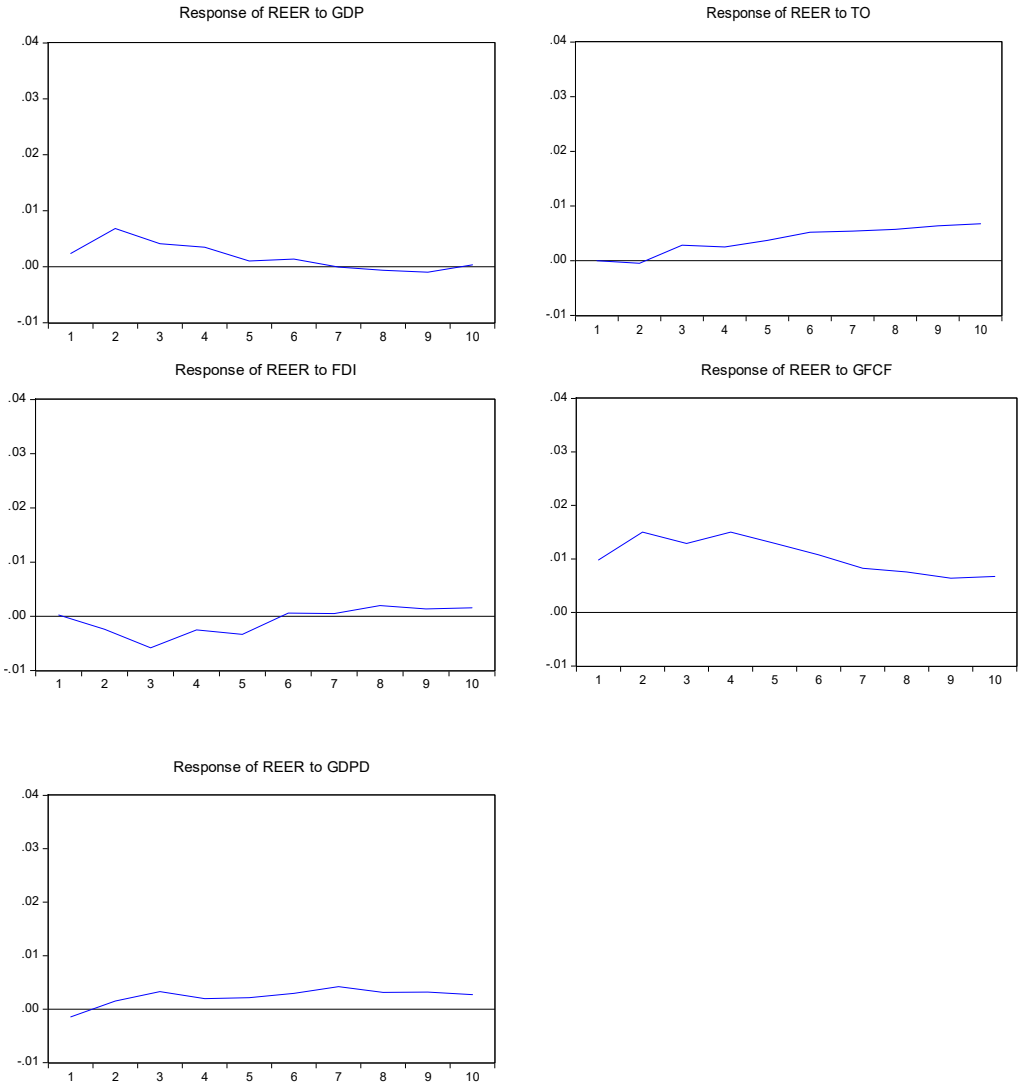
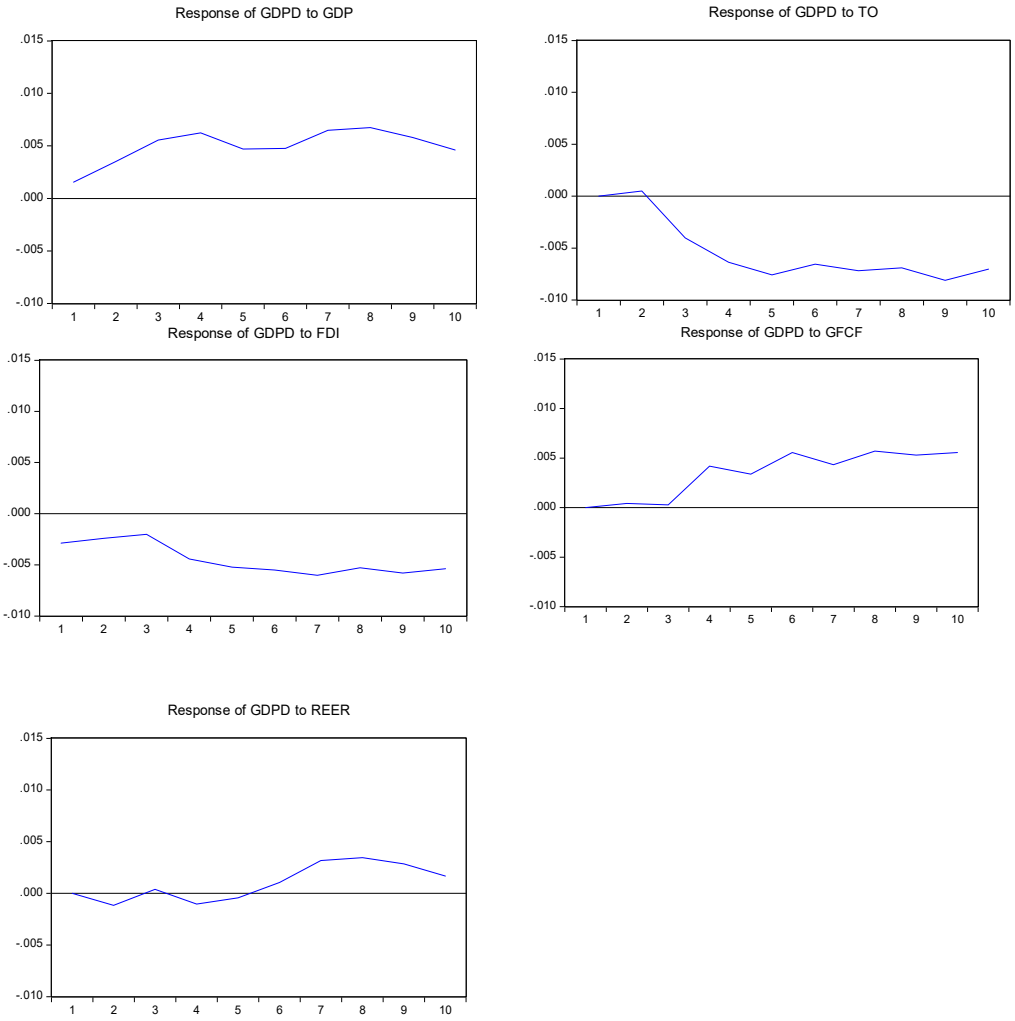


Figure 6 shows the response of GDP deflator to one unit shock in the other independent variables. GDP Deflator falls rapidly in the negative trend to one unit of innovation in Trade Openness and FDI inflows. But the same dependent variable i.e. GDP Deflator responds in an increasingly positive trend to one unit innovation in GFCF and GDP for the next 10 quarters. The reaction of GDP Deflator to one unit shock or innovation in REER is that it fluctuates and remains negligibly negative in 2nd quarter and 4th quarter till it maps an increasingly positive path further.

Figure 6. *Response of GDP deflator*



Source: Calculated by author.

4. Conclusion

It is observed that the Trade Openness affects GDP positively but Trade Openness is negatively impacted by GDP where as FDI inflow to India has a positive impact on Trade Openness. GDP deflator in the first lag shows a highly positive relationship with Trade Openness. Further, the REER has negative impact on FDI inflows at two lags. GDP at two lags has negative impact on the GFCF whereas GDP Deflator has positive impact on GFCF. IRF results reveals that when one unit shock of is given to GDP, the GFCF responds in the positive way but when one unit of shock is given to GDP Deflator the GFCF responds in the negative way over the period under study. Similarly it is found that GFCF at one lag has positive impact on REER. The GDP at both the lags has a negative

impact on GDP Deflator but FDI inflows at both the lags have a positive impact on GDP Deflator. REER at first lag has a negative impact on GDP Deflator. GDP is major variable that influence the other variables under study. FDI inflow is the outcome of GDP growth. Similarly trade openness and GDP deflator are influenced by GDP. Real effective exchange rate has little impact on GDP. But capital formation plays very important role in GDP. Therefore more importance may be given to stimulate capital formation in India. Reform and appropriate policy implications would advance the functionality of foreign investment in the nation. To make the FDI beneficial, the government must improve the absorptive capacity of the country and change the policy related to FDI.

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Impact of credit guarantee on the output gap: A panel data analysis of Asian sovereigns

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Abstract. *This paper aims to assess the impact of financial variables on output gap in a group of middle-income Asian countries such as India, Indonesia, Republic of Korea, Malaysia, and Thailand. In order to improve on the previous methodologies, this study followed a different approach by considering a binary nature of dependent variable. In order to explore role of credit guarantee, this paper considered credit guarantee to credit offtake ratio as an explanatory variable in defining output gap. Moreover, in order to get a clear picture on influence of monetary and fiscal policy, we have included revenue deficit and debt to GDP ratio along with real interest rate and inflation rate. Our Probit model ultimately proves that credit guarantee is an important factor for identifying output gap. Additionally, output gap is found to be neutral towards the movement of other financial variables.*

Keywords: output gap, GDP, credit guarantee, financial variable, Asia.

JEL Classification: O4, O49, H81.

Introduction

Arguably, credit guarantee schemes have grown from strength to strength over the years since their formal implementation in the 1960s as MSME enablers. To measure the effectiveness of these schemes, numerous studies have been conducted across financial institutions and think tanks. However, the focus of most of these works has been narrow, studying the impact on the MSME sector alone. Even in country wide assessments, previous papers seem to operate within the confines of the sector per se, i.e. employment generated (Veiga and McCahery, 2019) cost of funding (Liang et al., 2017), SME collaterals and small enterprise development (Samujh et al., 2012).

The purpose of this paper is to therefore expand the horizon and see the bigger picture, through the lens of the scheme. Consequently, we attempt to gauge whether the credit guarantee scheme (at a sovereign level) can be an effective explanatory variable that can explain macroeconomic trends.

Moving forward, we began our methodology by first trying to identify the best possible dependent variable, which in turn meaningfully represents the state of an economy. It was inferred that the identified variable(s) must essentially be a proxy of macro stability and wellbeing. Eventually, Output Gap was found to be the best fit as it embodies the research requirement and best gauge the performance consistency of any economy in transition. Rath, Mitra and John (2017) argue in their paper that policymakers consider potential output as a key benchmark and use output gap as an input to adjust policy stance to reduce possible macroeconomic imbalances and control aggregate fluctuation. On the side of independent variables in our regression tool, we followed a panel data approach given the fact that in the light of considered nominal GDP sizes ranging between $0.4-2.93 trillion (as on FY2018) among the sample, the quantum guaranteed by the scheme would have appeared inconsequential. Hence it was assessed that the scheme's impact is analyzed as part of a panel comprising of other important macro variables.

Various studies argue that credit supply is an instrumental in firm's productivity. In a most recent study, Manaresi and Pierri (2019) observed that contraction in credit supply could impair firm's total factor productivity (TFP) and thereby harm IT-adoption, innovation and acceptance of superior management practices. In addition, higher credit cost may adversely impact R&D investment of a firm and thereby lower the potential output. Aghion (2010) states that firms with tight credit constrain may reduce R&D expenditure being scared to liquidity risk. In contrast, Field (2003) believes that lack of resources may increase firm's productivity as it creates a circumstance to innovate for survival resulting in a higher potential output. Convinced by the finding of previous researchers, the paper therefore attempts to further examine how Credit Guarantee as a ratio of credit offtake is a relevant macroeconomic variable that can explain output gap.

To the best of the author (s) knowledge, no previous study has attempted to see Credit Guarantee as a macroeconomic determinant of output gap.

Output gap: A conceptual framework

Estimating potential GDP and output gap are vital from an economic policy viewpoint. Due to various factors such as those pertaining to the developments in the financial and

monetary policy, actual output often time differs from its potential level; we know this condition as 'output gap'. However, defining potential GDP is a major challenge; we therefore rely on H-P filter in our assessment.

Earlier literature argues that financial cycle is crucial in driving the output gap and consequently excess credit may lead to misallocation of resources. At the same time, credit unavailability can restrict the growth in actual output. Therefore, credit behaviour can deviate actual output from the potential level as argued by Drehmann, (2012). It is further observed that cited literature gives higher importance to the financial sector in output gap. Here, the observations of (Borio et al., 2013) come to mind; the authors state that the output may be expanded at an unsustainable pace when financial imbalance is created thereby causing a disequilibrium between actual and potential output.

Further, it is known that during an unsustainable financial boom, economic parameters are shored up in the short term. This results in the economic outlook appearing deceptively healthy. Law and Singh (2014) debate that financial sector can have an adverse impact on output growth due to misallocation of resources and therefore, financial sector can benefit the economic growth until a certain point is reached. On the other hand, Claessens, Kose and Terrones (2015) argue that financial and business cycles are highly integrated.

Some studies claim that a gap between actual and potential output is reflected in terms of inflation rate. The assumption is that an economy experiences higher inflation rate when actual output is above the potential output and vice-versa (Woodfod, 2003 and Mishkin, 2007). A condition which in turn is created when the demand supply equilibrium is disturbed by a preceding financial boom. An alternate viewpoint pertains to the fact that inflation may be a function of higher currency in circulation/new money as globalization of capital aided financial boom increases actual output beyond potential. It is further argued that inflation rate remains stable when output gap is closed as argued by Friedman (1968).

Given this background, in the earlier literature, studies have consequently considered inflation rate, growth in credit offtake and interest rate as the key explanatory variables of output gap.

Methodology for assessing output gap

In order to assess the behaviour of output gap, Borio et al. (2013) have considered inflation rate, real interest rate, credit growth, and property price and lagged output gap for a panel regression. Another study, Felipe, Sotocinal, and Dacuycuy (2015) estimates the output gap using the same variables as proxy for financial cycle. Following the previous studies, this paper examines the indicator output gap with a group of five middle-income economies in Asia, namely, India, Indonesia, Republic of Korea, Malaysia, and Thailand. India, Thailand, Indonesia and Malaysia are taken as peers under the OECD Development Centre definition of Emerging Asia. Countries under this grouping are characterized by a resilient private consumption, strong economic growth and trade. South Korea, even though not part of the OECD definition of emerging- is added because the country represents similar characteristics seen in Emerging Asia apart from having a significant presence of the credit guarantee scheme.

In the literature, absolute value of output gap was considered as a dependent variable. However, as the lagged variable of the output gap is considered as an independent variable, from a model specification point of view, we are defining the dependent variable in a binary form. In addition, our primary concern is negative output gap where actual output remains below the potential level. Therefore, a binary variable is created where '1' is assigned whenever actual output is below its potential level and '0' otherwise. This is expected to give a robust result in identifying the influence of financial cycle on output gap. In addition, this paper considered credit guarantee to credit offtake ratio as an important explanatory variable instead of growth in credit offtake. Moreover, in order to get a clear picture on influence of monetary and fiscal policy, we have included revenue deficit and debt to GDP ratio along with real interest rate and inflation rate.

The rest of the paper is divided into three parts. Part II, pertains to the Data and Methodology. Part III, pertains to the Empirical Analysis of the study. Finally, Part IV comprises of the Conclusion of this paper.

1. Data and methodology

1.1. Data

For an empirical analysis on a cross-country level data, this study has considered output gap, consumer inflation, revenue deficit, fiscal deficit, debt to GSDP, real interest rate and credit guarantee to offtake ratio. Output gap is estimated using H-P model. The countries are included in the study are India, Indonesia, Korea Republic of, Malaysia and Thailand. A major challenge for the study is getting recent data on credit guarantee. Credit guarantee data for some countries is not available publicly. Therefore, the Asian countries (under the Emerging Asia bucket) are chosen based on the availability of most recent data. The cross-country level data has been collected from International Monetary Fund (IMF), World Bank, Small Industrial Development Bank of India (SIDBI), Annual Report 2018 of Korea Credit Guarantee Fund, Bank Indonesia, Annual Report 2018 of Credit Guarantee Corporation of Malaysia, Small Business Credit Guarantee Corporation of Thailand, Asia SME Finance Monitor 2014 of Asian Development Bank (ADB). This study has considered a time period from FY2011 to FY2018 as all data available for the considered countries.

1.2. Methodology

The empirical study is based on a Probit panel regression. Objective of this research is to examine the impact of financial variables including credit guarantee on output gap. First, output gap is measured using the Hodrick-Prescott (HP) filter method. Further, in order to make it fit into the model, the output gap is assigned '1' if the gap is negative and '0' otherwise.

Model 1:

$$Y_{it} = \beta_1 Z_{it} + \beta_2 X_{it} + \mu_i + v_i + e_{it} \quad (1)$$

Where, y is a binary variable – assigned '1' if the actual output is less than potential output and '0' otherwise.

The output gap is estimated as deviation of actual output in log form (Y_t) from its potential level $(\bar{Y}_t)$. The potential output is estimated using the H-P filter. There are several methods to obtain output gap. However, the earlier literature suggests that no method can be claimed to be superior over another. Therefore, the study has chosen H-P filter to estimate the output gap. This method is suggested by Felipe et al. (2015) and Bhoi and Behera (2016) for India as well as for Asia specific study. Podpiera et al. (2017) argue that H-P filter is simpler and more transparent.

Model 2:

$$Min\sum_{t=1}^{T}\left(y_t - y_t^*\right)^2 + \lambda\sum_{t=2}^{T-2}\left[\left(y_{t+1}^* - y_t^*\right) - \left(y_t^* - y_{t-1}^*\right)\right]^2 \quad (2)$$

Where, Y_t is actual GDP, Y_t^* is potential output, λ is a weighting parameter for smoothening the trend pertaining to output gap. λ assigns greater weight close to the beginning and end of the sample period.

2. Empirical analysis

Before heading for a panel regression test, we have presented descriptive statistics and correlation matrix. The descriptive statistics for 40 observations for five countries shows that there is no outlier in the series.

Summery statistics

		Mean	Std. Dev.	Min	Max	Observation	
CGO	Overall	1.19	1.18	0.03	3.34	N=	40
	Between		1.24	0.09	2.83	N=	5
	Within		0.36	0.1	2.12	T=	8
Interest rate	Overall	4.02	2.28	-0.47	9.22	N=	40
	Between		1.9	2.61	7.00	N=	5
	Within		1.49	0.48	6.72	T=	8
Inflation rate	Overall	3.37	2.52	-0.9	10.00	N=	40
	Between		2.15	1.49	6.39	N=	5
	Within		1.58	0.41	6.98	T=	8
Y_{t-1}	Overall	0.08	0.94	-1.64	1.98	N=	40
	Between		0.05	-0.04	0.08	N=	5
	Within		0.94	-1.60	2.02	T=	8
RD	Overall	-2.01	3.01	-8.35	2.57	N=	40
	Between		3.26	-7.21	1.38	N=	5
	Within		0.60	-3.34	-0.91	T=	8
Debt	Overall	45.19	15.00	22.96	68.77	N=	40
	Between		16.42	26.25	67.81	N=	5
	Within		1.98	40.33	49.03	T=	8

Note: CGO is credit guarantee to offtake ratio, Y_{t-1} is lagged output gap, Interest rate is lending rate adjusted with GDP deflator, which express real interest rate, Inflation rate is change in consumer price index, RD is revenue deficit to GDP ratio, Debt is debt to GDP ratio.

Correlation matrix

The correlation matrix shows that revenue deficit is highly correlated with inflation rate (66%) and debt (76%). Apart from these pairs, no pairs have correlation coefficient more than 50%.

	CGO	Y_{t-1}	Inflation rate	Interest rate	RD
CGO	1.00				
Y_{t-1}	0.08	1.00			
Inflation	-0.45	-0.01	1.00		
Interest rate	-0.36	0.33	0.26	1.00	
RD	0.11	0.03	-0.66	-0.28	1.00
Debt	0.09	-0.01	0.26	-0.21	-0.76

Panel Regression Result (Probit Random Effect)

Dependent Variable: Output gap – A binary variable was created such that when actual output is less than the potential GDP then 1 is assigned otherwise 0.

	M1	M2	M3	M4	M5
CGO	-0.3842*** (0.071)	-0.3527** (0.045)	-0.403*** (0.064)	-0.3583*** (0.078)	-0.4468 ** (0.045)
Y_{t-1}		-0.5369*** (0.079)	-0.5477** (0.041)	-0.5283** (0.048)	-0.5883** (0.033)
Interest rate	-0.2200** (0.036)	-0.1538 (0.167)	-0.1450 (0.197)	-0.1587 (0.173)	-0.1133 (0.334)
Inflation	-0.0416 (0.664)		-0.0601 (0.545)		-0.1033 (0.350)
RD				-0.0110 (0.887)	
Debt					0.0168 (0.311)
Constant	1.4387** (0.048)	0.9576 (0.126)	1.1770 (0.107)	2.2961*** (0.341)	0.4903** (0.311)
rho	0.00	0.00	0.00	0.00	0.00
Sigma_u	0.0002	0.00004	0.0003	0.00004	0.0002
χ^2	5.66	9.08**	9.40***	9.07***	10.08***
Obs	40	40	40	40	40
No. of group	5	5	5	5	5

Note: ** indicates significant at 5% level, *** indicates significant at 10% level; p-value is given in the parenthesis.

In order to examine the role of financial variables in output gap, this study has considered various combinations of financial variables such as real interest rate, credit guarantee to credit offtake ratio (CGO), inflation rate, revenue deficit to GDP ratio (RD), debt to GDP ratio (Debt). For all the models, variable CGO is significant at 5 or 10 percent level with negative sign. This indicates the probability of output gap to be negative is higher if the credit guarantee to credit offtake declines and vice-versa. Similarly, one period lagged output gap is used as proxy for growth cycle. The explanatory variable is significant at 5 percent level in the last three models. In order to examine the monetary impact, the research has included real interest rate as proxy for monetary policy. Consequently, for fiscal policy, revenue deficit to GDP ratio and debt to GDP ratio has been considered. However, these variables are found to be insignificant. This indicates that when CGO and lag output are considered the gap is neutral to the monetary and fiscal policy determinants.

Conclusion

In this paper, we attempt to gauge the significance of the credit guarantee scheme as a macroeconomic determinant. Even though credit guarantee scheme is operational in several countries across the world, we focused our attention on Asian emerging nations. The countries thus included in the study are India, Indonesia, Republic of Korea, Malaysia and Thailand, which are effectively peers by way of GDP size.

In order to have a different approach, the dependent variable (output gap) is converted into binary form and applied with a Probit panel regression model. It was observed that the financial variables such as inflation rate, interest rate along with RD and Debt are found to be insignificant, which is in line with the earlier literature (Felipe et al., 2015). Credit guarantee to offtake ratio and lagged output gap, on the other hand are found to be statistically significant. The model therefore proves the high probability of actual output remaining below its potential level whenever the credit guarantee to offtake ratio falls and vice-versa. Therefore, from a policy perspective, in order to maintain actual output close to its potential level, credit guarantee scheme can be used as an instrument.

As mentioned in the data and methodology section, credit guarantee data for most countries is publicly not available. Moreover, the data is available in annual frequency from 2011 onwards only; a reason why this study was compelled to proceed with annual frequency. The researchers are aware that the output gap with a quarterly frequency for the considered time frame would have thrown more robust results. Additionally, a country specific dummy could have been more insightful.

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Analyzing the robustness of ARIMA and neural networks as a predictive model of crude oil prices

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Abstract. *The paper is focusing in analyzing the robustness of the Auto Regressive Integrated Moving Average (ARIMA) and Artificial Neural Networks (ANNs) as a predictive model in forecasting the crude oil price. The paper has identified stochastic trend in the daily time series data starting from (03.01.2011 to 11.10.2019). The time considered in the study is subject to high volatility, which makes this paper unique from the current stock of knowledge. During this time frame it has been identified that there is no structural break. The empirical analysis furnishes that the ARIMA is the best suited model. The decision criterion for the selection of the best suited model depends on ME, RMSE, MAE and MASE. From the results of the criterion it has found that both the models are providing almost closed results but again ARIMA is the best suited model for the current data set.*

Keywords: ARIMA, ANNs, Crude-Oil.

JEL Classification: G1, G17, G170.

Introduction

World economies in general and developing economies in particular largely depend on crude oil. The overall structure or sectors of the economies depends on one of the crucial commodity i.e. crude oil. The volatility, spillover, conitegration, forecasting are the buzzword now a days (Gulzar et al., 2019). The increase in $ per barrel crude is meant a lot for the developing economies. Developing economies in particular, because of high potential to expand and high growth, where their import bills are largely driven on crude, any increase in the prices, directly affects the sectors, trade deficit, rupee depreciation, output and inflation. The increase in crude oil prices accentuates the cost push inflation and after a lag converges into general inflation called as imported inflation (Prakash and Sharma, 2016). Crude price sensitivity with various sectors or industries has been done that analysed the impact of changes in crude on the performance of various sectors (Sarwar et al., 2017). Narayan and Sharma (2011). Several studies have been done on the spillover effect of crude prices on various countries stock market like Asian, European and developed countries (Irshad et al., 2014; Maclaury, 1978; Sarwar et al., 2018). These studies are imperative for the portfolio managers by investing in negative correlated asset class to provide the complete hedge against financial and economic turmoil. These studies reflect the fascination of portfolio manager towards the crude oil as base commodity. Thus, economists and policy makers are largely interested in predictive modelling of base commodity i.e. crude oil prices. Investors who invest in commodities market are interested to forecast the future trend and simultaneously predict the futuristic movement of other asset class to earn abnormal returns from their investments and hedge their current portfolio. The studies also provide their insight to the policy makers for the future plan of action regarding the importing strategies. This motivates the author to make a predictive model of crude oil prices. Several studies already been done on the prediction of crude oil prices but this study considers the period of high volatility. Thus, to the best of my knowledge because of the coverage of the study makes the study unique from the current stock of knowledge.

Several studies are based stock prices predictive modelling, based on ARIMA, GARCH & ANNs. After studying the current stock of knowledge based on the predictive modelling of crude oil prices, mostly the authors applied ARIMA, GARCH and ANNs (Jaya Selvi et al., 2018; Hale, 2018; Ahmed and Shabri, 2014; Mo and Tao, 2016, etc.) This further motivates the author to take a further analysis of predictive modelling on crude prices with a unique data set and very few studies are focusing on the robustness of the available model. Papers that applied ARIMA and Neural Networks for predicting the crude prices had varied consensus in the results. This motivates author to further analyse the crude oil prices with more than decadal data. ARIMA is to be considered as one of the robust method to predict the future realizable value of time series. But again the model is having a constraint that the future values depend on its past/ lagged realized values. This is limiting the theory of dynamic model that considers exogenous factors apart of lagged values. Since, ARIMA Modeling is based on assumption of future depends on its past performance, which limits its scope static rather dynamic. Again the paper has applied machine learning i.e. Artificial Neural Networks (ANNs) that is again limited to the inputs based on its past values. Despite of the limitation, these models are considered by analysts to understand a broad

outline/behavior of the time series in future. The robustness of the model has been derived from the results of ME, RMSE, MAE and MASE.

The study would be relevant for investors, portfolio managers and policy makers to consider the future trends of the crude and understand the best suited model for the given time series and evolve or formulate their respective strategy accordingly.

Literature review

Several studies has been done on forecasting model to predict the crude prices, as discussed very large studies have been done on spillover or co integration of crude prices on various stock markets. The literature review considers the review of the papers done on predictive modeling and forecasting techniques. The section also captures the few studies done on spillover.

Selvi J., Shree R.K. and Krishnan J. (2018), study based on crude oil forecasting the paper is an attempt in predicting the crude oil prices through ARIMA models. The study considered yearly data from 1946 to 2016. The study predicts the crude prices from 2017 to 2021. The study leaves a scope for further study to analyze daily price data. Another study done by Hale (2018), *Predicting Oil Prices*, the paper considered daily WTI oil price data from January 1986 to November 2017. The study applied both ARIMA and Neural Networks for predicting the oil prices. Mixed results had come out, where the ARIMA builds a simple lagging version of the input data and the neural network sees either over fitting of the training set or under fitting of both the training and test sets. The results are in consensus of our study that to make analyse the most dynamic model. This study could include more inputs that effect demand and supply of crude oil. In the same league one study done by, Ahmed and Shabri (2014), in his study considers the ARIMA, GARCH & SVM technique in predicting crude oil prices. The results show the Support Vector Machine is the most robust among the three methods. The conclusion is based on RMSE & MAE. Mo Z. and Tao H. (2016), the study considered *ARIMA and RBF neural network*, the study finally analysed that both the models are equally robust in predicting the crude oil prices. Zhao and Wang (2013), in his study the author applied auto regressive model to predict the crude prices. The data considered in the study from 1970 to 2006. Further the study has used SAS and the results are based on the MAPE i.e. 4.059%. Further the study analyzed that the model is showing robust results in short term. Kulkarni and Haidar (2009), The author forecasted the crude oil prices using *ANN*. Moshiri and Foroutan (2005), also examined the chaos and nonlinearity in crude oil futures prices by the application of ARIMA, GARCH and ANN. The author applied neural networks on the West Texas Intermediate (WTI) Crude data. The author as usual considered two basic parameters to judge the performance of the model i.e. RMSE & MAE. The Author applied two models i.e. ARIMA and GARCH had shown RMSE i.e. 0.9856 and 1.0134 respectively.

Studies have done on exclusive usage of ANN, Adly et al. (2014), Zhang (2014). Refenes et al. (1994), Castillo and Melin (1995), Giles et al. (1995), Donaldson and Kamstra (1996), Kamstra and Boyd (1995) and Sharma et al. (2003), these studies demonstrated that the ANN is the most superior techniques.

The studies on crude oil prices and its spillover on emerging, Asian and developed countries are Studies conducted on the spillover effect of oil prices on stock markets , out of which few studies are showing negative relations , Maclaury (1978), Melick et al. (1997), Basher et al. (2016), Ederington et al. (2010), Filis et al. (2011), Arouri et al. (2012), Awartani et al. (2013), Narayan et al. (2014), Du and He (2015), Khalfaoui et al. (2015), Ghosh et al. (2016), Sarwar et al. (2018) and few studies are showing positive relation, Narayan et al. (2010), Zhu et al. (2014), Degiannakis et al. (2014), Silvapulle et al. (2017), whereas some studies have shown mixed results, Apergis et al. (2009), Miller and Ratti (2009), Reboredo et al. (2014), Hatemi et al. (2017).

Research methodology

Objective of the study

To analyze the robustness of ARIMA and Neural Networks as a predictive model of crude oil prices.

Data

The study considers the West Texas Intermediate (WTI) Crude oil price data from 03.01.2011 to 11.10.2019. The rationale of taking up WTI, to have a consensus with previous study done (Ahmed and Shabri, 2014; Hale, 2018, etc.). The data compiled from World Bank. The software used for predictive analysis is R studio.

Rationale of the study

Many studies had already done in the past to analyse the best predictive model of Crude oil prices at different data point. Mostly done on yearly or monthly prediction, only few researches to the best of my knowledge conducted on daily spot prices. The rationale of the paper that gives uniqueness from the current stock of knowledge, that motivates the author for further study that none of the paper considered this time period. The uniqueness of this period is that from 2011 to 2013 the crude oil prices became at its peak i.e. more than 100$ per barrel and around 90$ per barrel then it came down steadily. This volatile time frame has been considered for study to make the consensus from the results of the previous studies.

Methods and models

ARIMA: An autoregressive integrated moving average (ARIMA) model has been used widely to forecast the future realized values, this model is an extension of autoregressive moving average (ARMA) model in time series analysis. ARIMA models are used in a time series that are not stationary. It has been denoted as p, d and q, where p is autoregressive model, d is integrated and q is moving average model. The non-stationary time series has to be converted into stationary by going first order or second order or next level of differencing, till the series comes to be stationary. AR and MA as a constituents of ARIMA, AR i.e. Auto regressive reflects that the future values depends on its past values, having lead and lagged structure pattern, where the MA i.e. Moving average reflects regression error is a linear combination linear combination of error terms whose values occurred

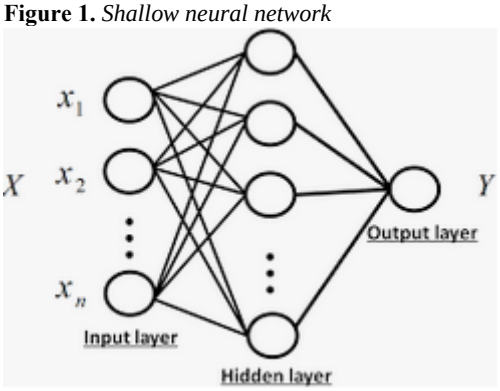
contemporaneously and at various times in the past. ARIMA models can be estimated following the Box- Jenkins approach. The ARIMA Model for crude oil price returns could be formulated as:

$$C(R)_t = a_0 + a_1 Ret_{t-1} + a_2 Ret_{t-2} + \cdots a_n E_{t-n} + a_{n+1} E_{t-2} \ldots \ldots a_{n+1+m} E_{t-n+1+m} + \varepsilon t \quad (1)$$

Where, $C(R)_t$ is Crude Oil Return, Ret_{t-1} is lagged return and E_{t-n} is the lagged error.

Artificial Neural Network: Artificial Neural Network has been used by the analyst to predict wide range of time series data. The paper applied shallow neural network with one hidden layer. The input that has considered in the model i.e. lagged values of the crude oil price returns.

Figure 1. *Shallow neural network*



Source: Course era.

Empirical results

Analysis of the results of descriptive statistics

The descriptive statistics of WTI crude oil prices from 3 Jan 2011 to 11 Oct 2019 is given in Table 1. The daily price data having number of realizations i.e. 2282. The lowest price of crude to be incurred during the time period is 26.21 $ per barrel whereas the highest is 113.93. Over the time, the average price is realized as 71.67$. The variance and standard deviation is 530 and 23 respectively. It shows the skewedness in the data i.e. 0.117. Where the peakedness is -1.491, it reflects the data departs from its normality. This inference further cross validated from box plot and Jarque Berra Test. Although in auto regression functions, normality is not the desired assumption.

Table 1. *Descriptive statistics of WTI crude oil prices*

Crude Price	
nobs	2282.00
Minimum	26.21
Maximum	113.93
1. Quartile	50.79
3. Quartile	94.87
Mean	71.67
Median	65.86

Sum	163560.86
SE Mean	0.48
LCL Mean	70.73
UCL Mean	72.62
Variance	530.06
Stdev	23.02
Skewness	0.12
Kurtosis	-1.49

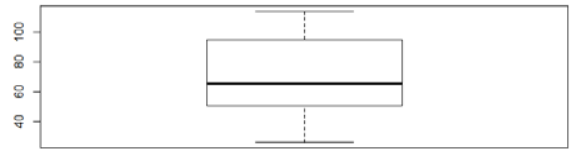
Source: Authors own work.

Analysis of the Results of Normality

The above descriptive statistics could be further strengthen by the results of normality. The crude method to check the normality in the data set, Jarque Berra Test has been applied. Although in time series normality is not important, rather stationary is the crucial aspect.

For normality check, null hypothesis is data is normal and alternate is data is not normal; less than 0.05 Null Hypothesis rejected. Thus, series is not normal. For the time series data normality is not having a great relevance, especially in stochastic trend rather stationarity having great importance for running regression. Further the analysis furnishes the results of stationarity.

Chart 1. *Box plot*



Source: Authors own work.

Table 2. *Result of normality*

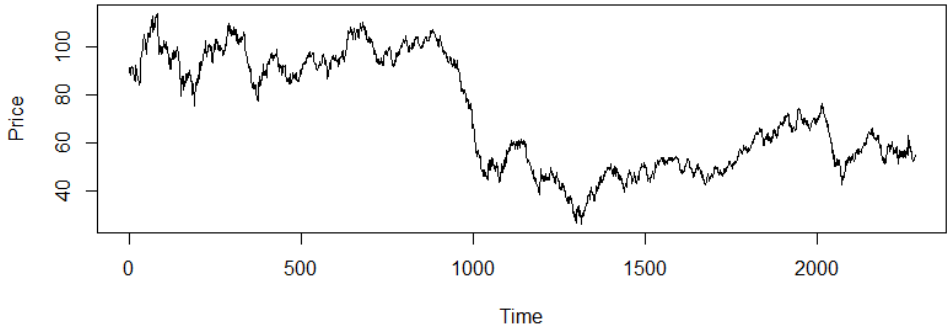
Result of Jarque Bera Test
data: Spot Prices
X-squared = 54.018, df = 2, p-value = 1.862e-12

Source: Authors own work.

Analysis of the plot

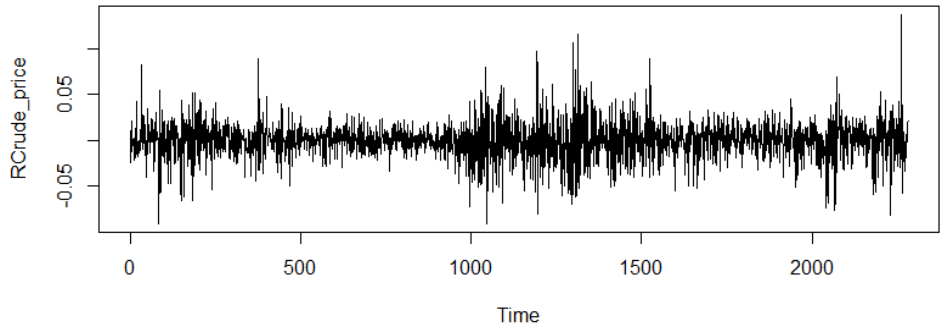
The Plot of the crude price data shows the prima facie visual effect of trend exists in the data set. Chart shows that it is a stochastic trend rather than deterministic trend. To further validate the presence of stochastic trend in crude oil price time series, Auto Correlation Function (ACF) and Partial Auto Correlation Function have (PACF) have to be applied. From the results of ACF & PACF, analyst can infer that the current price depends on previous price; this lead and lagged structure between the prices have been validated by the correlation function. The ACF & PACF should be applied on returns of crude price data. The results of ACF & PACF of returns of WTI Crude price are as followed:

Chart 2. *Plot crude spot price*



Source: Authors own work.

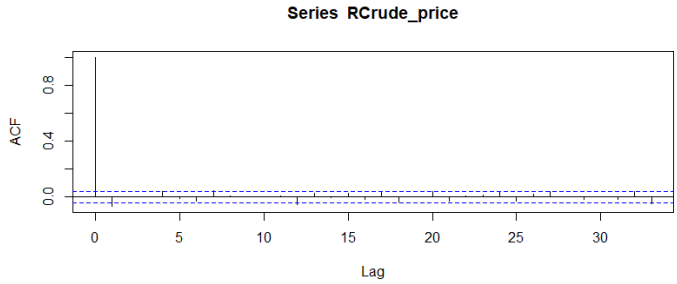
Chart 3. *Plot crude spot price returns*



Source: Authors own work.

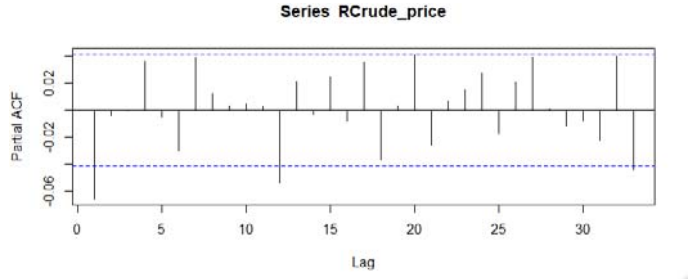
Analysis of the Results of PACF and ACF: Chart 4 presents the result of Autocorrelation Function (ACF) which is a correlation between variables but with its own lag. There exist various lags and autocorrelation in X-axis and Y-axis respectively. ACF helps to determine the suitable lag for moving average through error term. As per Chart 3, there is correlation in error term in lag 1, lag 12, lag 18 and lag 32 because the ACF of these lags are either higher than upper bound or lower than lower bound. It gives base for forecasting the series associated with error term. Similarly, Chart 5 presents the result of Partial Autocorrelation Function (PACF). PACF is correlation between observations X_t and its lag after removing the linear relationship of all observations that fall between X_t and its lag. PACF helps to determine the suitable lag for autoregressive in Autoregressive Integrated Moving Average (ARIMA). The various lags and partial autocorrelation functions are presented by X –axis and Y-axis respectively. The PACF are significant in lag 1, lag 12 and lag 32 as their spikes are either higher than upper bound or lower than lower bound in these lags. It can be said that ACF and PACF gives ARIMA order for predicting a series. ACF is denoted by “q” and PACF is denoted by “p” in ARIMA model but the best order is tested with the help of auto.arima command in R Studio.

Chart 4. Plot of ACF



Source: Authors own work.

Chart 5. Plot of PACF



Source: Authors own work.

Analysis of the results of stationarity

As discussed earlier before forecasting of time series data, it is crucial to determine the data should be stationary otherwise the results of regressions are spurious and not appropriate for further forecasting. The results is shown in Table 3, the results of Dickey Fuller and Phillips Perron of unit root test are in consensus, both tests are showing the p value less than 0.05, the null hypothesis is rejected that data is not stationary and alternate is selected that infers the data is stationary thus integrated at I(0).

Table 3. *Result of stationarity*

Results of Augmented Dickey-Fuller Test
data: RCrude_price
Dickey-Fuller = -12.756, Lag order = 13, p-value =0.01
alternative hypothesis: stationary
Result of Phillips-Perron Unit Root Test
data: RCrude_price
Dickey-Fuller Z(alpha) = -2464.3, Truncation lag
parameter = 8, p-value = 0.01
alternative hypothesis: stationary

Source: Authors own work.

Analysis of the results of structural break point

Further for preparing the robust predictive model, the structural break in time series should be required to identify otherwise the results of the forecasting model becomes spurious. Thus to make model effective the structural break has to identified. The results of the test shows that there is no structural change as the P value is greater than 0.791, thus null hypothesis still intact and the series shows no structural break points.

Table 4. *Result of structural break point*

supF test
data: model_rspotprices
sup.F = 1.9867, p-value = 0.791

Source: Authors own work.

Comparison as a predictive model in ARIMA & ANNs

The comparison in between ARIMA and ANNs reflects that both are showing approximately same results with same level errors. Despite of same level of error in predicting the crude oil prices, ARIMA is a robust model than ANNs. The conclusion has inferred from the results of RMSE, MAE and MASE. The outputs of the summary of the predicting model are given hereunder:

Table 5. *Results of ARIMA model*

Predictive Model	*RMSE*	*MAE*	*MASE*
ARIMA	0.02070857	0.01480789	0.6825379
ANNs	0.02075406	0.0148408	0.6840548

Source: Authors own work.

Conclusion

The study considers the crude oil as a vital commodity for a developing economy in particular. Thus, the study focuses on the prediction of crude oil prices by identifying the best way to predict future by considering its own lagged values. The study identified that the crude data more than decadal i.e. from 2011. The stochastic trend has been identified by the plot of the price data and its returns. It has been identified that the data is not normal but stationary. This further provides a way to apply the ARIMA Model. With the results of PACF and ACF it has validated that the future values depends on the lagged values and error term.

It has also been identified that the data used in study has no structural break. The results of the study are in consensus of the research done previously (Mo and Tao, 2016; Hale, 2018, etc.), but not in the consensus of (Ahmed and Shabri, 2014; Moshiri and Foroutan, 2005 etc.). It has found that the two models are approximately giving the same results but with some minor differences the ARIMA model is found more close model then ANNs. Lest all of the two model is restricted with its exogenous variables or inputs, this makes the model static. If it includes variables like gold prices, Fed interest rate, demand and supply side factors, makes model more dynamic and robust (Hale, 2018). This leaves enough scope for further intense study.

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Does the agriculture value-added contribute to the economic growth in 30 African countries?

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Abstract. *Not a long ago, the agriculture sector was the main pillar of any economy in the world. It not only provides food production, but it participates to the expansion of the economic growth as well. In this paper, we shall try to investigate the relationship between agriculture sector and economic growth for 30 African countries over the period of 1980-2017 with individual and temporal fixed-effect panel model and panel cointegration. We found with Pedroni and Westerlund tests that we have not a cointegration relationship between variables; hence we cannot estimate the long-run panel model. Therefore, we only estimated the panel model with individual and temporal fixed-effect, then we established that the two variables of economic openness relied to agriculture sector are positive, but insignificant, while the variable of the agriculture value-added was positive and statically accepted at the level of 1%, and the coefficient of the labour force in the agriculture sector appears negative and insignificant. The panel Granger causality showed that there is bidirectional causality between agricultural raw materials exports and imports, and the causality of Dumitrescu and Hurlin established that there are several causalities.*

Keywords: agriculture; economic growth; African countries; individual and temporal fixed-effect panel model; panel cointegration; panel Granger causality, Dumitrescu and Hurlin causality.

JEL Classification: C33; O13; Q10.

1. Introduction

Since the last century, most African countries have witnessed a rapid and huge development (Wiggins, 2014). This expansion is relied to different factors, including agricultural growth, improvement in the rule of law and control of corruption, increases in foreign direct investment, government commitment to invest in the agriculture and food sectors, improvement in soft and hard infrastructure, higher prices for natural resources, and development assistance. Therefore, such countries have given a key role to agriculture growth in producing the broad-based growth needed to reduce poverty and hunger (ReSAKSS, 2014). Regarding to different studies, the development of the agricultural outputs is necessary for the whole economic system and account for the lion's share of employment and overall gross domestic product (GDP) in Africa. In addition, agriculture is capable of producing surplus food and labour, which boosts the productivity and profitability of the non-agricultural sector.

In several African countries, the agricultural sector takes a key part in the lives of the inhabitants, and can have a close relationship with the objectives of sustainable development defined by United Nation for Development program ranging from improving food security, ending poverty, creating employment, generating foreign exchange, supplying raw materials for industry, and providing a cushion during shocks, to supporting environmental sustainability, among others. Also, this sector contributes to rise the food production and exportation, which can effect or to be influenced by both domestic and international markets through forward (product market) and backward (factor market) linkages (Boansi, 2014). These spillover effects from the agriculture sector to the non-agriculture one will result in high overall productivity and growth. So, these developing countries are aiming at achieving the sustainable growth and sustainable development, therefore, the international trade (agriculture export for example) is generally perceived as a motivating factor to attaining this.

Indeed, the agriculture sector allows decreasing poverty; supplementing food availability and it generally improve the livelihood of the population. Timmer (2004) approves the hypothesis of agriculture-led growth (ALG), which denotes that the growth of the agricultural sector is essential for industrialization through a rise in rural incomes and delivery of industrial raw materials, provision of a domestic market for industry and above all, the release of resources to support the industry.

However, the abandonment of the agriculture in favour of the industrial sector will reduce the expansion of the economic growth and increase the inequality in income distribution. In spite of the fact that agriculture may be incapable to single-handedly transform an economy, it is a necessary and sufficient condition in kick-starting industrialization in the early stages of development (Byerlee, 2005). In fact, several investigations found that the agricultural sector in Africa is at its survival threshold and fails to trigger a positive spillover to the non-agriculture sector. For example, the industry sector supplies important agricultural inputs, new technology, electricity, more irrigation, and better infrastructure that links it to lucrative regional food markets (World Economic Forum, 2016).

In this study, we shall make a panel model to analyse the main determinant of the agriculture sector and the economic growth in 30 African countries over the period 1980-2017. This paper is divided into 5 main sections. The first section defines the introduction and it gives a brief description about the importance and the role of agriculture to reach the sustainable development goals. The second section is the literature review, we will see the theoretical framework about the agriculture and the empirical investigations about the main determinant of the economic growth related to the agriculture sector. The next section describes the data and the methodology employed in this study. The fourth section is the main empirical result and the last section represents the general conclusion.

2. Literature review

The potential of the agricultural segment is huge and we confirmed that it plays an important role in securing the food demand for the urban population and export goods for the international market. The economic systems of underdeveloped countries are mostly characterized by dual economies that comprise subsistence traditional agriculture and a modern urban sector (Lewis, 1954; Jorgenson, 1961; Schultz, 1964). Johnston and Mellor (1961) identified five main channels through which agriculture growth activates economic growth as follow:

- Supply of surplus labour to firms in the industrial sector.
- Supply of food for domestic consumption.
- Provision of markets for industrial output.
- Supply of domestic savings for industrial investment.
- Supply of foreign exchange from agricultural export earnings to finance the import of intermediate and capital goods.

Federico (2005) demonstrated three significant characters that agriculture has in the process of economic growth, the product role, the factor role, and the market role.

Many scholars (Verter and Bečvářová, 2014; Verter, 2015; Sari Hassoun and Mouzarine, 2019) claimed that the agricultural export is a catalyst for growth, especially in developing countries where it is the main source of foreign earnings and national incomes. In addition, they showed that the foreign trade in food provides a full quantity of goods and services to the countries involved. It also delivers various supplies that upsurge selections to the population. To some extent, the international trade preserves stability demand and supply that permits efficient exchanges and stimulate economic growth and development.

Bakari and Ahmadi (2018) persuaded that South Africa still among developing country due to its weakness of investment and exports in the agricultural sector. They showed that this segment represents only 3% of South Africa GDP. And they demonstrated that this country is based on agriculture import rather than export, so they are consuming more than producing.

Santos-Paulino (2002) employed fixed and random effects panel model for 62 developing countries during the period 1974-1995 and he assumed two theoretical models. The first

model relied on agricultural production function, including both agricultural and non-agricultural exports as inputs. The second model was based on dual economy model (agricultural and non-agricultural where each sector was subdivided into the export and non-export sectors). The outcomes support the theory of export-led growth. It also highlighted the role of agricultural exports in economic growth and therefore suggested a balance in export promotion policies.

Dawson (2005) inspected the influence of agricultural exports on the economic growth in developing nations. The findings showed some alterations in economic growth amongst low, lower-middle, and upper-income nations. Therefore, the investment in the agricultural export had a direct impact on the economic growth. Debatably, proactive actions ought to be encouraged for improving the agricultural exports.

Hausmann et al. (2007) analysed the long-term elasticity of response of Uganda's mainly agricultural primary commodity exports over the floating exchange rate regime in Uganda. They suggested that Uganda's exports are positively and significantly correlated with relative prices and the levels of exchange rate, but negatively correlated with the terms of trade, capacity utilization, and exchange rate variability. They said that Uganda's export-led growth strategy must be recognized, but the policy makers ought to take full consideration to the differences in supply conditions and responses of particular subsectors.

Shombe (2008) approved that the agricultural export-led economic performance in Tanzania.

Sanjuan-Lopez and Dawson (2010) studied with panel cointegration methodology and panel Granger causality the link amongst GDP, agricultural and non-agricultural exports over 42 nations. They established that there is a long-run connection, with agricultural exports having an elasticity of 0.07 and the non-agricultural export elasticity of GDP was 0.13. The Granger causality displayed unidirectional causality running from agricultural export to economic growth.

Henneberry and Curry (2010) employed three simultaneous equations to investigate the link amongst agricultural exports and import and GDP in Pakistan. They concluded for a positive connection between GDP and export from agriculture.

Bbaale and Mutenyo (2011) found evidence with a panel data that the agricultural exports-led income per capita in Sub-Saharan African Countries. Kang (2015) confirmed the agricultural export-led growth in the major rice exporting countries like Pakistan, Vietnam and Thailand.

Oluwatoyese et al. (2016) employed the VECM method to analyse the connection amongst agricultural export, oil export and economic growth in Nigeria over the period of 1981-2014. They established in the long term that the agriculture export and oil export cause economic growth.

Mehrara and Baghbanpour (2016) used the static gravity model to investigate the involvement of industry and agriculture exports to economic growth in 34 developing countries during the period of 1970-2014. The outcomes showed that the agricultural

exports have no effect on economic growth. However, industry exports had a positive effect on economic growth.

Uremadu and Onyele (2016) analysed the contribution of total agricultural exports, exports of cocoa and exports of rubber on economic growth in Nigeria over the period of 1980-2014. They concluded that only total agricultural exports had a positive effect on economic growth.

Toyin (2016) employed the VAR model and the Granger causality to examine the link amongst agricultural exports and economic growth in South Africa during the period of 1975-2012. As results, they established that there is no existence of causality between the two variables.

Edeme et al. (2016) examined the relationship between the agricultural sector and economic growth for ECOWAS (15 African countries) over the period of 1980-2013. They employed the variables of the labour force participation rate, capital stock, agricultural exports, non-agricultural exports, inflation, GDP. As results, they displayed with panel fixed effect model that almost all exogenous variables had a positive but an insignificant contribution on the economic growth, except the non-agricultural exports which had a negative influence on economic growth. However, they established with the pooled regression that the labour force participation rate, agricultural exports have a significant and positive influence on economic growth, demonstrating that the agriculture sector can have a key role in increasing the economic development, especially in Liberia.

Verter and Bečvářová (2016) employed the OLS regression, Granger causality, impulse response function and the variance decomposition to study the contribution of agricultural exports on economic growth in Nigeria during the period of 1980-2012. The Granger causality result showed that there is bidirectional causality between the agricultural export quantity index and real GDP growth (evidence of the hypothesis that agricultural exports led economic growth). Also, they concluded that the agricultural export quantity index and the real effective exchange rate index have a significant and positive impact on GDP growth, but the agricultural degree of openness had a negative and significant impact on GDP growth.

Bakari and Mabrouki (2017) investigated the contribution of agricultural exports on economic growth in South Eastern Europe Countries during the period of 2006-2016. They employed the correlation analysis and the static gravity model, and they found that agricultural exports have a positive and strong correlation with GDP. Mahmood and Munir (2017) used VECM Granger causality to analyse the connection between agricultural exports and economic growth in Pakistan over the period of 1970-2014. Their findings showed that agricultural export has a positive, but insignificant effect on economic growth. However, the economic growth had a positive and statically accepted impact on the agricultural exports. This may be explained by the inability of agricultural exports to compete in international markets because of the high competitiveness and low quality of exported agricultural products. Bakari (2017a) employed VECM model to examine the influence of vegetables exports on economic growth in Tunisia over the period of 1970-2015. He concluded that vegetables exports have a positive effect on

economic growth in the long run and in the short run. In the same context of the impact of agricultural product exports in Tunisia, Bakari (2017b) investigated the impact of olive oil exports on economic growth; he found that olive oil exports have a positive incidence on Tunisian economic growth in the long term and in the short run. Still in the same context, Bakari (2018) examined the effect of citrus exports on economic growth over the period of 1970-2016, and he established that citrus exports have a positive but insignificant effect on economic growth in the long term.

Ahmed and Sallam (2018) employed the ECM model and generalized autoregressive conditional heteroskedasticity (GARCH) models to study the relationship between agricultural exports and economic growth during the period of 1970-2013. Their outcomes displayed a positive connection amongst agricultural exports and economic growth in both long and short terms.

Bakari and Mabrouki (2018) employed the fixed effect to analyse the link amongst agricultural trade (agricultural exports, and agricultural imports), gross fixed capital formation, and economic growth (GDP) in 4 North Africa countries during the period 1982-2016. They established that all exogenous variables have a positive influence on economic growth, except the agricultural import which had a significant sign, so an increase by 1% in the agricultural exports may upsurge the level of GDP by 0.21%. These outcomes showed that such countries need to encourage the development and the investments in the agricultural sector to cover the value of imports (especially manufactural imports).

Therefore, from these investigations, we can summarise that the export in the agriculture in most Africa countries has a positive and a major influence on the development of Africa economic growth. Also, we saw that the agriculture import has a positive effect, but most authors do not focus on this variable in their investigations.

However, there are some studies that do not support the hypothesis of agricultural export-led growth and some researchers denote that the agricultural export does not have a robust relationship for fostering economic growth. Marshall et al. (1988) showed in their findings that they do not support the hypothesis of agricultural exports-led growth in the developing countries. Faridi (2012) analysed the relationship between GDP, labour force participation, capital stock, agricultural exports, non-agricultural exports and inflation in Pakistan during the period of 1972-2008 with using VECM method. He showed that almost all exogenous variables have a positive and significant contribution on economic growth, but the agricultural exports had a negative and significant effect. In addition, they determined that there is bidirectional causality between non-agricultural exports and real GDP, but there is no causality between agricultural exports and GDP.

Furthermore, several authors analysed the connection amongst the agriculture and economic growth (Oyejide, 2004; Oji-Okoro, 2011; Olajide et al., 2012; Ishola et al., 2013; Ebere and Osundina, 2014) found that the agricultural output, government expenditure, foreign direct investment and GDP are positively and significantly related. However, they said that the agricultural sector in Nigeria still suffers from inadequate finance, and poor infrastructure. In addition, we can find the same deprived situation in

almost all Africa countries. Also, there are other papers that were based on the direct connection between the agricultural sector and economic growth.

Chebbi and Lachaal (2007) investigated the relationship between agriculture sector and economic growth in Tunisia during the period of 1961-2005 with using cointegration methodology and VAR model. The variables were GDP index of agricultural sector in constant price, GDP index of manufacturing industry in constant price, GDP index of non-manufacturing industry in constant price, GDP index of transportation, tourism and telecommunication sector in constant price and GDP index of commerce and service sector in constant price. They established that there is a cointegration connection and they rejected the weak exogeneity test, meaning that agricultural growth can cause the growth of the non-agricultural sector, while the non-agriculture sectors can cause the growth of the agricultural. In the short-term, the agricultural sector had a small and a positive contribution on the growth of the other non-agricultural sectors in Tunisia's economy.

Awokuse (2009) employed the procedure of ARDL to study the connection among agricultural sector and economic growth for 15 developing and transition economies over the period of 1971-2006. The variables were real GDP growth, gross capital formation per worker, population as a proxy for labour, agricultural value added per worker, real exports, and inflation rate. They demonstrated that the agricultural sector impacts positively and significantly the economic growth in 10 countries examined.

Faycal and Ali (2016) analysed the influence of the government support of the agricultural sector on economic growth in Algeria during the period of 1970-2014 with using ARDL methodology. The variables were GDP growth rate, added-value of the agricultural sector growth rate, added-value of the industrial sector growth rate, added-value of the agricultural sector (% of GDP), added-value of the industrial sector (% of GDP), food and nutrition imports (% total of imports), final expenditure in the agricultural sector and irrigation, dummy variable of support of the agricultural production and producers. They concluded that the support of the agricultural production and producers has a positive contribution on the agricultural growth, but in the long-run it has a negative effect. These findings determine that the policy of supporting in the agricultural sector allows a surplus in the production factors and it permits to keep the agricultural sector in Algeria. In addition, they showed that the total agricultural support regardless of its relationship with production and producers has a positive effect on agricultural production growth and economic growth in the long term.

Matthew and Ben (2016) employed the VAR model to investigate the influence of the agricultural sector and economic growth in Nigeria during the period of 1986-2014. The variables were per capita income, agricultural output and public agricultural expenditure. As result, they established that almost all variables were insignificant, meaning that there is no real effect of agriculture sector on economic growth, but with the impulse response and the variance decomposition, the authors said that the government should up its expenditure on the agricultural sector and to diversify the Nigeria's economy.

Ligon and Sadoulet (2018) used an unbalanced panel due to country-quantile and the interval between periods for the variables of expenditures and income to analyse the

relative benefits of agricultural growth on the distribution of expenditures for 62 countries during the period of 1978-2011. They divided their study into two panels; the 1st panel was based on the expenditures, the share of total expenditure (%) and average annual growth rate in expenditures per capita. The 2nd panel was relied on income variable, per capita GDP, the average share of agriculture, average annual growth rates in value-added. They established that the growth in GDP from agriculture has a larger effect on the expenditures of the poorer than does growth in GDP from other sectors. Also, they established that the income growth from agriculture was disproportionately beneficial for the poorest households.

Getahun et al. (2018) aimed at studying the connection amongst investment in agriculture, food sectors, economic growth and food and nutrition insecurity for 44 African countries during the period of 1961-2014. They employed the methodology of panel cointegration and Granger causality to examine the variables of total factor productivity, share of employment in agriculture, the total gross output of crops and livestock, land, capital, machinery power, synthetic nitrogen/phosphorus/potassium fertilizers, policy variable, food production, undernourishment, global hunger index, institutional support and commitment index, budgetary commitment (share of government spending on agriculture), six governance indicators, GDP per capita growth, openness, the share of food and beverage imports, index of the share of the sum of imports and exports to GDP, R&D expenditures in the agriculture sector (number of wheel and crawler tractors), natural resources abundance as a share of GDP, the expenditure share of GDP in health, and education infrastructure development, the real agricultural output growth rate. They found that the agricultural growth, government commitment to the sector, progress in food and nutrition security and improvement in governance quality impact positively and significantly the economic growth with FMOLS model. The Granger causality result displayed that the agricultural growth, government commitment, and quality of governance Granger cause overall economic growth.

3. Data and methodology

Data

In this paper, we investigated the relationship between per capita gross domestic product, per capita agricultural raw materials exports, per capita agricultural raw materials imports, per capita agricultural value-added and labour force in agriculture sector for 30 African countries (Algeria, Benin, Burkina Faso, Burundi, Cameroon, Cabo Verde, Central African Republic, Republic of the Congo, Rep., Egypt, Gabon, Ghana, Cote d'Ivoire, Kenya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Niger, Nigeria, Rwanda, Senegal, South Africa, Sudan, Togo, Tunisia, Uganda, Zambia, and Zimbabwe) during the period of 1980-2017. The following table describes different variables employed in this study.

Table 1. *Variables definition*

Variables	Unites	Source of data
GDP: per capita gross domestic product	current US$	World Bank national accounts data, and OECD National Accounts data files.
AGRME: per capita agricultural raw materials exports	current US$	World Bank staff estimates through the WITS platform from the Comtrade database maintained by the United Nations Statistics Division.
AGRMI: per capita agricultural raw materials imports	current US$	World Bank staff estimates through the WITS platform from the Comtrade database maintained by the United Nations Statistics Division.
AGVA: Agriculture, forestry, and fishing, value added	current US$	World Bank national accounts data, and OECD National Accounts data files.
LF: employment in agriculture	Number of employment	International Labour Organization

Methodology

The supply side viewpoint is considered in the theoretical framework in order to inspect the role of the agricultural sector (value-added, exports and imports) to economic growth. We begin with the neo-classical growth model, originally developed by Solow (1956). The objective of this paper is to investigate how agriculture influences the economic growth. Therefore, we extend Solow's aggregate production by incorporating both agriculture variables and labour force as additional inputs with inflation as a control variable

We shall apply an estimate based on a production function that describes the situation of countries characterized by an open economy includes the exogenous variables (AGVA, AGRME, AGRMI, and LF). The basic model is written and modelled as follows:

$$GDP = Function\ (AGVA, AGRME, AGRMI, LF) \quad (1)$$

$$GDP_{it} = C + AGVA_{it}^{\beta 1} + AGRME_{it}^{\beta 2} + AGRMI_{it}^{\beta 3} + LF_{it}^{\beta 4} \quad (2)$$

We employ the natural logarithm specification, because the coefficient on the natural-log scare is directly interpretable as approximate proportional differences and as elasticity. This transformation has provided us with the following benefits, problems related to dynamic qualifications of the data set are avoided log-linear specification and it gives a more consistent and efficient empirical results (Gujarati et al., 2009; Sari Hassoun et al., 2019; Sari Hassoun and Ayad, 2020).

$$Ln\ (GDP_{it}) = Ln\ (C) + \beta_1\ Ln\ (AGVA_{it}) + \beta_2\ Ln\ (AGRME_{it}) +$$

$$+ \beta_3\ Ln\ (AGRMI_{it}) + \beta_4\ Ln\ (LF_{it)} + \varepsilon_{it} \quad (3)$$

$$Ln\ (GDP_{it}) = \beta_0 + \beta_1\ Ln\ (AGVA_{it}) + \beta_2\ Ln\ (AGRME_{it}) + \beta_3\ Ln\ (AGRMI_{it}) +$$

$$+ \beta_4\ Ln\ (LF_{it)} + \varepsilon_{it} \quad (4)$$

The augmented production function, including all variables is expressed in equation (2). The intercept or constant term (C or a_0) shows the level of technology employed in the country which is assumed to be constant. The returns to scale are associated with agriculture value-added (AGVA), agricultural exports (AGRME), agricultural import (AGRMI), and labour force (LF) which are shown by β_1, β_2 and β_3, and β_4 respectively.

In equation (3), we can show that all the variables are transformed into logarithms to create linear to the nonlinear form of Cobb-Douglas production. Finally, we retain the technology constant in the equation (4).

This study is carried out two panel models, a static panel data analysis under fixed or random effect model, which permits us to estimate coefficients in short-run and to model individual heterogeneity. In the fixed effect model, the estimation can be accomplished by MCO on a model corresponding to the divisions to the individual means. But, with the random effect model, the MCO estimator is not efficient, whereas the MCG estimator is good. To select between these two models, we will include the Hausman (1978) test, which is a test for the lack of correlation of specific effects and regresses.

On the other hand, we should use a panel cointegration model to display the long run estimation.

The 1st panel model can be written as follows:

$$\mathrm{LNGDP_{i,t}} = \mathrm{a_0} + \mathrm{a_{0i}} + \mathrm{a_1 LNAGRME_{i,t}} + \mathrm{a_2 LNAGRMI_{i,t}} + \mathrm{a_3 LNAGVA_{i,t}} + \\ + \mathrm{a_4 LNLF_{i,t}} + \varepsilon_{\mathrm{i,t}} \quad (5)$$

a_0 : Is the intercept term and it is identical for all cross-sections (individuals).

$a_{0\mathrm{i}}$: Defines the term of fixed effect for the countries (i).

However, if the relationship between the endogenous variable and the exogenous variables is not fixed, but random, the individual effect cannot be a fixed parameter ($a_{0\mathrm{i}}$), but a random one, thus in this case, we shall reformulate the equation with:

$$\varepsilon_{i,t} = a_{0\mathrm{i}} + \Delta_t + v_{i,t} \quad (6)$$

$a_{0\mathrm{i}}$: In this case, the term is random effect for the countries (i);

Δ_t : Represents the temporal effect;

$v_{i,t}$: Designs the error term, which is orthogonal to cross-section and temporal effects

The 2nd panel model is formulated as follows:

$$\mathrm{LNGDP_{i,t}} = \mathrm{a_1 LNAGRME_{i,t}} + \mathrm{a_2 LNAGRMI_{i,t}} + \mathrm{a_3 LNAGVA_{i,t}} + \\ + \mathrm{a_4 LNLF_{i,t}} + \varepsilon_{\mathrm{i,t}} \quad (7)$$

$\mathrm{LNGDP_{i,t}}$: Represents the variable of sustainable economic development or the economic growth or the income of the country (i) over the period of (t). Generally, it is the sum of gross value added by all resident producers in the economy plus any product taxes minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current US dollars.

$\mathrm{LNAGRME_{i,t}}$: Defines the variable of agriculture export of the country (i) over the period of (t). Agricultural raw materials comprise crude materials, except fuels.

$\mathrm{LNAGRMI_{i,t}}$: Is the variable of agriculture import of the country (i) over the period of (t). Agricultural raw materials comprise crude materials, except fuels.

$LNAGVA_{i,t}$: Signifies the variable of agriculture value-added of the country (i) over the period of (t). It includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC).

$LF_{i,t}$: Symbolises the number of workers or the labour force of the country (i) over the period of (t).

$\varepsilon_{i,t}$: Denotes the error term or the specified error of the country (i) over the period of (t).

This research is one of the rare studies that emphasize the connection between economic growth, and agriculture variables within a panel framework of 30 African countries. The objective is to inspect the link between (GDP), (AGRME), (AGRMI), (AGVA) and (LF). We started by testing the short-term panel model, whether it is influenced by a fixed or random effect with the Hausman (1978) test and then estimating the appropriate model.

Afterward, we shall try to estimate the long-run panel model with paying attention to the heterogeneity term, and following the panel cointegration methodology. We shall start with the panel unit root test to see whether the variables have the same order of integration, then we will test the existence of panel cointegration between variables, if there is a confirmation of the long run relationship, we can perform the panel model with Fully-Modified Ordinary Least Square (FMOLS), and Dynamic Ordinary Least Square (DOLS). Finally, we will test the panel Granger and Dumitrescu-Hurlin causality.

Panel unit root tests

The panel-based methods proposed by Levin, Lin and Chu (2002), Im, Pesaran and Shin (2003), Augmented Dickey-Fuller-Fisher and Phillips-Perron-Fisher of Maddala and Wu (1999), and Breitung (2001) are employed in this research. For each variable, we tested for unit roots in the panel by using three types of models (one with constant and trend term, one with only constant term and one without constant and trend term).

Panel cointegration test

In this paper, we shall run the Westerlund (2007) panel cointegration tests; due to the panel cross-sectional dependence and when we have a time dimension greater than the cross-section dimension (T > N). And, we will confirm our results with the procedure of Pedroni (1999, 2004), because he uses 11 different tests that take into consideration the heterogeneity and its tests examine the dynamic relationship in the long-term.

4. Empirical result

The first panel model estimation

We used an estimation of pooled data to work with the standard error robustness of the estimator of within group, incomplete panel, and heterogeneous panel.

The Hausman test indicates 92.24*** and its probability is zero, denoting that we cannot accept the null hypothesis, rather we accept the alternative hypothesis at the level of 1%, thus this panel model can be estimated with a fixed-effect model.

Therefore, we estimate three panel models with fixed-effect described in the Table 2, and we found that the panel model with individual and temporal fixed-effect is the optimal model, due to the coefficient of Akaike, Schwarz and Hannan-Quinn criterion and the coefficient of Loglikehood.

Table 2. *The first panel model*

Models / Variables	Pooled model	Panel model with individual fixed-effect	Panel model with temporal fixed-effect	Panel model with individual and temporal fixed-effect
Intercept	2.55***	-1.926***	2.983***	4.122***
LNAGRME	-0.038***	0.014*	0.038***	0.010
LNAGRMI	0.419***	0.067***	0.426***	0.017
LNAGVA	0.776***	1.014***	0.693***	0.657***
LNLF	-0.025***	0.220***	-0.026***	-0.048*
AIC	1.390	-0.284	1.400	-0.846
SC	1.419	-0.086	1.580	-0.498
HQ	1.401	-0.208	1.469	-0.713
Loglikehood	-557.998	149.084	-536.376	402.923
R^2	0.780	0.961	0.792	0.979
F statistic	716.744***	591.208***	98.975***	609.218***
F probability	0	0	0	0
Hausman test	92.240***		Probability	0

*, **, ***, denotes that we cannot accept the null hypothesis; rather we accept the alternative hypothesis at the level of 10%, 5%, and 1%.

Source: Done on EViews 10.

The regression coefficient is (0.979), meaning that the four exogenous coefficients explain 97.9% of the model. The fisher coefficient is 609.218, indicating that we can't reject the alternative hypothesis at the level of 1%, so we can say that the model is statistically accepted.

The intercept term appears positive and significant at the level of 1%, demonstrating that there are some omitted variables or the variables that are not introduced in this model affect positively and significantly the African economic growth. In various investigations, the term of intercept signifies the technology advancement, thus we can say in this case that the machinery expansion and the novel knowledge in the agriculture sector will boost the elasticity of the economic growth by more than 4.

The two variables of economic openness relied to agriculture sector are positive, but insignificant, indicating that in the short term, the agriculture export and import are not efficient and they cannot supplement the level of the economic growth. Therefore, such countries are required to improve their foreign balance in the agriculture sector in order to achieve the two sustainable development goals, by having the food security as making food, crop and agriculture output available for population and reducing the level of poverty.

The sign of the agriculture value-added is positive and statically accepted at the level of 1%, showing that a rise by 1 unit in this variable improve the level of (LNGDP) elasticity by 0.657, signifying that the agriculture sector is supporting the African economic growth by providing extra food and labour, which lifts the level of the productivity and profitability of the non-agricultural sector. Not only does the agriculture increase the rate of the economic growth, but it diversifies the whole economic system of such African countries as well.

The sign of the labour force in the agriculture sector appears negative and insignificant, displaying that a rise by 1 unit in (LNLF) decreases the rate of (LNGDP) elasticity by 0.048, meaning that the number of workers in this domain has not the necessary skills and knowledge to enhance the level of the economic growth.

The result of the individual and temporal fixed-effect is presented in the Tables 3 and 4. The findings of the individual fixed-effect shows that 14 countries (Algeria, Benin, Cameron, Cape Verde, Republic of the Congo, Egypt, Gabon, Mauritius, Morocco, Senegal, South Africa, Tunisia, Zambia and Zimbabwe) have a positive effect, denoting that such countries are encouraging the achievement of the first and second target of the sustainable development, and they are directing their economic condition, but the 16 countries (Burkina Faso, Burundi, Central Africa, Ghana, Côte D'Ivoire, Kenya, Madagascar, Malawi, Mali, Mauritania, Niger, Nigeria, Rwanda, Sudan, Togo and Uganda) have a negative effect, meaning that they are still not working enough for the adoption of sustainable development. However, the outcomes of the temporal fixed-effect display that from 1991 to 2004, there was a negative influence, meaning that such countries did not focus on the development of the agriculture sector to improve their economic situation. But, since 2005, these African countries have worked to expanse their agriculture condition and then it started to have a real impact on their economic growth.

Table 3. *The individual fixed-effect estimation*

Countries	Cross-section fixed effects
Algeria	0.794
Benin	0.991
Burkina Faso	-0.651
Burundi	-0.997
Cameron	0.145
Cape Verde	0.462
Central Africa	-0.999
Republic of the Congo	0.747
Egypt	0.377
Gabon	1.256
Ghana	-0.413
Côte d'Ivoire	-0.168
Kenya	-0.329
Madagascar	-0.531
Malawi	-0.721
Mali	-0.644
Mauritania	-0.323
Mauritius	1.168
Morocco	0.452

Countries	Cross-section fixed effects
Niger	-0.844
Nigeria	-0.007
Rwanda	-0.704
Senegal	0.0849
South Africa	1.692
Sudan	-0.531
Togo	-0.756
Tunisia	0.671
Uganda	-0.574
Zambia	0.198
Zimbabwe	0.155

Source: Done on EViews 10.

Table 4. *The temporal fixed-effect estimation*

Countries	Period fixed effects
1991	-0.247
1992	-0.236
1993	-0.273
1994	-0.296
1995	-0.242
1996	-0.254
1997	-0.222
1998	-0.242
1999	-0.205
2000	-0.170
2001	-0.184
2002	-0.150
2003	-0.107
2004	-0.037
2005	0.017
2006	0.080
2007	0.150
2008	0.194
2009	0.180
2010	0.235
2011	0.289
2012	0.282
2013	0.310
2014	0.318
2015	0.271
2016	0.257
2017	0.281

Source: Done on EViews 10.

The result of the cross section dependence test developed by Breusch-Pagan (1980), Pesaran (2004) based on scaled LM and the other one based on the average of the pairwise correlation (CD), and Baltagi, Feng and Kao (2012) are displayed in the Table 5. The outcomes show that all tests rejected the null hypothesis, and accepted the alternative hypothesis for all variables, meaning that there is a spillover or a neighbouring effect between such countries, as they have the same socioeconomic situation.

Table 5. *Cross-Section Dependence Test*

Test	LNGDP	LNAGRME	LNAGRMI	LNAGVA	LNLF
Breusch-Pagan	8682.110***	2173.396***	2867.410***	5437.037***	8216.432***
Prob	0	0	0	0	0
Pesaran scaled LM	279.603***	58.937***	82.466***	169.584***	263.815***
Prob	0	0	0	0	0
Pesaran CD	92.016***	20.650***	35.045***	69.281***	52.554***
Prob	0	0	0	0	0
Baltagi, Feng and Kao	279.026***	58.360***	81.889***	169.008***	263.238***
Prob	0	0	0	0	0

*, **, ***, denotes that we cannot accept the null hypothesis; rather we accept the alternative hypothesis at the level of 10%, 5%, and 1%.

Source: Done on EViews 10.

The second panel model estimation

Panel unit root results

The findings of the panel unit root tests in the Tables 6, 7 and 8 shows that the variables are reported to be integrated on first difference I (1), so we can reject the null hypothesis at the level of 1% for all tests, rather we accept the alternative hypothesis. In the econometrics theory there are usually ambiguities between different outcomes, but in this case we can say that all variable are integrated at the same order. Consequently, we can perform the Pedroni and Westerlund cointegration test.

Table 6. *Panel unit root test with trend and intercept term*

Null hypothesis: the existence of unit root						
Variables		Methods				
		LLC (t-stat)	Breit (t-stat)	IPS (w-stat)	MW-ADF. F (χ^2)	MW-PP. F (χ^2)
Level	LNGDP	-1.98** (0.023)	-1.22 (0.889)	-2.56*** (0.005)	95.50*** (0.002)	60.66 (0.451)
	LNAGRME	9.29 (1)	2.39 (0.991)	-2.48*** (0.006)	84.48** (0.020)	80.16** (0.042)
	LNAGRMI	-3.49*** (0)	-3.65*** (0)	-5.22*** (0)	134.60*** (0)	118.32*** (0)
	LNAGVA	-2.26** (0.011)	-0.51 (0.301)	-2.65*** (0.003)	85.467** (0.017)	89.00*** (0.008)
	LNLF	-1.34* (0.089)	0.98 (0.837)	1.56 (0.941)	57.57 (0.564)	48.32 (0.860)
1st dif	LNGDP	-17.89*** (0)	-10.70*** (0)	-16.24*** (0)	326.59*** (0)	335.61*** (0)
	LNAGRME	-5.61*** (0)	-1.27 (0.101)	-21.28*** (0)	435.31*** (0)	996.94*** (0)
	LNAGRMI	-20.80*** (0)	-12.84*** (0)	-22.95*** (0)	484.25*** (0)	1346.18*** (0)
	LNAGVA	-17.16*** (0)	-7.23*** (0)	-15.99*** (0)	358.12*** (0)	535.73*** (0)
	LNLF	-7.75*** (0)	-0.72 (0.235)	-8.89*** (0)	232.50*** (0)	620.98*** (0)

Source: Done on EViews 10.

Table 7. *Panel unit root test with intercept term only*

Null hypothesis: the existence of unit root						
Variables		Methods				
		LLC (t-stat)	Breit (t-stat)	IPS (w-stat)	MW-ADF. F (χ^2)	MW-PP. F (χ^2)
Level	LNGDP	0.67 (0.748)	…	4.58 (1)	16.95 (1)	16.22 (1)
	LNAGRME	-1.88** (0.029)	…	-5.30*** (0)	127.29*** (0)	102.63*** (0)
	LNAGRMI	-2.76*** (0.002)	…	-3.02*** (0.001)	92.73*** (0.004)	94.35*** (0.003)
	LNAGVA	0.36 (0.640)	…	0.610 (0.729)	54.47 (0.677)	46.79 (0.893)
	LNLF	-0.14 (0.44)	…	3.24 (0.999)	51.20 (0.783)	90.21*** (0.007)
1st dif	LNGDP	-17.87*** (0)	…	-17.24*** (0)	376.90*** (0)	421.29*** (0)
	LNAGRME	-5.46*** (0)	…	-23.24*** (0)	514.56*** (0)	569.25*** (0)
	LNAGRMI	-24.69*** (0)	…	-25.74*** (0)	552.20*** (0)	593.65*** (0)
	LNAGVA	-22.52*** (0)	…	-20.41*** (0)	452.04*** (0)	517.31*** (0)
	LNLF	-10.30*** (0)	…	-11.82*** (0)	274.57*** (0)	285.23*** (0)

Source: Done on EViews 10.

Table 8. *Panel unit root test without trend and intercept term*

Null hypothesis: the existence of unit root						
Variables		Methods				
		LLC (t-stat)	Breit (t-stat)	IPS (w-stat)	MW-ADF. F (χ^2)	MW-PP. F (χ^2)
Level	LNGDP	6.09 (1)	…	…	8.46 (1)	6.81 (1)
	LNAGRME	3.41 (0.999)	…	…	55.88 (0.626)	57.48 (0.568)
	LNAGRMI	-0.05 (0.476)	…	…	67.92 (0.225)	68.37 (0.214)
	LNAGVA	2.57 (0.995)	…	…	17.65 (1)	15.33 (1)
	LNLF	16.87 (1)	…	…	22.12 (1)	15.26 (1)
1st dif	LNGDP	-21.86*** (0)	…	…	521.44*** (0)	558.98*** (0)
	LNAGRME	-0.84*** (0)	…	…	709.52*** (0)	796.97*** (0)
	LNAGRMI	-28.66*** (0)	…	…	722.51*** (0)	861.48*** (0)
	LNAGVA	-24.61*** (0)	…	…	596.21*** (0)	703.74*** (0)
	LNLF	-4.10*** (0)	…	…	224.01*** (0)	256.96*** (0)

*, **, ***, denotes that we cannot accept the null hypothesis; rather we accept the alternative hypothesis at the level of 10%, 5%, and 1%.

Source: Done on EViews 10.

Panel cointegration results

We employ the Stata command of Persyn and Westerlund (2008) to display the four error-correction-based panel cointegration tests and 11 panel cointegration of Pedroni. Our outcomes established that we cannot reject the null hypothesis, which indicate that there is no cointegration relationship between these variables. Therefore, we cannot perform a long run model as (FMOLS), or (DOLS).

Table 9. *Cointegration test with Westerlund*

Bootstrapping critical value under H_0: model with trend and intercept term				
Statistic	Value	Z-value	p-value	Robust P-value
Gt	-2.999**	0.815	0.208	0.040
Ga	-2.296	9.547	1	0.980
Pt	-7.534	6.863	1	0.470
Pa	-1.764	7.714	1	0.920
Bootstrapping critical value under H_0: model with intercept term only				
Statistic	Value	Z-value	p-value	Robust P-value
Gt	-2.150	1.693	0.955	0.170
Ga	-2.710	7.325	1	0.950
Pt	-8.253	3.244	0.999	0.370
Pa	-1.754	5.455	1	0.900
Bootstrapping critical value under H_0: model without trend and intercept term				
Statistic	Value	Z-value	p-value	Robust P-value
Gt	-1.872**	0.572	0.716	0.030
Ga	-2.206	5.910	1	0.870
Pt	-7.465	1.097	0.864	0.180
Pa	-1.522	3.440	1	0.580

*, **, ***, denotes that we cannot accept the null hypothesis; rather we accept the alternative hypothesis at the level of 10%, 5%, and 1%.

Source: Done on Stata 15.

Table 10. *Pedroni cointegration test*

		Tests	Statistic	Prob	Tests	Statistic	Prob
Panel model with trend and intercept	Pedroni (1999)	Panel v-stat	1.09	0.137	Group p-stat	3.98	1
		Panel rho-stat	2.97	0.998	Group pp- stat	-4.36***	0
		Panel PP-stat	-1.50*	0.065	Group ADF- stat	-4.00***	0
		Panel v-stat	-1.86**	0.031			
	Pedroni (2004)	Panel v-stat	0.80	0.211			
		Panel rho-stat	2.10	0.982			
		Panel PP-stat	-3.22**	0			
		Panel v-stat	-3.43***	0			
Panel model with only intercept	Pedroni (1999)	Panel v-stat	-1.28	0.899	Group p-stat	2.06	0.980
		Panel rho-stat	1.41	0.922	Group pp- stat	-3.63***	0
		Panel PP-stat	-1.48*	0.068	Group ADF- stat	-2.78***	0.002
		Panel v-stat	-1.21	0.111			
	Pedroni (2004)	Panel v-stat	-0.43	0.668			
		Panel rho-stat	0.38	0.648			
		Panel PP-stat	-3.44***	0			
		Panel v-stat	-2.97***	0.001			

		Tests	Statistic	Prob	Tests	Statistic	Prob
Panel model without trend and intercept	Pedroni (1999)	Panel v-stat	-2.23	0.987	Group p-stat	3.21	0.999
		Panel rho-stat	2.49	0.993	Group pp- stat	-0.55	0.289
		Panel PP-stat	0.77	0.782	Group ADF- stat	-0.39	0.345
		Panel v-stat	0.91	0.819			
	Pedroni (2004)	Panel v-stat	-2.06	0.980			
		Panel rho-stat	1.34	0.910			
		Panel PP-stat	-1.18	0.118			
		Panel v-stat	-0.97	0.163			

*, **, ***, denotes that we cannot accept the null hypothesis; rather we accept the alternative hypothesis at the level of 10%, 5%, and 1%.
Source: Done on EViews 10.

Panel Granger and Dumitrescu-Hurlin results

The previous result will not have a serious impact on the outcomes of two tests of panel causality. We began with defining the optimal lag model with vector autoregressive model, according to the final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), and Hannan-Quinn information criterion (HQ), it appears that the best model is with 3 lagged variables, so we ought to use it to test whether there is a panel causality between these variables. From Granger (1969) panel test, we established that there is bidirectional causality between AGRMI and AGRME, meaning that there is two-way effect among the importation and the exportation and any effect occur in one variable will have a serious impact on the other. Also, we found that there are five unidirectional causalities running from GDP to AGRMI, from AGRMI to LF, from GDP to AGVA, from AGVA and from GDP to LF, confirming some outcomes provided from the literature review. On the other hand, the results from the panel causality of Dumitrescu and Hurlin (2012), we established that there are eight homogenous bidirectional causalities, between AGRMI and AGRME, among GDP and AGRME, amongst LF and AGRME, between AGVA and AGRMI, among LF and AGRMI, amongst GDP and AGVA, between LF and AGVA and among LF and GDP. Besides, there are two unidirectional causalities, running from AGVA to AGRME and from GDP to AGRMI.

Table 11. *VAR lag order selection criteria*

Lag	FPE	AIC	SC	HQ
0	18.563	17.110	17.152	17.126
1	$8.93*10^{-8}$	-2.0421	-1.7930	-1.9444
2	$6.32*10^{-8}$	-2.3869	-1.9302*	-2.2078
3	$5.61*10^{-8}$	-2.5071*	-1.8429	-2.2467*
4	$5.85*10^{-8}$	-2.4644	-1.5926	-2.1226
5	$6.08*10^{-8}$	-2.4264	-1.3470	-2.0032
6	$6.05*10^{-8}$	-2.4323	-1.1454	-1.9278
7	$6.00*10^{-8}$	-2.4405	-0.9460	-1.8545
8	$6.37*10^{-8}$	-2.3819	-0.6798	-1.7145
9	$6.11*10^{-8}$	-2.4245	-0.5148	-1.6758
10	$6.14*10^{-8}$	-2.4196	-0.3024	-1.5895

* denotes the optimal lag model.
Source: Done on EViews 10.

Table 12. *Panel Granger Test*

Null hypothesis	Fisher statistic	Fisher statistic
AGRMI does not Granger cause AGRME	5.093***	0.001
AGRME does not Granger cause AGRMI	3.008**	0.029
AGVA does not Granger cause AGRME	0.764	0.514
AGRME does not Granger cause AGVA	0.252	0.859
GDP does not Granger cause AGRME	1.274	0.281
AGRME does not Granger cause GDP	1.281	0.279
LF does not Granger cause AGRME	0.295	0.828
AGRME does not Granger cause LF	0.073	0.974
AGVA does not Granger cause AGRMI	0.802	0.492
AGRMI does not Granger cause AGVA	1.167	0.321
GDP does not Granger cause AGRMI	5.113***	0.001
AGRMI does not Granger cause GDP	0.483	0.693
LF does not Granger cause AGRMI	0.644	0.586
AGRMI does not Granger cause LF	2.531*	0.056
GDP does not Granger cause AGVA	6.010***	0.0005
AGVA does not Granger cause GDP	1.066	0.362
LF does not Granger cause AGVA	1.799	0.145
AGVA does not Granger cause LF	3.743**	0.010
LF does not Granger cause GDP	2.076	0.102
GDP does not Granger cause LF	4.508***	0.003

*, **, ***, denotes that we cannot accept the null hypothesis; rather we accept the alternative hypothesis at the level of 10%, 5%, and 1%.

Source: Done on EViews 10.

Table 13. *Panel Dumitrescu-Hurlin Test*

Null hypothesis	W-stat	Zbar-stat	Prob.
AGRMI does not homogeneously cause AGRME	4.756**	2.274**	0.022
AGRME does not homogeneously cause AGRMI	5.487***	3.499***	0.0005
AGVA does not homogeneously cause AGRME	5.444***	3.427***	0.0006
AGRME does not homogeneously cause AGVA	4.335	1.569	0.116
GDP does not homogeneously cause AGRME	5.594***	3.678***	0.0002
AGRME does not homogeneously cause GDP	4.477*	1.805*	0.070
LF does not homogeneously cause AGRME	4.804**	2.354**	0.018
AGRME does not homogeneously cause LF	6.719***	5.565***	0
AGVA does not homogeneously cause AGRMI	4.384*	1.651*	0.098
AGRMI does not homogeneously cause AGVA	4.784**	2.322**	0.020
GDP does not homogeneously cause AGRMI	5.650***	3.773***	0.0002
AGRMI does not homogeneously cause GDP	3.948	0.921	0.356
LF does not homogeneously cause AGRMI	7.353***	6.629***	0
AGRMI does not homogeneously cause LF	4.945***	2.591***	0.009
GDP does not homogeneously cause AGVA	9.475***	10.187***	0
AGVA does not homogeneously cause GDP	6.737***	5.596***	0
LF does not homogeneously cause AGVA	8.087***	7.859***	0
AGVA does not homogeneously cause LF	4.949***	2.598***	0.009
LF does not homogeneously cause GDP	9.046***	9.467***	0
GDP does not homogeneously cause LF	5.397***	3.349***	0.0008

*, **, ***, denotes that we cannot accept the null hypothesis; rather we accept the alternative hypothesis at the level of 10%, 5%, and 1%.

Source: Done on EViews 10.

5. Conclusion

Nowadays, some developing countries see that the agricultural expansion is a prerequisite to industrialization and economic growth; other nations strongly disagree and claim for a dissimilar pathway. In spite of considerable discussion and qualitative inspection of the contribution of agriculture to economic growth and development, few empirical investigations on this issue exist. This study investigates the importance of the agriculture sector as an "engine of growth" by examining data for 30 African countries during the period 1980-2017 with using the methodology of panel model with individual and temporal fixed-effect and panel cointegration.

We confirmed with Pedroni and Westerlund tests that we have not a cointegration relationship between these variables; therefore we cannot estimate the long-run panel model. Thus, we estimated only the panel model with individual and temporal fixed-effect, and we found that the two variables of economic openness relied to agriculture sector are positive, but insignificant, demonstrating that an increase by 1 unit in export and import enhance the level of (LNGDP) by 0.010 and 0.017, respectively, while the variable of the agriculture value-added was positive and statically accepted at the level of 1%, showing that a rise by 1 unit in this variable improve the level of (LNGDP) elasticity by 0.657. The coefficient of the labour force in the agriculture sector appears negative and insignificant, displaying that a rise by 1 unit in (LNLF) decreases the rate of (LNGDP) elasticity by 0.048.

The outcomes of the individual fixed-effect shows that 14 out of 30 countries have a positive effect, so they inspire the adoption of the sustainable development goals, but 16 out 30 countries have a negative effect, so they are not encouraging the integration of (SDG). However, the outcomes of the temporal fixed-effect display that from 1991 to 2004, there was a negative influence, meaning that such countries did not focus on the development of the agriculture sector to improve their economic situation. But, since 2005, these African countries have worked to expanse their agriculture condition and then it started to have a real impact on their economic growth.

The result from the cross section dependence test display that we rejected the null hypothesis, and we accepted the alternative hypothesis for all variables, meaning that there is a spillover or a neighbouring effect between such countries, as they have the same socioeconomic situation.

The findings from the panel causality provides several confirmations of the positive relationship the agriculture sector and the economic growth factor, confirming that these African countries need to improve their agricultural situation to enhance the level of the economic growth and reach the socioeconomic satisfaction.

Conflict of interest

There is no competing interest regarding this manuscript.

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