Contents

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An approach to the use of cryptocurrencies in Romania using data mining technique

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Abstract. *The global economy can be regarded as a complex global adaptive system, which adapts and evolves according to the environment and the behavior of the agents existing on the market. A topic that is topical and can even affect the welfare of a country is the field of cryptocurrencies. Today, the most well-known phenomenon by people in this field is the emergence of bitcoin. Cryptocurrencies or virtual currencies are an emanation of the financial crisis that started in 2008, a crisis that had led to a decline in confidence of traditional bank. In this paper, we discussed the creation of possible speculative bubbles, we presented the virtual currencies, we applied techniques of multidimensional analysis of the data for their analysis, and we evaluated the effects that the appearance of the cryptocurrencies had on the cybernetic economic system in Romania. Also, the paper deals with a section on identifying risks in the field of cryptocurrencies. In the last part of this paper, we focus our attention on the viability of these coins and their future prospects.*

Keywords: speculative bubbles, cryptocurrencies, Bitcoin, R Studio, cybernetic systems, risk.

JEL Classification: C10, C21, C45, C63, C87, D40, E70, F18.

1. Introduction

Economics, defined as a set of economic activities, as well as science, refers, in general terms, to the need for optimal organization of limited objective resources in order to meet and balance unlimited and constantly diversifying needs. It consists of cyber and dynamic systems at both microeconomic and macroeconomic levels.

Virtual currencies explore a concept that has existed for years, namely the idea of currency digitization. For some years now, virtual currencies have exploded in popularity and are trying to produce a revolution in the way people pay.

Cryptocurrencies have aroused a cultural as well as an economic movement, and effects have also been produced politically, discussing the impact that technology will have on the world, but also the process of legalization and regulation.

Virtual currencies or cryptocurrencies are the blood that irrigates the unseen arteries of decentralized electronic payment systems, systems that have become known and functional due to the emergence of what is known today as Bitcoin.

Digital currencies appeared before Bitcoin, computer game enthusiasts, like Second Life or World Craft using such coins. Also, online trading platforms have tried to launch virtual currencies, but only their customers used in relationships with the seller. This alternative to the traditional payment system is due in part to the success of the financial crisis that rocked the world of finance at the end of 2007 and the beginning of 2008. The decentralized systems are not under the control of the monetary authorities, they do not use the traditional intermediaries, functioning exclusively due to the trust that their users invest in them. In fact, these are electronic payment systems that are based on cryptographic evidence that allow both parties to trade directly without going through the approval of an intermediary.

Decentralized systems use cryptocurrencies, virtual currencies based on cryptographic principles. The users' trust in these payment systems is based on the cryptographically validated transaction log, created and maintained by all users of the virtual currency. This paper aims to carry out an analysis both at the theoretical level by studying the history of the appearance of virtual currencies and the conceptual dimensions regarding the first 10 cryptocurrencies, as well as at the analytical level by using the statistical modeling tools or the analysis of cybernetic systems. The main objectives of the research are to improve the level of knowledge on this concept, to analyze the economic system in Romania compared to other economic systems from the perspective of regulating virtual currencies, analyzing their price volatility, statistical analysis and representation of the cryptocurrency cybernetic networks and drawing relevant conclusions.

2. Analytical study on the appearance of digital currencies

A cryptocurrency is a digital asset whose purpose is to act as a trading medium that uses powerful and complex cryptographic algorithms to secure financial transactions, control the issuance of additional units and verify asset transfers. Unlike centralized systems used by banks, cryptocurrencies use a decentralized control mechanism.

The decentralized control device of each cryptocurrency works based on a distributed registry, usually a growing list of registrations, called a blockchain, which serves as a public database of financial transactions.

In 1983, American cryptographer David Chaum developed a type of cryptocurrency which he called ecash. Later, in 1995, it implemented it with the help of Digicash, an early form of electronic payment by virtual currencies that required a software component installed on the user's computer in order to withdraw banknotes and assign certain encryption keys before being sent to the recipient. This has enabled the digital currency to be impossible to track by the issuing bank, government or any other third party.

In 1996, the National Security Agency of the United States of America launched a publication entitled "How to Make a Mint: the Cryptography of Anonymous Electronic Cash", which describes a cryptocurrency system and was first published in a mailing list from Massachusetts Institute of Technology (Laurie et al., 2016).

In 1998, Wei Dai published a presentation of b-money, described as an anonymous and distributed electronic payment system. Shortly after, Nick Szabo brought to the public the attention of bit gold, categorized as a system of electronic currencies that asked users to solve a proof-of-work function, a consensus mechanism that is linked to a fundamental problem of distributed computing, and multiagent systems. The purpose of this problem is to obtain the general reliability of the system in the presence of a certain number of defective processes. Proof-of-work rejects computer attacks or other abusive actions, such as spamming a network through the need to perform certain steps by the requester, which usually results in a processing time performed by the computer.

The first virtual currency, bitcoin, was created in 2009 by the so-called developer or group of programmers Satoshi Nakamoto, whose identity has remained undisclosed to date. It uses the SHA-256 hash encryption feature set, present in many security applications and protocols, as a proof-of-work mechanism. Shortly, in 2011, Name coin cryptocurrency was created, aimed at eliminating internet censorship by implementing a decentralized domain name system (DNS).

Litecoin currency appeared in the same period. Unlike bitcoin, it uses the script mechanism, derived from the original SHA-256 algorithm, which resulted in trading speeds about 75% higher than in the case of bitcoin. After the emergence of Litecoin, several alternative currencies, called suggestive altcoins, were created further.

At the end of 2011, the proof-of-stake concept was introduced, which implies that a user can create new units from a certain cryptocurrency directly in proportion to the amount already held by it. Compared to proof-of-work, this concept is not based on the mining process, so it does not require a certain computational power from the computer system. In 2012, the first virtual currency using a hybrid based on the proof-of-work and proof-of-stake systems, called Peercoin.

As for alternative uses, bitcoin was a widely used means of trading in the digital black market Silk Road, which ran from 2011 to 2013. Specifically, bitcoin was the only accepted payment method, being difficult to track by government authorities and semi-anonymity,

compared to other means of payment. Thus, total sales of about $ 1 billion were recorded on Silk Road. Also, for these transactions, the users used dark wallets, alternative wallets for cryptocurrencies that offer additional layers of protection, as opposed to the classical ones, used for most transfer operations.

The year 2013 proved to be a truly disruptive one in terms of cryptocurrency evolution. Blockchain technology, on which cryptocurrencies such as bitcoin, Litecoin or Ripple are based, has been oversubscribed due to the unusually large number of transactions conducted in that period as a result of growing popularity and mass adoption and partly because bitcoin has reached value from $ 998. Thus, the virtual currency exchange platform Mt. Gox, one of the most important players in the industry at that time, briefly stopped deposits in bitcoin.

In 2015 there were several technological advances in the field of blockchain. Also, this period gave rise to several virtual currencies, one of the most important being Ether, based on the distributed computing platform Ethereum. Thus, there was a real impact on the cryptocurrency market.

The most popularized period in the history of bitcoin was 2017. After a glaring rise from $ 998 on January 1, 2017 to $ 19,783.06, the highest value ever reached, on December 17, 2017, the Chinese government began to warn the population. It's about the occurrence of a speculative bubble caused by this unexpected growth. Moreover, China imposed a total restriction on bitcoin trading on February 1, 2018. Since 2018, the price of bitcoin has been steadily declining, and 2019 started with a trading rate of $ 3747/bitcoin, with 81% less than its highest value, recorded at the end of 2017.

Intercontinental Exchange, the entity that holds the New York Stock Exchange, has made available for trading futures contracts on bitcoin on its exchange platform, called Bakkt. Bakkt also announced that it will launch options trading on bitcoin in December 2019. However, losses caused by the decline in the value of virtual currencies have had a major impact, and population confidence in the cryptocurrency market has declined enormously. That said, the cryptocurrency market has continued to fluctuate, but slightly lower and has never reached historical highs, as in 2017.

Figure 1. *Timeline of cryptocurrencies occurring 2008-2017*[1]
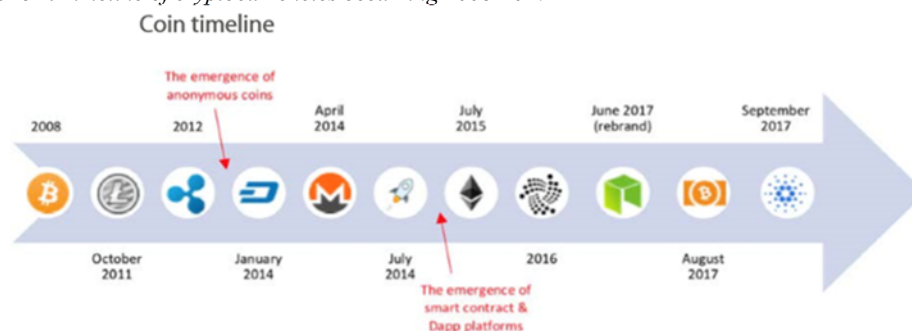
Source: Cryptocurrencies and blockchain, European Parliament, 2018, http://www.europarl.europa.eu/cmsdata/150761/TAX3%20Study%20on%20cryptocurrencies%20and%20blockchain.pdf

3. Literature review and mathematical models

An important aspect in an investor's decision to invest in a cryptocurrency portfolio is the existence or occurrence of a price bubble or a speculative bubble. Thus, research and identification of these bubbles must remain a topic of great interest. The statistical tools that have been developed for the testing of financial bubbles have been applied quite recently in cryptocurrencies and are generally used to detect one or more bubbles; one of the differences between the two types of tests is the change of the time window. The first study that was conducted was that of MacDonell (2014) who investigated the existence of a price bubble in Bitcoin using the LPPL (Log Periodic Power Law) methodology proposed by Johansen et al. (2000), as well as by Sornette (2003).

One of the ideas that the authors have developed is that market agents are of two types: agents with rational expectations and agents with behavior influenced by what most agents do, imitative behavior. Conditions in a normal market are characterized by disorder and a lack of behavioral similarity. The authors consider that when agents form groups with similar and organized behaviors, a bubble is formed through the interactions of the agents and the increase of risk.

Using the LPPL model, the expected value of the logarithm of the price of an asset when it is on the rising trend due to a price bubble is:

$$E[lnp(t)] = A + B(t_c - t)^\beta + C(t_c - t)^\beta \cdot \cos[\omega ln(t_c - t) - \phi]$$

where ω represents frequency of oscillations in a bubble, t_c is the critical time from the end of a bubble, A > 0 is the value $lnp(t)$ at the critical moment of time t_c, B < 0 increase $lnp(t)$ before the critical moments t_c, C $\neq$ 0 is the proportional magnitude of the oscillations around the exponential growth, $0 < \beta < 1$ represents the power of accelerating prices, iar $0 < \phi < 2\pi$ is a phase parameter.

The conditions for a positive price bubble to be realized are the following:
- $\beta \in (0,1)$
- The rate of collapse of the price, according to van Bothmer and Meister (2003), should be:

$$b = -B\beta - |C|\sqrt{\beta^2 + \omega^2}$$

- Lin et al. (2014) added a third condition according to which residuals the equation of expectation on the logarithm of the price to be stationary.

MacDonell (2014) used the LPPL model to predict the price bubble burst of December 4, 2013, showing the utility of these models for detecting price bubbles within cryptocurrencies. In order to detect multiple price bubbles, in the following we will present several methods, of which we will also choose the applicative study.

One method that is based on the one mentioned earlier is that of the "Didier Sornette" (DS) confidence indicators abbreviated in the DS-LPPLS specialty literature proposed by Sornette et al. (2015). The authors extend the LLPLS method starting from the study of Filimonov and Sornette (2013).

A point is set at time t2, and the time series is captured in periods (t1, t2) whose periods dt = t2-t1 decrease successively from 750 days to 125 days, point t1 changing in steps of 5 days.

 The total time segments with the ends t1 and t2 are of a total of 126. Then, a series of conditions and search intervals are applied on the parameters of the model that we illustrated in the table below. Only the LPPL models that satisfy these conditions are considered and estimated to be valid. Then, from the LPPL models considered valid, two other indicators are calculated: the DS LPPLS trust indicator and the DS LPPLS trust indicator.

Table 1. *Filter and search range conditions for choosing LLPL models according to Sornette et al. (2015)*

Appearance	Notation	Search range	The first filtration condition	Second filtration condition
Acceleration	β	[0,2]	[0.01,1.2]	[0.01,0.99]
Nonlinearity	ω	[1,50]	[2.25]	[2.25]
Parameters	t_c	$[t_2 - 0.2\text{dt},$ $t_2 + 0.2\text{dt}]$	$[t_2 - 0.05\text{dt},$ $t_2 + 0.1\text{dt}]$	$[t_2 - 0.05\text{dt},$ $t_2 + 0.1\text{dt}]$
Oscillation	$(\frac{\omega}{2\pi})\ln[\frac{\|t_c - t_1\|}{\|t_c - t_2\|}]$	-	$[2.5,+\infty)$	$[2.5,+\infty)$
Dumping	$\frac{\beta}{\omega}\frac{\|B\|}{\|C\|}$	-	$[0.8,+\infty)$	$[1,+\infty)$
Relative error	$\frac{p_{t-\hat{p}_t}}{\hat{p}_t}$	-	[0,0.05]	[0,0.02]

Figure 2. *Evolution of the price of Bitcoin and the detection of a bubble (pink area) by the DS-LPPLS test applying the filtering conditions used by Sornette et al. (2015) and Fantazzini (2016).*
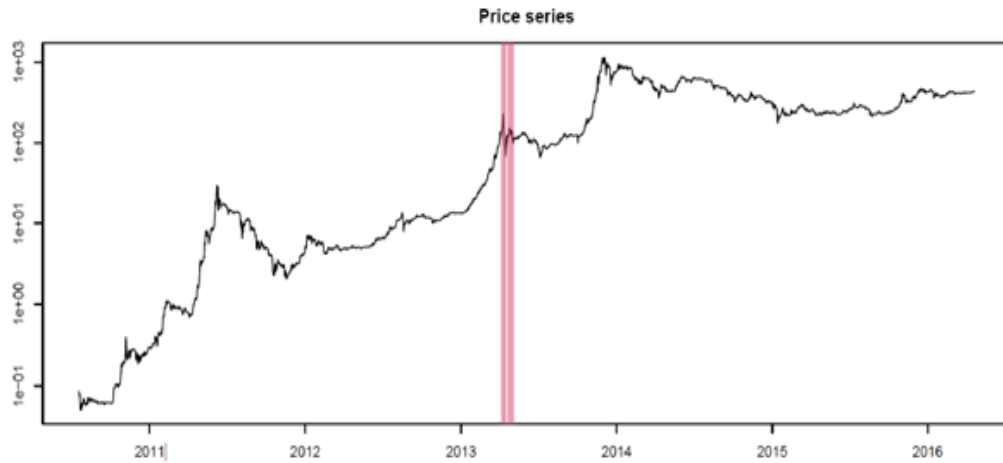
It can be seen that the test detected 2 bubbles where in the first third of 2013, indicated by the pink areas, while, using different filtering conditions, the results showed that there were more bubbles starting with the last third of 2013 until about the first third of 2014. It should be noted that the results are not very accurate as there were only 5 estimation windows for simplification. For the best accuracy, 126 estimation windows are recommended, but the calculation is far too complex for an ordinary computer.

Ceah and Fry (2015) also tested the existence of multiple price bubbles using a test proposed by Fry (2014), detecting the presence of a price bubble in the case of Bitcoin. Ceah and Fry (2015) assumed the following equations:

$$P(t) = P(t)(1 - k)^{j(t)}$$
where

$$dP_{1(t)} = \left[\mu(t) + \frac{\sigma^2(t)}{2}\right] P_{1(t)} dt + \sigma(t) P_{1(t)} dW_t$$

where W_t is a Weiner type process, and $j(t)$ is a type process:

$$j(t) = \begin{cases} 0, before\ the\ bubble\ burst \\ 1, \quad after\ the\ bubble\ burst \end{cases}$$

and k represents the loss expressed as a percentage of the asset after the price bubble burst. Before the break, we have $P(t) = P_1(t)$ and, using Ito theoreme, the authors showed that $X_t = \log(P(t))$ satisfy:

$$dX_t = \mu(t)dt + \sigma(t)dW_t - vdj(t),$$

$$v = -\ln[(1 - k)] > 0$$

4. Data analysis in R, results and discussion

Usually, bitcoin (BTC) is described as a virtual, decentralized, and (at first glance) anonymous currency that is not backed by the government or supported by any other legal entity and cannot be exchanged for gold or any other commodity. Bitcoin can be bought with and converted directly into fiat currency within a wide range of cryptocurrency exchange platforms (for example, Coinbase, Kraken, Coinflux, etc.).

Of all the cryptocurrencies currently in circulation, bitcoin is one of the easiest currencies to convert to fiat currency. Bitcoin is accepted as a legitimate source of funds by a relatively large number of traders (online), including various large companies (i.e. Microsoft, Playboy, LOT Polish Airlines, etc.). As a result, it can be qualified as a medium of exchange.

Following the analysis of the evolution of the Bitcoin price during the period 23.04.2013-23.12.2019, the following results were obtained:
- Average = $ 3037.51 / BTC;
- Median = $ 704.32 / BTC;
- Standard deviation = $ 3748.21 / BTC.

The standard deviation far exceeds the value of the average, with Bitcoin being highly volatile, a thing commonly found in virtual currencies. The coefficient of variation has a value of well over 35%, indicating that the value of the average is not representative in Bitcoin analysis. The distribution has asymmetry to the right, which is due to the relatively low prices mainly recorded during this period. The existence of high value outliers is

observed during the period studied. These values were recorded in the period 07.12.2018-10.01.2019, a period in which the historical maximum of almost USD 20,000 was reached.

Figure 3. *The evolution, histogram and boxplot of the Bitcoin price in the period 23.04.2013 – 23.12.2019*
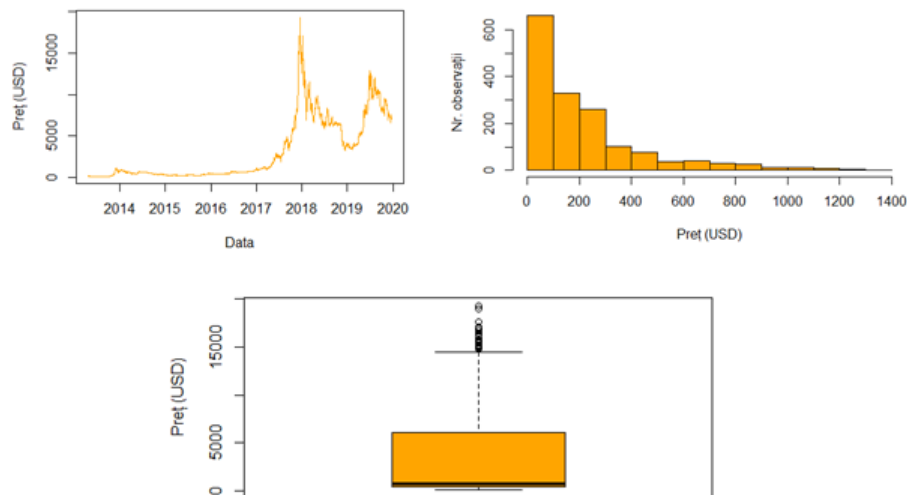
Source: Authors' own research results.

Research from the University of Cambridge estimates that in 2017, there were 2.9 to 5.8 million unique users using a cryptocurrency wallet, most using bitcoin. Bitcoin has been criticized for its use in illegal transactions, high electricity consumption, price volatility and exchange theft. Some economists, including several Nobel laureates, have characterized it as a speculative bubble. Bitcoin has also been used as an investment, although several regulatory agencies have issued warnings to investors about bitcoin.

Regarding the returns of BTC cryptocurrencies, a minimum of -16.85% was registered on 16.01.2018, and a maximum of 25.24% on 07.12.2017. The average return is 0.159% and the standard deviation is 0.04. The coefficient of variation is 2686%, so we have to deal with very large changes, inhomogeneous data, and the data set is not representative.

Figure 4. *Dailey return of Bitcoin*
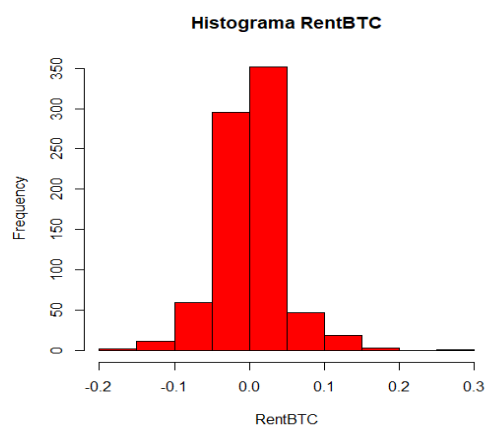
Source: Authors' own research results.

From the above histogram but also from the calculation of the asymmetry coefficients (= 0.38) and vaulting (= 6.67), we have a slightly asymmetrical distribution of returns to the right, and pronounced leptokurtic. Values are highly dispersed, with obvious fluctuations of large and small values.

Figure 5. *Matrix of the correlations of the closing prices of the analyzed shares and their returns*
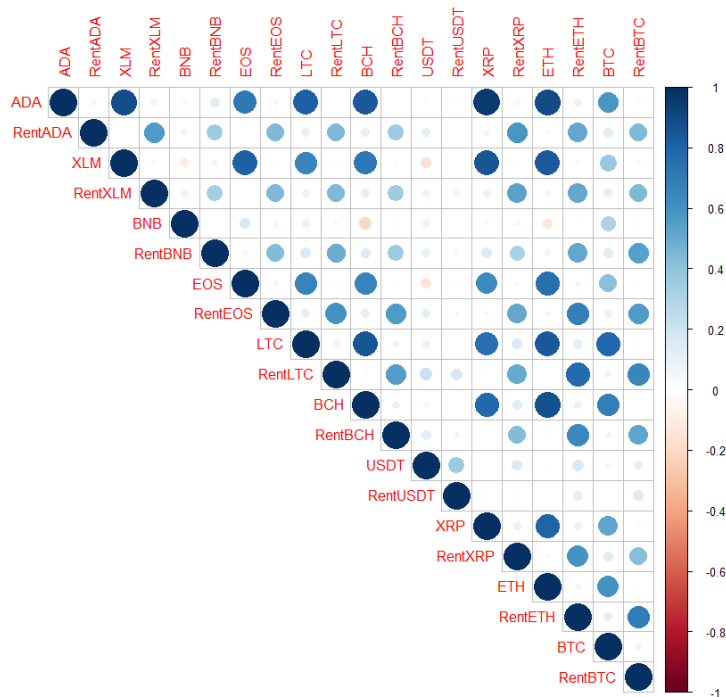
Source: Authors' own research results.

We observe with darker shades the strong correlation between the prices of Cardano cryptocurrencies compared to Ripple and Etherum, and between Bitcoin Cash and Etherum, these being just a few examples. As the shades are less pronounced we identify independent behaviors of the cryptocurrencies observable due to the weak correlation.

Figure 6. *BTC ETH regression model*

```
Call:
lm(formula = BTC ~ ETH)

Residuals:
    Min      1Q  Median      3Q     Max
-3306.3 -1877.2  -631.5  1540.3  9602.6

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 5282.8429   142.4856   37.08   <2e-16 ***
ETH            6.9387     0.3265   21.25   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2366 on 789 degrees of freedom
Multiple R-squared:  0.364,      Adjusted R-squared:  0.3632
F-statistic: 451.6 on 1 and 789 DF,  p-value: < 2.2e-16
```

Source: Authors' own research results.

The model equation is: BTC = B0 + B1 * ETH meaning BTC = 5282.8429 + 6.9387 * ETH. The coefficient B1 shows us by its positive value that the connection between the 2 variables is a direct one. Thus, an increase in the ETH price would inevitably lead to a BTC price increase. Specifically, a 1 percent increase in ETH would increase BTC's share by 6%. We notice that the free term is statistically significant (p-value <0.05 & ***) but this does not matter much. Note: the ETH coefficient is significant (p-value <0.05 & ***). The coefficient of determination (R-squared = 0.3632) shows that 36% of the BTC variation is due to the ETH variation.

Figure 7. *Graphical representation of the BTC ~ ETH model*
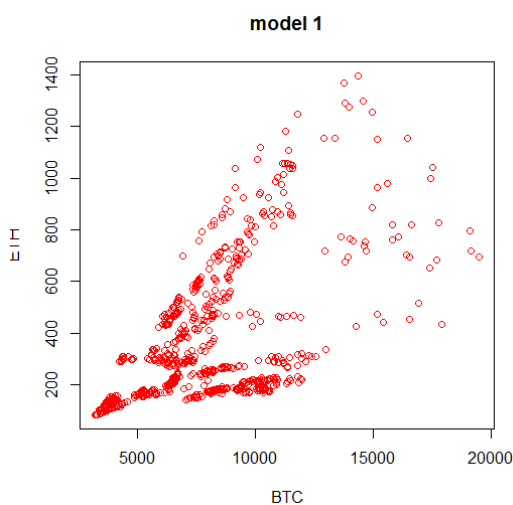
Source: Authors' own research results.

Analyzing the graph confirms the dependence between the two variables, we can draw a representative line through which we can see a direct connection between the evolution of the 2 prices of cryptocurrencies Bitcoin and Etherum.

4.1. Risk analysis regarding the use of virtual currencies

In order to be able to identify and understand the risks of using cryptocurrencies, we must first understand how it works (Chiriță and Nica, 2019). Cryptocurrencies are based on a platform called blockchain. This is a digital, decentralized and public counter for all virtual currency transactions. A transaction is called a block. Complete blocks are recorded and added chronologically in the blockchain, allowing users to keep track of all transactions, without the need for a central record. Each node, meaning a computer connected to the network, receives a copy of the blockchain.

This platform has the following characteristics:
- It is irreversible, meaning a transaction cannot be canceled.
- It is anonymous, the accounts used for the transactions being encrypted.
- It has an extremely high transaction speed, almost immediately.
- It is secure, strongly encrypted, making it impossible to break it.

Figure 8. *How a blockchain works*
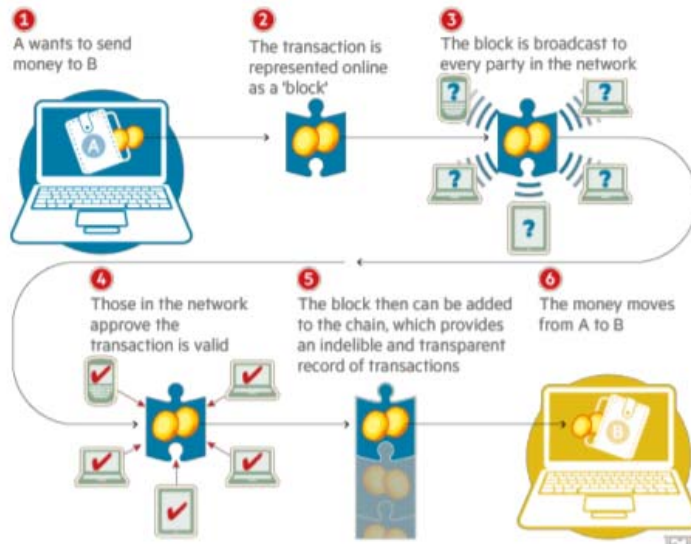
Source: Technology: Banks seeks the key to blockchain, J. Wild, M. Arnold and P. Stafford, 1 November 2015, Financial Times, https://www.ft.com/content/eb1f8256-7b4b-11e5-a1fe-567b37f80b64?segid=0100320#axzz3qK4rCVQP

Risk of human error (r6)

Cryptocurrencies worth more than $ 300m were lost following a series of bugs in a popular Digital Wallet service that led to a developer accidentally taking control and then blocking funds.[2]

Cybernetic risk (r1)

Cyber risk usually refers to any risk of financial loss, disruption or deterioration of an organization's reputation as a result of the failure of its information technology systems. Cyber risk could materialize in a variety of ways such as:
- Deliberate and unauthorized breaches of security to gain access to information systems.
- Unintentional or accidental breaches of security.
- Operational IT risks due to factors such as poor system integrity.

Business risk (r2)

Cryptocurrencies are not supported by a central bank or any national or international organization. Their value is determined strictly by the value that market participants attribute through transactions. Decreased consumer confidence may cause a collapse of trading activities but also a sharp decline in the value of cryptocurrencies.

Operational risk (r3)

Due to the irreversible nature of the platform, accidental transactions cannot be canceled, as they are permanently registered in the blockchain. Also, in case of losing the access key to the virtual deposit, it cannot be replaced and the access to the deposit is permanently lost.

Regulatory risk (r4)

Some countries may prohibit the use of cryptocurrencies because the transactions violate anti-money laundering laws. Due to the large number of users and the complexity of the network, there is no way to combat money laundering.

Market risk (r5)

Due to accepting the limitation of cryptocurrencies, but also the lack of alternatives, the currency may seem more volatile than other physical currencies, being fueled by speculative demand and aggravated by hoarding.

Risk of developing illegal activities (r7)

Customers' personal data are private. Personal data is not associated with transactions.

Figure 9. *Probability impact matrix*

Risk matrix			Impact				
			Very low	Low	Moderate	Big	Very big
			1	2	4	8	16
Probability	Very low	1	1	3	4	8	16
	Low	2	2 R3	4	8 R6, R7	16	32
	Moderate	3	3	6	12	24 R5	48 R1
	Big	4	4	8	16 R2	32 R4	64
	Very big	5	5	10	20	40	80

Source: Authors' own research results: The above probabilities are established by authors based on historical events.

In conclusion, the operational risk is considered a minor risk, the business risk, the occurrence of a human error and the development of an illegal activity are considered medium risks, and the cyber risk, the market risk and the regulatory risk fall into the high risk category. These 3 types of risk are high because they have both a high probability of occurrence and a major impact so that they can endanger the activity of cryptocurrency users.

Cryptocurrencies are in Romania, as in the rest of the European Union, from a legal point of view in the gray area, that is the border between regulated and unregulated. On February 6, 2018, the NBR announced that it discourages any involvement of local credit institutions in the cryptocurrency sector due to the reputational risk. The bank also reminded of the

major risk of losing the money invested in cryptocurrencies. Subsequent to this announcement, banks announced the closure of accounts of several transactions with cryptocurrencies. In March 2018, the National Agency for Tax Administration announced that any income resulting from transactions with cryptocurrencies is taxable.

However, according to a study conducted on the global platform for cryptocurrency transactions, the Lunoun of ten Romanians, representing 9% of the total number of Romanians who have responded, owns a cryptocurrency. The 3 cryptocurrencies owned by Romanians are Bitcoin, owned by 72% of respondents, Ethereum, owned by 29% and Ripple, owned by 14%. Regarding the use of cryptocurrencies, the majority of the surveyed Romanians, accounting for 68%, said they considered them an investment, while 23% said they used them to make online payments. The remaining 7% of the surveyed Romanians stated that they use virtual currencies to transfer money to relatives or friends.

From the point of view of virtual currency security, Romanians are skeptical. Only 38% of the respondents consider cryptocurrencies as a safe investment, the rest being uncertain about the security of the coins. From the point of view of the level of interest by regions, the greatest interest for cryptocurrencies was shown by the Bucharest Municipality, followed by the counties of Bacau, Prahova and Sibiu. At the opposite pole are the counties with the lowest level of interest for virtual currencies: Galati, Mureș and Dâmbovița.

Compared to Romania, cryptocurrency transactions in Japan are regulated. The law on payment services was amended in June 2016 and entered into force on April 1, 2017. This law defines cryptocurrency as the value of the property that can be used as payment for the purchase or rental of goods or the provision of services by unspecified persons, which can be purchased or sold by unspecified persons and which is transferable through an electronic data processing system.

Japan has the world's most progressive regulatory climate for cryptocurrencies, and as of April 2017, recognizes Bitcoin and other digital currencies as a legal means of payment under the Payment Services Act. Japan is the world's largest market for Bitcoin, and in December 2017, the National Tax Agency ruled that all cryptocurrency earnings were classified as "miscellaneous revenue", and investors taxed at rates of 15-55%. Japanese banks plan to introduce digital currency ready for the 2020 Tokyo Olympics in response to the threat posed by Chinese giant Alibaba, which recently launched its mobile payment service in the country, reports the Financial Times.

Figure 10. *Complex network between Romania – Japan*
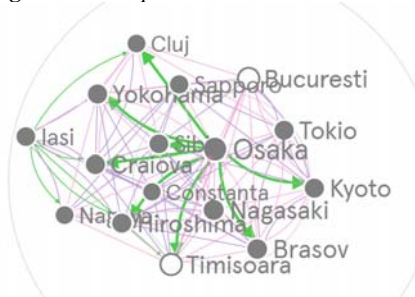
Source: Authors' own research results.

In the figure above we have created a complex network between 8 cities in Romania and 8 cities in Japan. Each arc represents a term that was searched on Google trends as follows:

|||||||||| → Search by "cryptocurrency";

|||||||||| → Search by "etherum";

|||||||||| → Search by "bitcoin".

The thickness of the arches shows the power of the connection established between 2 cities depending on the search terms.

5. Conclusions

Based on the analyzes presented, we consider that the cryptocurrency market is a large and volatile one. Every day new cryptocurrencies appear, others disappear, and early investors become wealthy.

The importance of multidimensional data analysis techniques is obvious in order to process sensitive information about cryptocurrencies. More and more researchers are analyzing these currencies through different mathematical models and data mining techniques make it easy to build the data framework needed for such analyzes. Speculative bubbles are important to analyze in any financial network and beyond. We have historical examples of speculative bubbles that led to the emergence of systemic shocks that spread contagiously in the respective network and led to economic crises.

One such bubble we remember is the speculative bubble of the tulip bulbs. This speculative bubble of the seventeenth century was represented by the fact that the tulip reached a price several times higher than that of the market.

Cryptocurrencies gain legitimacy as a protocol for commercial transactions, microplates and outperform popular payment instruments.

People around the world are buying Bitcoin to protect themselves from the devaluation of the national currency. In most of Asia, there is a lively market for Bitcoin remittances, and Bitcoin that uses cybercrime darkness is flourishing. More and more companies are discovering their power and adopting this emerging technology.

Institutional investors are starting to buy cryptocurrencies. Banks and governments realize that this invention has the potential to limit their control over the financial market.

Cryptocurrencies as a whole will never disappear will grow in use and acceptance as they mature.

The revolution is already happening.

Notes

[1] https://blogs.cfainstitute.org/investor/2018/04/03/cryptocurrencies-the-rise-of-decentralized-money/
[2] https://www.theguardian.com/technology/2017/nov/08/cryptocurrency-300m-dollars-stolen-bug-ether

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Intellectual property rights, human capital and types of entrepreneurship in emerging and developing countries

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Abstract. *This study examines the single and combined effects of intellectual property rights (IPR) and human capital on the types of entrepreneurship in emerging and developing countries. For this purpose, we use the Global Entrepreneurship Monitor data for the entrepreneurial activity, while IPR are assessed based on the IPR index of World Economic Forum and human capital is measured by the gross enrollment ratio for secondary school. Linear regressions are applied on data for 15 countries during the period 2009-2013. Findings show that improvement of intellectual property rights has no influence on opportunity driven entrepreneurship and affects negatively necessity driven entrepreneurship. Furthermore, the improvement of the education level allows to increase opportunity driven entrepreneurship in emerging and developing countries. However, it does not allow to increase necessity entrepreneurship. Moreover, countries with higher human capital level benefit from the enhancement of the IPR system more than countries with lower human capital. In summary, our study recognizes the complementary role of intellectual property rights and human capital in increasing high quality entrepreneurship. We conclude that both intellectual property rights and human capital are effective tools of industrial policy in emerging and developing countries.*

Keywords: Opportunity Driven Entrepreneurship, Necessity Driven Entrepreneurship, intellectual property rights, human capital, emerging and developing countries.

JEL Classification: L26, K11, O3, O25, I25, I28, J24.

I. Introduction

Entrepreneurship is increasingly seen as a key driver of economic development (Baumol 1990; Wennekers and Thurik 1999; Minniti and Lévesque 2008). That's why, scholarly contributions have set out to identify its national determinants. In this contribution we examine two determinants: human capital and institutions especially Intellectual Property Rights (IPR).

According to North (1991), institutions are the humanly devised constraints that structure political, economic and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, laws, property rights). Institutions can both enable behaviors and constrain them.

The OECD (2001, p. 18) defines human capital as "The knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being". Human capital is seen as an important source of competitive advantage for individuals, organizations and societies (Coleman, 1988; Gimeno et al., 1997).

While the entrepreneurship literature emphasizes the role of IPR and human capital, two main shortcomings emerge from previous studies.

First, previous studies neglect a crucial question: How the effect of institutional framework on entrepreneurship differ according to the human capital level of different countries?

Second, findings do not suggest an unanimous conclusion concerning the impact of IPR system and human capital on entrepreneurial activity. On the one hand, the impact of IPR on entrepreneurial activity is positive according to some studies like Johnson et al. (2002) and Estrin et al. (2009). On the other hand, it is negative (Desai et al., 2003; Livramento and Foray, 2007) or not significant (Pissarides et al., 2003 and Estrin et al., 2011). Similarly, previous works show that the relation between human capital and the founding of new businesses is uncertain. Some studies find a positive relationship (Robinson and Sexton, 1994 and Davidsson and Honig, 2003). Some others find a negative relationship (Blanchflower, 2004; Van der Sluis et al., 2005 and Reynolds et al., 2007).

To overcome this problem, we think that it is necessary to make distinction between different types of entrepreneurship.

The present paper extends the work of Eesley (2016) who focuses on institutional barriers to growth and their effects on individuals' decision to enter entrepreneurship. Thus, the purpose of our study is to shed some light on how the human capital, the institutional framework especially, the intellectual property rights and the interaction between these two aspects affect the different types of entrepreneurship in emerging and developing countries.

To define entrepreneurship, we refer to the Global Entrepreneurship Monitor (GEM) studies. Entrepreneurship is defined as "Any attempt at new business or new venture creation, such as self-employment, a new business organization, or the expansion of an existing business, by an individual, a team of individuals, or an established business". (Reynolds et al., 1999, p. 3). To distinguish different types of entrepreneurs, GEM studies

identify two types: opportunity driven entrepreneurs who start up a business to exploit an opportunity, and necessity driven entrepreneurs who start up a business to meet their needs.

Our study aims to answer the following questions: How do intellectual property rights affect both opportunity driven entrepreneurship and necessity driven entrepreneurship? How does human capital affect the two types of entrepreneurship? What is the combined effect of IPR and human capital on the two types of entrepreneurship?

The issue of IPR is becoming increasingly crucial in the context of developing countries because, following the Trade Related Intellectual Property Rights Agreement (TRIPS), all members of the World Trade Organization are required to achieve high standards of IPR.

While the question of what determines the level of entrepreneurship in developed countries is well studied, much less attention has been given to determinants of entrepreneurship in the context of emerging and developing countries, a context with specific characteristics. In fact, technological development in this group of countries aims to achieve the catching up, a process which includes two key forms of learning: imitation of foreign technologies and domestic Research and Development (R&D) effort (Song et al., 2003; Kim, 1980; Lee et al., 1988).

Our study analyses the links between human capital, intellectual property rights and entrepreneurial activity using the Global Entrepreneurship Monitor survey data for 15 emerging and developing countries during the period 2009-2013. It applies linear regressions on panel data models.

A number of key findings and contributions emerge from the present work. First, it examines the implications of emerging and developing countries' specificities for the determinants of entrepreneurship. Second, it examines the combined effect on entrepreneurship of two determinants often studied separately in entrepreneurship literature. Third, it highlights the link between IPR's regimes and entrepreneurship types. A low IPR regime is associated with necessity oriented entrepreneurship. Finally, this work contributes insights into how IPR protection differentially influences countries according to their levels of human capital. A strong IPR system helps countries with skilled individuals to raise their level of opportunity driven entrepreneurship. A key conclusion is that strengthening intellectual property rights' protection and improving human capital level simultaneously in emerging and developing countries are important for entrepreneurship policy because they attract opportunity entrepreneurs, that is, such a policy attracts better, not just more, entrepreneurs.

The rest of the paper is organized as follows: In Section 2 we discuss theoretical issues and empirical results relative to previous studies and propose research hypotheses. In Section 3 we introduce the data and empirical methodology. Empirical findings are presented and discussed in Section 4. Section 5 concludes.

II. Literature review and hypotheses

A. Opportunity Driven Entrepreneurship (ODE)

Opportunity driven entrepreneurs found a new firm to exploit an opportunity. According to Casson (1982), entrepreneurial opportunities are the situations in which new goods, services, raw materials, and organizing methods are introduced and sold at greater than their cost of production. The term "new" here means new in the domestic market, and not in the world. There are two types of entrepreneurial opportunities in emerging and developing countries: 1) domestic innovations, i.e., new products created by entrepreneurs and 2) foreign imported products adopted by entrepreneurs. So, what are the implications of such definition for the impact of IPR and human capital on opportunity driven entrepreneurship in emerging and developing countries?

1. IPR and opportunity driven entrepreneurship

According to several scholars, property rights systems form the backbone of the modern set of institutions that characterise the market economy (Aidis et al., 2012). Acemoglu and Johnson (2005) show that property rights have pronounced effects on investment, financial development and long run economic growth. Parker (2007) notes that property rights that are well protected help promote entrepreneurship and innovation. In addition, weaker property rights are likely to foster the development of predatory forms of entrepreneurial activities (Henrekson, 2007).

Intellectual property rights form the most important component of property rights, relevant for entrepreneurship.

Baumol (1993) points out that entrepreneurs tend to operate in areas that offer the highest financial returns. Thus, entrepreneurs activities vary according to the structure of rewards of the economy. When this structure changes, for market, political or institutional reasons, entrepreneurs will be the first economic agents to identify and respond to the opportunities generated by these changes.

Strengthening IPR protection in a given country can change the structure of the economy's rewards by increasing the potential returns generated by investment in innovation activities. Therefore, it allows for the formation of new firms in order to exploit these innovations.

Previous studies confirm the Baumol's arguments. On the one hand, Arrow (1962) stresses that the protection of new ideas through robust IPR prevents imitation and consequently ensures return on investment. Empirical studies such as those carried out by Allred and Park (2007), Ang (2010), Lin et al. (2010) and Lo (2011) show that IPR affect positively technological innovation. On the other hand, a number of studies conclude that IPR encourage individuals to exploit their innovations by setting up new businesses. Using data on 1,397 patents assigned to the Massachusetts Institute of Technology during the 1980-1996 period, Shane (2001) shows that the effectiveness of patent protection is one factor which influences the likelihood that new technology will be exploited through firm formation. Claessens and Laeven (2003) found that industries that rely on intangible assets show a disproportionately lower rate of growth in countries characterized by weak

intellectual property rights. Klapper et al. (2006) find that there is more entry in R&D intensive industries in countries that protect property better.

Although there are technological creation activities in many emerging and developing countries, these countries are deploying a great learning effort to make efficient use of technologies imported from advanced countries. Therefore, the imitative and adaptive nature of innovation in these countries requires weak IPR regimes. Low levels of protection help local firms in the early stages of industrialization build their technological capabilities by allowing imitation and reverse engineering (Kim, 2003). Empirical studies on East Asian economies (Japan, the Republic of Korea and Taiwan), the most successful economies in the world in terms of catch-up experience, suggest that relatively low levels of IPR protection encourage technological learning during the early years of industrialization (Kumar, 2003).

Strengthening IPR in emerging and developing countries has adverse effects. On the one hand, it increases the ability of innovators to appropriate the rent of innovation, and attracts consequently more opportunity entrepreneurs. On the other hand, it hinders individuals from setting up a new firm based on foreign product. In this case, and under a stricter legal regime of IPR protection, the cost of exploiting opportunity will be very high as prices will raise for imported products and new technologies (Maskus, 2000).

Based on these arguments, we cannot predict the nature of link between the protection of intellectual property rights and the new business formation by entrepreneurs who exploit entrepreneurial opportunities. Therefore, our first research hypothesis H1A is formulated as follows:

H1A: A strong IPR system may affect significantly (positively or negatively) the propensity for opportunity driven entrepreneurship.

2. Human capital and opportunity driven entrepreneurship

Human capital is the set of knowledge and skills acquired by individuals through education, experiences and training (Becker, 1964). Human capital may stimulate entrepreneurship. Indeed, well skilled individuals may be able to get more relevant information with regard to the process of starting a business compared to those with lower human capital (Bruderl et al., 1992). Moreover, it helps entrepreneurs to select promising projects: When individuals with high skills leave their job to exploit an opportunity, they may set up larger and financially better equipped businesses thanks to their past higher earnings.

Human capital allows to facilitate the number of opportunities entrepreneurs identify (Corbett, 2007; Ucbasaran et al., 2008). Shane and Venkataraman (2000) highlighted the key role of human capital in discovery and exploitation of entrepreneurial opportunities. Shane (2000) emphasises the importance of three dimensions of prior knowledge to the process of entrepreneurial discovery: prior knowledge of markets, prior knowledge of ways to serve markets and prior knowledge of customer problems. Prior information is mainly developed from work experience and education. It influences the entrepreneur's ability to comprehend, extrapolate, interpret, and apply new information he gets. Westhead et al. (2005) argue that experienced entrepreneurs have a high level of "entrepreneurial alertness" which involves a distinctive set of perceptual and cognitive processing skills that direct the

opportunity identification process. Bayon et al. (2016) found that human capital inputs and output are significant factors in influencing the decision to exploit innovative opportunities in Spain. Kollinger's (2008) study revealed the significantly positive role that human capital inputs like education, labor market experience as well as entrepreneurial self-confidence play in influencing some individuals to choose more innovative opportunities.

Based on these arguments, we formulate our second research hypothesis as follows:
H1B: Human capital will increase the propensity for opportunity driven entrepreneurship.

3. IPR, human capital and opportunity driven entrepreneurship

The question to ask now is: How does human capital interact with intellectual property rights to influence opportunity based entrepreneurs?

Literature on IPR points out that strengthening IPR protection is not always a good solution to stimulate innovation. Léger (2005) showed that a strong IPR system discourage innovation activities in corn industry in Mexico. Some authors highlight that high IPR standards are efficient only under certain conditions (Maskus, 2004; Siebeck et al., 1990). They are beneficial in markets characterized by weak entry barriers, labor market flexibility, developed international trading system, strong institutional system and high level of human capital. Introduced differently, high levels of protection have no effect or are even associated with negative effects on the economy. Such prerequisites are not reachable in some developing countries. Therefore, other factors should be exist in order to make IPR efficient. Ortega and Lederman (2010) emphasize the complementarity role between intellectual property rights and human capital in raising R&D expenditures. Human capital is crucial for technological change (Nelson and Phelps, 1966). Well qualified individuals generate knowledge that can be used to introduce innovations. Furman et al. (2002), Griffith et al. (2004), Van Uden et al. (2014) and Loukil (2016) showed that human capital has a positive and significant effect on technological innovation.

Thus, we reframe the argument of Baumol (1993) cited above to say that strengthening IPR protection in a given country can change the structure of the economy's rewards by increasing the potential returns generated by investment in innovation activities, *which are generated by skilled human resources*. Therefore, it allows for the formation of new firms in order to exploit these innovations.

H1C: A strong IPR system will increase the propensity for opportunity driven entrepreneurship more among countries with higher levels of human capital compared to countries with lower levels of human capital.

B. Necessity Driven Entrepreneurship (NDE)

Necessity driven entrepreneurship is the creation of new firms based on existing products or services in the national market in order to provide for the elementary needs. In this case, entrepreneurs are imitators and not innovators as in the case of ODE.

1. IPR and necessity driven entrepreneurship

The impact of IPR protection on entrepreneurial income is ambiguous (Kihlstrom and Laffont, 1979; Evans and Jovanovic, 1989). If IPR create new profit opportunities for new

firms by creating new opportunities that can be imitated and exploited perfectly by new small businesses, then they will have a positive impact on a country's entrepreneurial activity. But, if IPR protection laws act to restrict access to technology for imitative firms, then a negative effect will dominate. Indeed, the protection of IPR may lead to an intense monopoly power granted to national innovators. This causes the restriction of access to the stock of knowledge on which the entrepreneur can be based to imitate, which prevents the creation of new businesses based on imitation.

Thus, our research hypothesis is formulated as follows:
H2A: A strong IPR system may significantly increase or decrease the propensity for necessity driven entrepreneurship.

2. Human capital and necessity driven entrepreneurship

In the case of necessity driven entrepreneurship, entrepreneurs have no job, their financial resources are limited and they have not high qualifications. Entrepreneurial activity is considered as a source of revenue (Singer et al., 2015). So, NDE is conducted by individuals with low human capital levels. According to Bruderl et al. (1992), individuals with few human capital resources are often forced into self-employment. If unemployment is the main incentive for setting up a business, there may not be time to look for good opportunities, make detailed plans, get appropriate funding, and seek advice.

Baptista et al. (2014) found that founders' backgrounds have little influence on the early success of necessity-based entrepreneurs.

Thus, our next research hypothesis is:
H2B: Human capital is negatively associated with the necessity driven entrepreneurship.

3. IPR, human capital and necessity driven entrepreneurship

As IPR may affect positively or negatively the level of necessity entrepreneurship, we cannot decide on the nature of combined effect of institutions and human capital on NDE. If IPR decrease the necessity entrepreneurship level, then we predict that a high level of IPR protection combined with high level of human capital will be negatively associated with the level of NDE.

H2C: A strong IPR system will decrease the propensity for necessity driven entrepreneurship more among countries with higher levels of human capital compared to countries with lower levels of human capital.

C. Other determinants of entrepreneurship

One determinant of entrepreneurship that has galvanized a lot of theoretical and empirical attention is demand. The increase in demand for goods and services, attributed to population growth, per capita income growth and changing tastes, leads to market expansion (Weneker et al., 2005) and is therefore associated with a high rate of business creation (Gaygisiz and Koksal, 2003).

Unemployment is one of the documented determinants of entrepreneurship. The nature of the relationship between unemployment and new firm formation cannot be determined

theoretically. On the one hand, according to the so-called 'push hypothesis' the impact should be positive. Oxenfeldt (1943) pointed out that individuals confronted with unemployment and low prospects for wage employment turn to self-employment as a viable alternative. On the other hand, the 'pull hypothesis' suggests that the impact should be negative. Lucas (1978) and Jovanovic (1982) suggest that the unemployed tend to possess lower endowments of human capital and entrepreneurial talent required to start and sustain a new firm.

The literature emphasizes the level of financial development as a factor affecting the new firm formation. The probability of individuals becoming entrepreneurs is increasingly higher with the degree of their wealth and the volume of assets they control (Evans and Leighton, 1989). Capital is an important determinant of business formation because it influences not only the ability of firms to penetrate the market but also their ex post performance. Empirical studies have shown that sufficient financial resources allow new firms to survive (Kauermann et al., 2005) and grow (Bamford et al., 2004).

III. Methodology

A. Sample description

Our sample includes 15 emerging and developing countries[1]. The period of study is from 2009 to 2013. This choice is based on the limited data concerning the dependent variable: entrepreneurship.

B. Measurement of variables

1. Dependent variable

Entrepreneurship is measured with reference to GEM data which are quite popular in entrepreneurship analysis because they rely on a considerable number of countries and distinguish different types of entrepreneurs. In this study, we use two measures of entrepreneurship as defined in Singer et al. (2015, p. 24): ODE and NDE.

Opportunity Driven Entrepreneurship (ODE) is the improvement driven opportunity entrepreneurship defined in the GEM report. It represents the percentage of individuals involved in early-stage entrepreneurial activity who (1) claim to be driven by opportunity as opposed to finding no other option for work; and (2) who indicate that the main driver for being involved in this opportunity is being independent or increasing their income, rather than just maintaining their income.

Necessity Driven Entrepreneurship (NDE) is the percentage of individuals involved in early-stage entrepreneurial activity who claim to be driven by necessity (having no better choice for work) as opposed to opportunity.

2. Independent variables

Our measure for protection degree of intellectual property rights (IPR) is based on the index of World Economic Forum which conducts a survey covering business leaders in various countries. The survey aims to see whether they view intellectual property is well protected,

with a scale ranging between 1 (disagree) and 7 (strongly agree). The average score for all respondents in a country gives the index for that country. The results of this survey are published in the Global Competitiveness Report (GCR). So, we have obtained data from different issues of that report. This index is used by Desai et al. (2003), Livramento and Foray (2007) and Estrin et al. (2011).

However, this metric is imprecise for purposes of quantitative estimation of impact because of its ordinal nature and because the survey respondents' perceptions regarding what constitutes strong and weak IPR are likely to vary. That's why IPR in our study is a dummy variable taking the value of zero for the lowest rating (<= 3.5) and the value of one for the highest rating (> 3.5).

Human capital is measured by education level. The variable EDUC is the gross enrollment ratio for secondary school[2]. Data are from World Bank's World Development Indicators.

Control variables are: GDP per capita (GDP), population growth rate (POPG); unemployment rate (UNEMP) and financial development level (FD).

The data on GDP per capita are in constant 2010 US dollars. The variable is transformed in natural logarithm.

POPG is the annual population growth rate.

Unemployment rate refers to the share of the labor force that is without work but available for and seeking employment.

Financial development is measured by domestic credit to private sector as share of GDP.

Data on control variables come from the World Bank's World Development Indicators (WDI).

C. Descriptive statistics

Table 1 provides the descriptive statistics on the dummy variable (IPR).

Table 1. *Summary statistics of the variable IPR*

Dummy Variable	Percentage	
	Group 1 (variable taking value of 0)	Group 2 (variable taking value of 1)
IPR	38	37

Table 2 provides the descriptive statistics on the entrepreneurship variables (ODE, NDE) as well as the other explanatory variables (EDUC, GDP, POPG, UNEMP, FD).

Table 2. *Summary statistics*

	Mean	Median	Stand. dev	Minimum	Maximum
ODE	44.2	43	11.4	9.8	71.8
NDE	27.1	28	8.2	10.2	46.6
EDUC	98.8	96.6	10.4	65.5	110.4
GDP	9881.7	10276.2	2922	4682.7	14551
POPG	0.6	0.9	0.9	-2	1.8
UNEMP	9.7	7.4	5.4	3	25.1
FD	61.3	50.8	36.4	12.4	149.2

D. Statistical models

The present paper uses linear regression models. Due to the limited number of observations, we use a static approach which cannot address the endogenous issues caused by the inverse causality between entrepreneurship and some explanatory variables such as unemployment rate and GDP per capita. In the present research, endogeneity problem is resolved by using the first lag of all explanatory variables. To observe the long-term impacts on entrepreneurship, we follow Dvoulety (2017) and put into the regression models with a two year lag.

The general forms of models to be estimated in this study are:

$$ODE_{it+l} = \beta 0 + \beta 1\ IPR_{it} + \beta 2\ EDUC_{it} + \beta 3\ IPREDUC_{it} + \beta 4\ X_{it} + \varepsilon_{it} \qquad (1)$$

$$NDE_{it+l} = \beta 0 + \beta 1\ IPR_{it} + \beta 2\ EDUC_{it} + \beta 3\ IPREDUC_{it} + \beta 4\ X_{it} + \varepsilon_{it} \qquad (2)$$

$i = 1,…, N$ denotes the country (in our study, $N = 15$); $t = 1,…, T$ denotes the time period (in our study, $T = 5$) and l is the time lag, it is equal to 1 and 2.

ODE and NDE represent entrepreneurship variables. IPR is the indicator of intellectual property rights protection. EDUC is the level of human capital. IPREDUC is an interaction term between IPR and EDUC, IPREDUC = IPR * EDUC.

X is a vector of control variables, $X = (GDP, POPG, UNEMP, FD)$ and ε is the error term.

Linear models are estimated by the software STATA 12.

IV. Presentation and interpretation of results

Before presenting the regression models, we proceed to analyse the independence of the explanatory variables. This is the multi collinearity test. To check the condition of absence of multi-collinearity, we use the simple correlation matrix and assume a limit of 0.7. According to the correlation matrix, strongest correlations are found between IPR index and the interaction term IPREDUC (the correlation coefficient is equal to 0.98). Thus, these two variables should not be introduced in the same model in order to guarantee reliability of results.

A. Analysis of simple correlations

We begin our analysis by examining simple correlations. The matrix of simple correlations allows us to examine the correlation coefficients in order to study the null hypothesis of the absence of correlation between two variables. Table 3 summarizes the results found.

Table 3. *Simple correlations between the dependent variable and the explanatory variables*

Explanatory variables	Model (1): Dependent variable = ODE			Model (2): Dependent variable = NDE		
		Model with one year lag	Model with two year lag		Model with one year lag	Model with two year lag
	Predicted sign	Correlation	Correlation	Predicted sign	Correlation	Correlation
IPR	+/-	0.107	0.159	+/-	-0.255**	-0.402***
EDUC	+	-0.315***	-0.288**	-	0.274**	0.258**
IPREDUC	+	0.039	0.105	-	-0.207*	-0.368***
GDP	+	0.064	0.058	+	0.05	-0.044
POPG	+	0.303***	0.352***	+	-0.264**	-0.192*
UNEMP	-	-0.415***	-0.39***	+	0.345***	0.289**
FD	+	0.224*	0.272**	+	-0.035	-0.106
*, **, ***: significant correlations at the 10%, 5% and 1% thresholds.						

The analysis of simple correlations shows that the variable relative to intellectual property rights protection is positively but not significantly related to ODE. In contrast, IPR is negatively and significantly related to necessity driven entrepreneurship. Contrary to the predicted signs, the variable relative to human capital is negatively and significantly related to ODE and is positively and negatively related to NDE. The interaction term IPREDUC is positive but not significant in the model relative to ODE. As expected, this term is negative and significant for the case of NDE.

For control variables, the correlation coefficient for GDP per capita is not significant. Population growth has, as expected, a positive and significant sign in the model 1. However, it has a negative sign and is significant in model 2. Unemployment rate is negative and significant in the case of ODE. It has a positive sign and is significant in the case of NDE. For the financial development, the correlation is positive and significant in the model 1. This variable is negatively but not significantly related to necessity driven entrepreneurship.

B. Findings

1. Estimation results of Model 1 (Dependent variable: ODE)

To test hypotheses H1A, H1B and H1C, we have estimated eight models when the dependent variable is ODE: four models with one year lag and four other models with two year lag.

Before examining results, it is necessary to verify some tests applied on panel data.

We begin by models with one year lag.

First, the homogeneous or heterogeneous specification of the data generating process should be checked. If the test performed (individual presence test) shows that there are individual specificities, the Ordinary Least Squares (OLS) method is inappropriate and in this case, we apply Hausman test to determine whether the coefficients of the two estimates (fixed and random) are statistically different.

In models (1.1), (1.2), (1.3) and (1.4) the Lagrange multiplier test gives values of 12.43; 8.55; 8.36 and 8.38 respectively and the associated p-values are below the threshold of 1%. We then reject the null hypothesis of absence of specific effects, so it is necessary to introduce individual effects.

The probability of the Hausman test in the four cases is greater than 1% (0.6435 in model (1.1); 0.2253 in model (1.2); 0.3494 in model (1.3) and 0.3495 in model (1.4)). Based on the Hausman test, we choose the random effects model for these models.

The Breush-Pagan test allows us to detect heteroskedasticity. In models (1.1), (1.2), (1.3) and (1.4), the probabilities of the test are equal to 0.0032; 0.0101; 0.0061 and 0.0058 respectively which are inferior than 5%. We therefore conclude that there is a problem of heteroskedasticity for these models.

The Wooldridge test allows us to detect the auto-correlation whose null hypothesis is the absence of auto-correlation errors. In models (1.1), (1.2), (1.3) and (1.4) the probabilities of the test are equal respectively to 0.4084; 0.3469; 0.3500 and 0.3495 confirming the absence of an auto-correlation error problem for all these estimated models.

In the following, we present the results of the linear regressions with a correction of the problem of heteroscedasticity for the four models.

Columns 2, 3, 4 and 5 of Table 4 provide the results of the four linear regression models.

We turn now to the models with two year lag.

In models (1.5), (1.6), (1.7) and (1.8) the Lagrange multiplier test gives values of 20.07; 15.74; 16.55 and 16.90 respectively and the associated p-values are below the threshold of 1%. We then reject the null hypothesis of absence of specific effects, so it is necessary to introduce individual effects.

The probability of the Hausman test in the four cases is greater than 1% (0.4269 in model (1.5); 0.4075 in model (1.6); 0.6354 in model (1.7) and 0.5919 in model (1.8)). Based on the Hausman test, we choose the random effects model for these models.

In models (1.5), (1.6), (1.7) and (1.8), the probabilities of the Breush-Pagan test are equal to 0.1190; 0.4197; 0.1447 and 0.2206 respectively which are superior than 5%. We therefore conclude that there is not a problem of heteroskedasticity for these models.

In models (1.5), (1.6), (1.7) and (1.8) the probabilities of the Wooldridge test are equal respectively to 0.6892; 0.7863; 0.7169 and 0.6776 confirming the absence of an auto-correlation error problem for all these estimated models.

In the following, we present the results of the linear regressions without any corrections.

Results of these estimated models are reported in columns 6, 7, 8 and 9 of Table 4.

Table 4. *Results of model estimates (1)*

Independent variables	Dependent variable: ODE							
	Model 1.1	Model 1.2	Model 1.3	Model 1.4	Model 1.5	Model 1.6	Model 1.7	Model 1.8
Constant	76.871 (54.803)	86.415 (57.686)	83.723 (61.318)	82.390 (61.951)	66.146 (75.357)	74.235 (68.085)	111.119 (74.508)	123.072 (75.862)
IPR (-1)	-0.614 (2.599)		-0.065 (3.318)					
IPR (-2)					3.247 (4.245)		7.074 (4.372)	
EDUC (-1)		0.086 (0.138)	0.074 (0.175)	0.072 (0.157)				
EDUC (-2)						0.383** (0.190)	0.502** (0.203)	0.453** (0.193)
IPREDUC (-1)				-0.003 (0.034)				
IPREDUC (-2)								0.083* (0.045)
GDP (-1)	-2.981 (5.936)	-4.962 (7.131)	-4.526 (7.913)	-4.364 (7.894)				
GDP (-2)					-2.132 (8.068)	-7.161 (7.840)	-12.424 (8.782)	-13.208 (8.791)

Independent variables	Dependent variable: ODE							
	Model 1.1	Model 1.2	Model 1.3	Model 1.4	Model 1.5	Model 1.6	Model 1.7	Model 1.8
POPG (-1)	-0.247 (2.599)	-0.311 (2.641)	-0.263 (2.658)	-0.256 (2.649)				
POPG (-2)					0.584 (2.941)	0.966 (2.737)	0.587 (2.823)	0.591 (2.821)
UNEMP (-1)	-1.508*** (0.282)	-1.582*** (0.352)	-1.574*** (0.387)	-1.567*** (0.392)				
UNEMP (-2)					-1.306*** (0.487)	-1.527*** (0.468)	-1.732*** (0.498)	-1.780*** (0.501)
FD (-1)	**0.158***** (0.052)	0.174*** (0.066)	**0.170***** (0.064)	0.171*** (0.064)				
FD (-2)					0.148** (0.075)	0.237*** (0.076)	0.219*** (0.077)	0.219*** (0.077)
Observations	75	75	75	75	75	75	75	75
F/Chi2	51.59***	67.68***	70.42***	67.99***	14.94**	20.55***	22.29***	23.13***
R2	0.54	0.56	0.56	0.56	0.52	0.61	0.58	0.57

Standard Errors are in parentheses.
*, **, ***: Coefficients are significant at 10 %, 5 % and 1 %.
IPR, EDUC, IPREDUC, GDP, POPG, UNEMP and FD denote respectively: intellectual property rights indicator, secondary school enrollment ratio, interaction term IPR*EDUC, GDP per capita, population growth rate, unemployment rate and financial development level (domestic credit to private sector (%GDP)).

In all specifications, the Fisher/Chi2 statistic testing the joint significance of the explanatory variables is significant. This allows us to reject the null hypothesis that the regression coefficients β are zero. Therefore, our models are globally significant.

According to specifications (1.1), (1.3), (1.5) and (1.7) the coefficient of IPR is not significant. Thus, IPR standards have no influence on opportunity driven entrepreneurship in emerging and developing countries. Therefore, the first hypothesis H1A of our research is not verified. Contrary to the work of Shane (2001), our result does not confirm the argument of Baumol (1993).

The coefficient relative to education is positive. It is significant (at 5% threshold) only in specifications (1.6), (1.7) and (1.8). Based on the model (1.6) (as it has the highest R2), the coefficient implies that a 1% increase in gross enrollment in secondary education leads to 0.38% increase in the level of opportunity entrepreneurship. Our result validates the hypothesis H1B: Human capital is a key factor to identify and to exploit innovative opportunities. It is coherent with the studies of Bayon et al. (2016) and Kollinger (2008).

In specifications (1.4) and (1.8), we introduce the interacted term IPREDUC. Results from the fourth model indicate that the coefficient relative to this variable is not significant. In contrast, according to the eighth model, IPREDUC is as expected positive and significant (at 10% threshold). Based on the specification (1.8), the result implies that an increase of IPR index by 1 point raises the level of ODE more in countries with higher human capital than in countries with lower human capital by 0.083 percentage points. Hence, our hypothesis H1C is verified. This finding highlights the importance of human capital when deciding to enhance the quality of institutions. A certain level of education should exist among people in order to be able to respond to the opportunities generated by such changes. Considering both the insignificant effect of IPR and the significant effect of IPREDUC, our result confirms the arguments of Maskus (2004) and Siebeck et al. (1990) who claim

that other factors, such as human capital, should be present to make IPR efficient in emerging and developing countries. Thus, our study confirms the complementarity between human capital and intellectual property rights in entrepreneurial activity, especially, the opportunity based one.

Concerning control variables, the financial development level stimulates opportunity entrepreneurship. In contrast, unemployment rate decreases the level of entrepreneurs based on opportunities.

2. Estimation results of Model 2 (Dependent variable: NDE)

To test hypotheses H2A, H2B and H2C, we have estimated eight models when the dependent variable is NDE: four models with one year lag and four other models with two year lag.

For the models with one year lag, the Hausman test recommends the random effects model for the four specifications (2.1), (2.2), (2.3) and (2.4). The Breush-Pagan test and the Wooldridge test indicate that there is only a problem of auto-correlation for the first and second specifications. However, there are problems both of heteroskedasticity and of auto-correlation error for the third and fourth specifications. In the following, we present results of the linear regressions with a correction of auto correlation problems for the models (2.1) and (2.2), and with a correction of heteroscedasticity and auto correlation problems for the models (2.3) and (2.4). Results of these estimated models are reported in columns from 2 to 5 of the Table 5.

For the models when the dependent variable is necessity driven entrepreneurship with two year lag, we choose the fixed effects model for the four models (2.5), (2.6), (2.7) and (2.8). The Breush-Pagan test and the Wooldridge test indicate that there is only a problem of auto-correlation error in the four specifications.

In the following, we present the results of the linear regressions with a correction of the auto correlation problem for the models (2.5), (2.6), (2.7) and (2.8). Results of these estimated models are reported in columns 6, 7, 8 and 9 of Table 5.

Table 5. *Results of model estimates (2)*

Independent variables	Dependent variable: NDE							
	Model 2.1	Model 2.2	Model 2.3	Model 2.4	Model 2.5	Model 2.6	Model 2.7	Model 2.8
Constant	-35.195 (40.191)	-10.764 (47.937)	-55.954** (26.577)	-60.072** (26.842)	- 917.805*** (198.431)	- 923.255*** (190.677)	- 956.047*** (203.414)	- 974.663*** (204.604)
IPR (-1)	-5.653** (2.591)		-6.744*** (1.851)					
IPR (-2)					-1.527 (4.548)		-1.801 (4.590)	
EDUC (-1)		-0.041 (0.153)	-0.121 (0.096)	-0.078 (0.089)				
EDUC (-2)						-0.153 (0.220)	-0.160 (0.223)	-0.139 (0.223)
IPREDUC (-1)				-0.073*** (0.020)				
IPREDUC (-2)								-0.026 (0.048)

Independent variables	Dependent variable: NDE							
	Model 2.1	Model 2.2	Model 2.3	Model 2.4	Model 2.5	Model 2.6	Model 2.7	Model 2.8
GDP (-1)	6.432 (4.315)	4.173 (5.584)	10*** (3.112)	9.993*** (3.152)				
GDP (-2)					104.978*** (26.586)	107.281*** (26.195)	110.743*** (27.871)	112.479*** (27.95)
POPG (-1)	-0.161 (1.615)	-0.358 (1.956)	0.508 (1.042)	0.316 (1.054)				
POPG (-2)					-23.033*** (8.355)	-23.151*** (8.129)	-22.357** (8.466)	-22.059** (8.457)
UNEMP (-1)	0.728*** (0.271)	0.748** (0.358)	0.852*** (0.171)	0.867*** (0.173)				
UNEMP (-2)					1.316 (1.169)	0.962 (1.015)	1.2 (1.190)	1.310 (1.201)
FD (-1)	-0.009 (0.044)	-0.054 (0.057)	-0.034 (0.026)	-0.033 (0.026)				
FD (-2)					-0.262 (0.171)	-0.237 (0.174)	-0.239 (0.176)	-0.242 (0.176)
Observations	75	75	75	75	60	60	60	60
F/Chi2	15.79**	7.89	45.84***	45.26***	4.69***	4.81***	3.95***	3.99***
R2	0.54	0.28	0.18	0.19	0.36	0.37	0.37	0.38

Standard Errors are in parentheses.
*, **, ***: Coefficients are significant at 10 %, 5 % and 1 %.
IPR, EDUC, IPREDUC, GDP, POPG, UNEMP and FD denote respectively: intellectual property rights indicator, secondary school enrollment ratio, interaction term IPR*EDUC, GDP per capita, population growth rate, unemployment rate and financial development level (domestic credit to private sector (%GDP)).

In the specification (2.2), the Fisher/Chi2 statistic testing the joint significance of explanatory variables is not significant. In the other specifications, the Fisher/Chi2 statistic is significant. This allows us to reject the null hypothesis that the regression coefficients β are zero. Therefore, these models are globally significant and our interpretation will be based on these seven specifications.

According to the first and third specifications, IPR variable affects negatively and significantly the level of necessity entrepreneurship. Therefore, the hypothesis H2A is confirmed. According to the specification (2.1) (as it has the highest R2), an increase of IPR index by 1 point causes a decrease in NDE by 5.6 percentage points. Our result suggests that, as expected, intellectual property rights hinder individuals who have no job to set up new businesses. Strengthening IPR standards causes the restriction of access to the stock of knowledge on which the entrepreneur can be based to imitate.

In specifications (2.3), (2.4), (2.6), (2.7) and (2.8) the coefficient relative to education is, as expected, negative but not significant. The finding does not validate our research hypothesis H2B. It is not coherent with Bruderl et al. (1992) who claim that individuals with few human capital resources are often forced into self-employment.

Based on the specification (2.4), the combined effect between intellectual property rights and human capital on NDE is negative and significant at 1%. It implies that increasing IPR index by 1 point leads to a reduction in necessity driven entrepreneurship level more in countries with higher human capital than in countries with lower human capital by around 0.07 percentage points. Thus, our hypothesis H2C is confirmed.

Concerning control variables, we note that GDP per capita and the unemployment rate have a positive and significant (at 1% threshold) impact on the level of necessity entrepreneurship. In contrast, population growth affect negatively and significantly the necessity driven entrepreneurship.

V. Conclusion

The purpose of the present paper was to assess the effect of intellectual property rights, human capital and the interaction between them on entrepreneurial activities in developing and emerging countries. Entrepreneurship is defined by referring to the Global Entrepreneurship Monitor data which distinguish two types: opportunity driven entrepreneurship and necessity driven entrepreneurship. Analysis of theoretical issues and previous empirical studies allows us to formulate a number of research hypotheses.

Using linear regressions on panel data for 15 countries during the period 2009-2013, our study confirms some hypotheses and invalidates some others.

The present paper contributes to the already substantial body of entrepreneurship literature. Its main originality is to examine the interaction that may exist between institutions, especially intellectual property rights and human capital, an issue that is neglected in previous studies. It has important implications on both academic and political levels.

To summarize findings and identify the implications, we note that: 1) The improvement of intellectual property rights has no influence on opportunity driven entrepreneurship. In contrast, it affects negatively necessity driven entrepreneurship. 2) The improvement of the education level allows to increase opportunity driven entrepreneurship. However, it has no influence on the level of necessity entrepreneurship. These results imply that human capital is a key factor to attract better entrepreneurs in emerging and developing countries. 3) For countries with higher human capital level, the strenghtening of the IPR system increases the level of opportunity driven entrepreneurship. Therefore, the TRIPS agreement is beneficial for emerging and developing countries only if the factor of human capital is well developed. 4) For countries with higher human capital level, the strenghtening of the IPR system decreases the necessity driven entrepreneurship. Thus, we confirm the complementary role of intellectual property rights and human capital in eliminating more entrepreneurs and in attracting entrepreneurs with higher quality which is a great challenge for emerging and developing countries.

Our analysis suffers however from some weaknesses. For example, the endogeneity problem was addressed by using first lag of the explanatory variables. Lack of adequate data does not permit to use the Generalised Method of Moments (GMM) which allows to overcome this problem and to deal with omitted dynamics in static panel data models, owing to the ignorance of the impacts of lagged values of the dependent variable. Second, the measure of human capital takes into account only general issue of human capital. It ignores its specific aspect such as entrepreneurs' experience.

For further analyses, we propose new avenues. One possibility is to use other measures for intellectual property rights and human capital and compare the results with those found in

the present paper. A second way is to carry out a survey to identify entrepreneurs who are based on new domestic product and those based on foreign imported product and examine the implications of the two types of entrepreneurial opportunities for the relationship between intellectual property rights, human capital and opportunity driven entrepreneurship.

Notes

(1) In this paper, we adopt the ranking of countries according to the report of the International Monetary Fund (IMF, 2012), which classifies countries into two categories: "Advanced Economies" and "Emerging and Developing Economies". Countries included in our sample are: Argentina, Brazil, Chile, Colombia, Croatia, Hungary, Jamaica, Latvia, Malaysia, Panama, Peru, Romania, Russia, South Africa and Uruguay.

(2) According to the World Bank Database, gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. This ratio can be over 100% as it includes students whose age exceeds the official age group (e.g. repeaters). Thus, if there is late enrollment, early enrollment, or repetition, the total enrollment can exceed the population of the age group that officially corresponds to the level of education – leading to ratios greater than 100%.

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Trade relation between India and other BRICS countries: A multidimensional approach using Gravity Model and Granger Causality

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Abstract. *The aim of the study is to explore trade relation between India and other BRICS nations in the short-run as well as in the long-run. For empirical analysis, the study first checks stationary conditions using ADF- Fisher unit root test. To estimate the association between the selected variables, this study has applied Pedroni's cointegration test. After fulfilling the two conditions (Stationary & cointegration), this study employed Granger Causality Test for short-run impact and Gravity Model using Dynamic Ordinary Least Square (DOLS) and Fully Modified Ordinary Least Square (FMOLS) for long-run impact. Granger Causality test results strongly support India's trade with other BRICS nations. The study found Bi-Directional Causality between India's Exports & other BRICS Imports and No causality between India's Imports with other BRICS Exports. Also, the study found favorable unidirectional causality between India's GDP and other BRICS nation's volume of trade. Long-run results from Gravity model using DOLS and FMOLS found highly significant for the selected variables (GDP, PCGDP, PCGDPD, Exchange Rate, Trade-GDP ratio and Distance) other than inflation and trade agreement. Except inflation, per capita GDP differential and distance, all the other variables (GDP, PCGDP, Exchange Rate, Trade-GDP ratio and Trade Agreement)has positive coefficient to the volume of trade of BRICS nations. Majority of the selected variables possesses significant and positive relations with the independent variables clearly indicate that there is a favorable impact on the Indian economy. Finally, the test results validated the appropriateness of Gravity model for trade. So this study strongly recommended that India needs to strengthen its trade relation with other BRICS nations by promoting make in India, SEZs, EOUs and aggravating second generation reforms to reap the potential benefits from the global economy.*

Keywords: BRICS, Gravity model, Granger Causality Model, foreign trade, economic integration.

JEL Classification: C51, F10, F15, F17, F19, F41.

Introduction

Developing countries have gradually emerged as a regional and global engine of growth over the last two and half decades witnessed higher growth in world trade which in turn influences major macroeconomic variables in the international arena. Since the 1950s, many regional, bilateral, multilateral and intra-regional trade agreements take place among the grouping nations. Notably, BRICS economies, an acronym for the economies of Brazil, Russia, India, China and South Africa creates a strong counterweight and alternative to the existing world powers like US, EU and Japan in both economic and political areas.

BRICS countries account nearly 41 percent of world population, 25 percent of world's GDP, 27 percent of world's land area, holds the significantly high level of forex reserves and most attractive destinations for foreign investment occupy significance in research.

Initially, Jim O' Neill former chief economist and chairperson of Goldman Sachs who conceived the idea of BRICs, compared it with G7 (so-called US, Canada, UK, France, Italy, Germany and Japan) and projected that the BRICs would represent the world's leading economies in 2050. Also, he has projected that the GDP of BRICs would be higher than the GDP of North America and China would be the largest economy in the world followed by US, India, Japan, and Brazil.

After the successor of full-fledged economic reforms, India extended furthermore reform process in the external front with other BRICS countries in the 21st century. Since 2004, India has widened its liberal trade and investment policies with Brazil, Russia, and China. Further, it has extended with South Africa since its inclusion in the group in 2010. For India, cooperation with the BRICS is more important not only in terms of exports and imports also in terms of addressing its food and energy security issues, combatting terrorism in the region and so on. Engaging with China has been one of the important mechanisms of India's foreign policy to combat terrorism in the region. The BRICS holds the promise of greater understanding and cooperation among the member states for solving bilateral issues (India's foreign policy and BRICS).

From the above background, it is clear that the BRICS all together tries to increase their dominance in world trade and India also attempts to increase its trade and economic cooperation among other BRICS countries as well as with the rest of the world. Past literature reveals that the economic reform creates a positive impact on the Indian Economy in almost all spheres. But there are no studies that clearly evaluate the impact of other countries on India's foreign trade. Similarly, impact analysis (Pre and post BRICS formation) on India's foreign trade with other countries has not yet done. Hence a multidimensional impact analysis of trade and other relation between India and other BRICS countries occupy significance.

Research issues

Against the above background, the present study has given rise to several policy issues and research questions. For instance;
- Does India's trade relation with other BRICS are favorable or not?
- Do BRICS countries reap the benefits equally or not?

- Does comparative advantage create the excessive gap between them?
- Is there any significant impact of BRICS trade on major macroeconomic variables of India?
- Does the progress of BRICS trade be in the line of Jim O'Neill's projection?

It will be scholastically significant and academically expedient exploration to evaluate credible and reasonable responses to the above inquiries. The relevance of the answer lays in providing the intra-regional trade relations with both growth foundations and justifications in the Indian contexts. The basic stimulus of the present paper is to arrive at intraregional trading inferences. In this context, the present study challenges;

Objectives of the study
- To examine the impact of major macroeconomic variables that influence trade of BRICS nations.
- To evaluate the short run causality between India's foreign trade with other BRICS nations.
- To analyze the long run relationship between India's foreign trade with other BRICS nations.
- To suggest suitable policies to promote India's foreign trade with other BRICS nations and the rest of the world.

Period of the study and sources of data

To test the selected variables using the appropriate econometric technique with more observations, this study chooses twenty-six years of data from 1991 to 2016. The reason for choosing the study period is to compare the performances of external sector variables during pre and post one decade of the official meetings of BRICS nations. The study uses only time series secondary data collected from the Handbook of statistics of Indian Economy (Reserve Bank of India), World Integrated Trade Solution Statistics (WITS), World Bank Data and BRICS Joint Statistical Publication.

Limitations
1. The present study is restricted to analyze trade relations of BRICS nations only. This study will not compare BRICS trade with any other countries or global trade.
2. This study uses only secondary data and limited for the period of twenty-six years.
3. This study compares India's trade relation with Russia and China for the selected study period. To compare India's Trade relation with Brazil and South Africa, the study period is reduced to seventeen years from 2000 to 2016 due to non-availability of data and petty terms of trade (Unbalanced panel data).
4. Other than trade, the study is limited to analyze few macroeconomic variables like GDP, per capita GDP, Inflation and exchange rate which are closely correlated to foreign trade.

Research methodology

The present paper uses two pioneering model to analyze the influence of other BRICS countries on India's foreign trade. First, the study uses Tinbergen's reformulated Gravity model of Trade from Newton's law of universal gravitational, in order to assess the impact

of other BRICS countries in influencing the volume of trade of India. To regress gravity equations, this study will employ Dynamic Ordinary Least Square (DOLS) method and Fully Modified Ordinary Least Square (FMOLS) Method. The traditional OLS method struggle with serial correlation and heteroscedasticity problems. DOLS and FMOLS are usually better at considering endogeneity by adding leads and lags. Secondly, the study uses Grangers causality test to forecast future trade relations between India and other BRICS countries. All the estimates and analysis will be done by using Eviews 10 SV software.

The gravity model

This model originates from the Newtonian physics popularly known as Newton's gravity law in mechanics proves that two bodies attract each other proportionally to the product of each body masses divided by the square of the distance among the relevant centers of gravity.

$$F = G \frac{M_1 M_2}{D^2} \tag{1}$$

Where:
F is the force between the masses;
G is the gravitational constant;
M_1 is the first mass;
M_2 is the second mass, and
D is the distance between the centers of the masses.

The gravity model for trade is similar to the Newtonian law. The similarity is as follows: the trade movements between two countries is proportional to the product of each country's "economic mass", generally measured by GDP (national income) and inversely proportional to the distance between the countries respective "economic centers of gravity", generally their capitals. This formulation can be generalized to

$$VOT_{ij} = \alpha \frac{(Y_i \ Y_j)}{Dij} \tag{2}$$

Where:
VOT_{ij} represents the volume of trade from country to country,

Y_i and Y_j typically represent the GDPs for countries i and j,

D_{ij} denotes the trade costs incurred due to distances between the respective destinations.

The traditional approach to estimate this equation takes log values of both the sides which led to a log-log model in the following form;

$$\ln(VOT_{ij}) = \beta_0 + \beta_1 \ln(Y_i) + \beta_2 \ln(Y_j) - \beta_3 \ln(D_{ij}) + \varepsilon_{ij} \tag{3}$$

The comprehensive gravity model of trade expresses the volume of trade/ exports/imports between two nations (groups/nation), populations, distance (a proxy of transportation costs) and set of dummy variables either facilitating or restricting trade between two groups.

As the gravity model is initially expressed in a multiplicative method. From which, this paper linearises the model by taking the usual logarithm of many macroeconomic variables related to trade. So the model in log-linear form can be expressed as,

$$lnX_{ijt} = \beta_0 + \beta_1 lnY_{it} + \beta_2 lnY_{jt} + \beta_3 lny_{it} + \beta_4 lny_{jt} + \beta_5 lnD_{ijt} + \sum S_{ijht} + U_{ijt} \tag{4}$$

Where:

y_i and y_j are per capita GDP of country i and country j;

S_{ijh} is a summation of superior (preferred) trade dummy variables. Dummy variable proceeds the significance one when a certain state is fulfilled, if not, considered as zero.

From the tradition gravity model, this study reformulates traditional equation into a dynamic equation with more variables relating to Volume of Trade, Exports, and Imports of India and other BRICS countries.

The gravity model for volume of trade

$$\log \left(VOT_{ijt}\right) = \alpha_0 + \alpha_1 \log \left(GDP_{it}\right) + \alpha_2 \log \left(GDP_{jt}\right)$$
$$+ \alpha_3 \log \left(PCGDP_{it}\right) + \alpha_4 \log \left(PCGDP_{jt}\right) + \alpha_5 \log \left(D_{ijt}\right)$$
$$+ \alpha_6 \log \left(PCGDPD_{ijt}\right) + \alpha_7 \left(\frac{VOT}{GDP_{it}}\right) + \alpha_8 \left(\frac{VOT}{GDP_{jt}}\right) + \alpha_9(INF_{it})$$
$$+ \alpha_{10}\left(INF_{jt}\right) + \alpha_{11}\left(EXC_{ijt}\right) + \alpha_{12} \log \left(TA_{ijt}\right)$$
$$+ \delta_{ijt} \tag{5}$$

Where:
i – India;
j – Brazil, Russia, China and South Africa;
t – time (study period from 1991 to 2016);
VOT_{ij} – Volume of Trade between country i (India) and country j (BRCS);
GDP_i – Gross Domestic Product of Country i;
GDP_j – Gross Domestic Product of country j;
PCGDPi – Per capita GDP of Country i;
PCGDPj – Per capita GDP of Country j;
D_{ij} – Distance between country i and country j;
$PCGDPD_{ij}$ – Per capita GDP differential between country i and j;
INF_{it} – Inflation of Country i;
INF_{jt} – Inflation of Country j;
EXC_{ijt} – Exchange rate of country i and j;
VOT/GDP_i – Trade- GDP ratio of country i;
VOT/GDP_j – Trade- GDP ratio of country j;
TA_{ij} – Trade Agreement between country i and j (dummy variable);
α's – parameters and
δ – error term.

Per capita GDP provides a good proxy for the level of development and infrastructures that are essential to conducting trade, and as such the more developed the countries are, the more would be the trade between the pairs of countries (Frankel, 1993).

TR/GDP variable indicates the openness of the country. The more open the country is the more would be the trade.

Granger causality test

In the Granger Causality test, the directional relationships between two variables are very sensitive which can be used efficiently by using the optimal number of lags in the model. It can be inferred from the computed statistical values, based on the given equations, 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 IGDP do not possess in the regression (Accepting null hypothesis). This means India's GDP does not Granger cause Volume of trade of other BRICS countries, 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 BRCS volume of trade does not Granger cause India's GDP if the computed F statistic is low or P value is less than the conventional value, we can reject hypothesis and infer that BRCS volume of trade does cause India's GDP.

Similar results can be derived for other beta coefficients in the second hypothesis of the rest of equations.

Causality test for trade flows between India and other BRICS countries

To test causality between India's GDP, Exports, Imports and Volume of Trade with other BRICS countries Exports, Imports and Volume of Trade, the following model developed by Engel and Granger, (1987) will be used. The models are:

(a) GDP of India and Volume of Trade of other BRICS countries

$$IGDP_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, IGDP_{t-i} + \sum_{i=1}^{n} \beta_{2i} BVOT_{t-i} + u_{1t}$$

$$BVOT_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\, BVOT_{t-i} + \sum_{i=1}^{n} \beta_{5i} IGDP_{t-i} + u_{2t} \qquad (6)$$

(b) Exports of India and Imports of other BRICS countries

$$IX_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, IX_{t-i} + \sum_{i=1}^{n} \beta_{2i} BM_{t-i} + u_{1t}$$

$$BX_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\, BM_{t-i} + \sum_{i=1}^{n} \beta_{5i} IX_{t-i} + u_{2t} \qquad (7)$$

(c) Imports of India and Exports of other BRICS countries

$$IM_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} IM_{t-i} + \sum_{i=1}^{n} \beta_{2i} BX_{t-i} + u_{1t}$$

$$BX_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i} BX + \sum_{i=1}^{n} \beta_{5i} IM_{t-i} + u_{2t} \tag{8}$$

(d) The volume of Trade of India and Volume of Trade of other BRICS countries

$$IVOT_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} IVOT_{t-i} + \sum_{i=1}^{n} \beta_{2i} BVOT_{t-i} + u_{1t}$$

$$BVOT_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i} BVOT + \sum_{i=1}^{n} \beta_{5i} IVOT_{t-i} + u_{2t} \tag{9}$$

In the above equations, where:
IGDP is India's GDP;
BVOT is volume of trade of other BRICS countries like Brazil, Russia, China and South Africa;
IX is India's Exports;
BX is Exports of BRCS;
BM is imports of BRCS;
IM is India's Imports;
IVOT India's Volume of Trade;
BVOT is BRCS's Volume of Trade;
β and u are coefficients and error terms, respectively.

Review of literature

This study focuses blend of theoretical and empirical studies relating to the application of the most appropriate econometric technique to analyze the trade and economic relations between intra-regional countries. More specifically, the suitability of Gravity model and Granger Causality test to assess the effectiveness of India's Trade relations with other BRICS countries.

Tinbergen, Jan is the one who first applied Newtonian Gravity model in International Trade. Furthermore, studies like Anderson (1979), Helpman and Krugman (1985) and Deardorff (1998) strengthened the effectiveness of Gravity model in International Trade. Linnemann (1966) was the first one developed the most common clarification of Gravity model that was used by Aitken (1973) and Sapir (1981).

Among the past studies, the studies by Anderson and Wincoop (2003), Limao and Vinables (2001), Sohn (2005) and Nguyen (2010) are the most reputed and relevant studies occupies significance in the context of intra-regional trade.

The traditional Gravity model of international trade focused only two independent variables like Differences in GDP and distances between two respective trading centers/partners. Later many explanatory variables like per capita GDP, exchange rate, Trade GDP ratio, Inflation, Taxes are added in the equation developed in the past studies like Bergstand (1985), Dell Arricia (1999), Frankel (1997), Limao and Venables (2001), Nguyen (2010), Mukhtar and Malik (2010), Frankel (2010) and so on. Similarly, Adrino, Mazenda (2016), Irwan Shah Zainal Abidin, Muhammad Haseeb, Lee Wen Chiat, Muhammad Rabiul Islam (2016) and others developed new dimensional intra-regional trade model using Granger Causality, Dynamic Ordinary Least Square (DOLS) and Fully Modified Ordinary Least Square Model (FMOLS).

Sahu, Pratish Kumar and Sam Yong Heng (2017) investigated India's competitive advantage and the influence of trade gravity variables in determining India's exports with its top 50 trading partners. The study has applied an augmented gravity model to India's exports and estimated the same in a panel data framework during 2000-14. The study finds that India's exports with its top trading partners were more sensitive to distance, GDP, population, and real exchange rate. However, to our surprise, we could not find a significant evidence of the effect of trade agreements on India's exports.

Aswini Mishra, Jigar N. Gadhia, N. Kubendran and Makara Sahoo (2015) delivers a detailed theoretical justification for the application of gravity model in the context of India's trade relation with other BRICS countries. Using 20 years of data from 1990 to 2010, the study found that there is a positive relationship between gross national product/per capita GNP of the nation and its volume of trade. They also found that the transport cost plays a negative role in influencing foreign trade among BRICS nations, other variables related to foreign trade like exchange rate, inflation, and import-GDP ratio does not play a major role in influencing it.

Mottet, Laetitia (2013) examined the cooperation and competition among the BRICS countries and other emerging powers. They found that the members of BRICS align periodically with the bloc to demand greater representation in the international institutions and to resist Western dominance. Despite their appearances as a unified bloc of fastest growing economies, The BRICS countries mismatch in their political setup, economic systems, huge differences in per capita incomes, geopolitical rivalries and conflicts among them that are undermining their reciprocal collaboration.

Ang, Su (2016) did a comparative analysis of BRICS trade which mainly focuses how economic growth, budget deficit, disposable per capita income and currency affect trade in the bloc. The study found that China owns the strongest trade competitiveness compared to all other members in the group, second is Russia, followed by India, Brazil and South Africa. According to trade competitiveness based on economic growth, population and the fiscal deficit of China creates its competitive advantage and the disposable per capita income of South Africa have the advantage of foreign trade. The study also found that the exchange rate appreciation has a high level of negative effect on China's foreign trade.

Kaya, Halil D (2014) examined the relationship between exchange rates, exports and GDP for BRICS countries over a period of 26 years from 1985 to 2011. This study found that

there is no statistically significant difference between the increase in exports and increase in exchange rate, similarly increase in exports during the periods of decreasing exchange rates. Also, this study found that the BRICS countries do not increase their exports significantly when exchange rate falls. Finally, the study witnesses BRICS countries GDP per capita measures are significantly lower when their currency values are low.

Underlying the robust trend in bilateral trade between India and rest of BRICS countries has been the rising trend in India's trade deficit with the rest of BRICS increased from the US $8.7 Billion in 2006 to $ 58.4 Billion in 2015. India maintained its largest trade deficit with China, followed by Russia, South Africa, and Brazil. Before enhancing trade with other BRICS countries, India should address issues relating to the trade deficit and they have to focus export potential to other BRICS countries. (EXIM Bank of India, 2016).

Somesh, Mathur K., Rahul Arora, and Monika Bhardwaj (2016) investigated the impact on India aligning with RCEP (Regional Comprehensive Economic Partnership) and BRICS beneath the conjecture of free trade area. The important objective of the study is to evaluate gains and losses to Indian economy from intra-regional trade. The outcome discloses that it would be favorable for India to have trade relationships with RCEP member countries under free trade in merchandise trade. The study suggested if India wants to continue free trade with BRICS, it must negotiate for the entry of comparatively advantageous commodities into their markets for reciprocity, also it should allow other countries comparatively advantageous commodities into the domestic market.

Mazenda Adrino (2016) addresses the central issue on whether South Africa's align with BRICS has led to a sustainable growth as was predicted. The study uses Autoregressive Redistributive Econometric Modeling and quarterly data from 1990 to 2014. The study found an insignificant long-run relationship between South Africa's Trade, FDI and Economic Growth with other BRICS countries but they found a little short-run effect on South Africa's Growth. Granger Causality test result shows no causality between South Africa's Growth and its Trade with other BRICS countries.

Research gap

Oodles of research studies have been done in relation to the application of Gravity model in international trade. There are several studies in which scholars applied Gravity model and analyzed trade flows between many intra-regional groups using panel data method. Interestingly, this study found that many scholars applied either Gravity model or Granger causality model in their analysis. There is no single study that uses both the models together for analysis even though there is a significance to assess the impact of trade variable on major macroeconomic variables and predict its future trends. Similarly, all the past studies are limited to exports or imports or volume of trade with limited periods. Hence, the present study tries to fill the gap by applying both Gravity Model and Granger Causality model with more explanatory variables that are highly correlated to major macroeconomic variables. Further extent, the present study uses 27 years of data to differentiate the impact of other BRICS countries on the Indian Economy during pre and post one decade of formal meetings of BRICS.

An analysis on India′s Trade relation with other BRICS Countries

To analyze trade relation between India and other BRICS nations in the short-run as well as in the long-run, this study is designed at four stages. Stage one focuses on the application of ADF-Fisher Unit Root Test to check the presence of unit root for stationary conditions. Stage two uses Pedroni's cointegration test to verify the association between the selected variables for regressions. Stage three and four employs two pioneering econometric models called Granger Causality test and Gravity model of trade for empirical results.

ADF-Fisher Unit Root Test

There are six major unit root tests can be applied for stationary conditions for panel and cross-section data's. Of which, the most important and relevant unit root test for this study is ADF-Fisher unit root test. Using ADF-Fisher unit root test, we can check stationary conditions at three levels (Unit root at Level, at first difference and a second difference).

Table 1. *ADF Fisher unit root test (at first difference)*

Variables	Statistic	Prob
$LnVOT_{ijt}$	49.4573	0.0000
$LnGDP_{it}$	18.9839	0.0001
$LnGDP_{jt}$	27.4412	0.0006
$LnPCGDP_{it}$	18.4207	0.0001
$LnPCGDP_{jt}$	27.4117	0.0006
$LnExports_{it}$	11.6324	0.0030
$LnExports_{jt}$	45.8609	0.0000
$LnImports_{it}$	9.74683	0.0076
$LnImports_{jt}$	36.7366	0.0000
$LnPCGDPD_{ijt}$	26.8513	0.0008
$LnExchange\ Rate_{ijt}$	47.7545	0.0000
$LnInflation_{it}$	28.2321	0.0000
$LnInflation_{jt}$	65.0289	0.0000
$LnVOT/GDP_{it}$	12.3983	0.0020
$LnVOT/GDP_{jt}$	64.8891	0.0000
$LnTA_{ijt}$	17.3681	0.0000
$LnDistance_{ijt}$	21.9461	0.0000

The null hypothesis of ADF-Fisher unit root is that the variables have a unit root. Stating that the variables are non-stationary if the probability values are more than the conventional value. Based on the above conception from Table 1, the study has applied ADF-Fisher test at the level and found Non-Stationary. Due to which, the study uses unit root at first difference and found all the probability values are less than the conventional value. So the study rejected the null hypothesis of Unit Root and accepts the alternative hypothesis and inferred that the variables are stationary at first difference.

Pedroni's cointegration test

After verifying the stationary conditions, this study examines whether there is a cointegration between the selected variables or not. For that purpose, the present study has observed three popular and essential cointegration tests. They are Pedroni's residual cointegration, Kao's cointegration, and Fisher's cointegration. Of which, the present study has applied Pedroni's cointegration test due to its significance and relevance to this study.

The null hypothesis of Pedroni's cointegration test is the variables have no cointegration. According to this test, if the probability values for the majority of the test results establish less than 0.05 led to the rejection of the null hypothesis. In such instance, the study can infer that the variables are cointegrated.

Table 2. *Pedroni Residual Cointegration Test (Dependent Variable is Volume of Trade$_{ijt}$)*

Tests	Statistic	Prob	Weighted Stat	Prob
Panel V – Stat	- 0.038004	0.5152	-0.833361	0.79
Panel Rho – Stat	0.698733	0.7576	0.579800	0.71
Panel PP – Stat	-5.983097	**0.0000**	-7.247671	**0.00**
Panel ADF – Stat	-4.653448	**0.0000**	-4.301881	**0.00**
Group Rho – Stat	1.381945	0.9165	---	---
Group PP – Stat	-8.349807	**0.0000**	---	---
Group ADF – Stat	-4.377081	**0.0000**	---	---

Out of 11 test results depicted in Table 2, the probability values of 6 results are less than the conventional value. So the study rejects the null hypothesis and accepts the alternative hypothesis. Stating that there is a long run relationship exists between the selected variables (VOT$_{ijt}$, GDP$_{it}$, GDP$_{jt}$, PCGDP$_{it}$, PCGDP$_{jt}$, Exchange Rate$_{ijt}$, and Distance$_{ijt}$. Other independent variables are restricted from cointegration for the greater degree of freedom). From the test result, the study observed that there is a cointegration between the selected variables and exposed positive signal to run the appropriate model for analysis.

Granger causality to test short-run trade relation between India and other BRICS Nations

To assess the impact of India's trade with other BRICS countries in the short run, this study uses several major macroeconomic variables like GDP, Exports, Imports, Volume of Trade of India and Imports, Exports, Volume of trade of other BRICS nations. This study has tested eight null hypotheses using Granger Causality test and the results are given in Table – 3.

Table 3. *Granger causality test result*

Null Hypothesis	Lags	Obs	F-Statistics	Prob	Results
IGDP Does not Granger Cause BVOT	2	24	5.44310	0.0135	Unidirectional
BVOT Does not Granger Cause IGDP	2	24	1.58698	0.2305	Causality
IX Does not Granger Cause BM	2	24	9.56936	0.0013	Bidirectional
BM Does not Granger Cause IX	2	24	6.39491	0.0075	Causality
IM Does not Granger Cause BX	2	24	2.75588	0.0889	No Causality
BX Does not Granger Cause IM	2	24	0.99802	0.3871	
IVOT Does not Granger Cause BVOT	2	24	5.13996	0.0164	Unidirectional
BVOT Does not Granger Cause IVOT	2	24	2.89502	0.0799	Causality

India's GDP (IGDP) and other BRICS nations Volume of Trade (BVOT)

Granger Causality test results for India's GDP with BRICS nations Volume of Trade, this study has observed unidirectional causality. From the probability values in Table 3, it can be inferred that IGDP does affect BVOT but BVOT does not affect IGDP. Uttering that India's Excess GDP goes to other BRICS nations in the form of exports and creates exports earnings to India. Similarly, an increase in BVOT does not reduce GDP via increasing imports. So it creates a positive impact on India's trade balances and the economy as a whole.

India's Exports (IX) and other BRICS nations Imports (BM)

Granger Causality test results from table 3 gives the probability values of 0.0013 and 0.0075 for India's Exports and Other BRICS nations imports implying that India's Exports does granger cause other BRICS nations Imports, Similarly other BRICS nations imports does cause India's Exports. This Bi-Directional causality clearly indicates that India's exports will influence other BRICS nations Imports and an increase in other BRICS nation's imports will increase India's Exports, i.e.., other BRICS nations receive a considerable portion of their imports from India and it creates the surplus trade in favor of India.

India's Imports (IM) and other BRICS nations exports (BX)

The probability value of 0.0889 and 0.3871 clearly stated that there is no causality between India's imports and other BRICS nation's exports. This result clearly pointed out that an increase in India's imports does not significantly affect the exports of other BRICS nations. Similarly, an increase in the exports of other BRICS nations have no significant impact on India's exports stating that the other BRICS nations exporting more to the rest of the world and not to India.

India's Volume of Trade (IVOT) and other BRICS nations Volume of Trade (BVOT)

Finally, the study observed favorable unidirectional causality between India's Volume of Trade and other BRICS nation's Volume of Trade. The probability value of 0.0164 for IVOT and BVOT proves that India's Volume of Trade enhances other BRICS nation's volume of trade. On the other hand, the probability value of 0.0799 proves that other BRICS nation's volume of trade does not enhance India's volume of trade. It can be inferred by saying when India's volume of trade increases, the majority of its exports goes to other BRICS nation's but it is not true when other BRICS nations increase its volume of trade. Based on the overall empirical results from Granger Causality test, the study has observed that India has positive and favorable trade relationships with other nations.

Panel Data Analysis on the long run output elasticity's of BRICS Trade

The trade relation between the BRICS nations is also estimated by applying Gravity model of trade using Dynamic Ordinary Least Square (DOLS) method and Fully Modified Ordinary Least Square (FMOLS) Method. The significance of DOLS and FMOLS is it rectifies serial correlation and simultaneity inaccuracies.

Table 4. *Cointegration Regression for BRICS Trade using DOLS & FMOLS: Dependent Variable (VOT_{ijt})*

Variables	Dynamic OLS Model				Fully Modified OLS Method			
	Coefficient	Std. Error	t-Stat	Prob	Coefficient	Std. Error	t-Stat	Prob
$Ln(GDP_{it}*GDP_{jt})$	0.5961	0.0335	17.759	0.0000	0.4823	0.0143	33.697	0.00
$Ln(PCGDP_{it}*PCGDP_{jt})$	0.3936	0.0508	7.7375	0.0000	0.5502	0.0231	23.7849	0.00
$Ln(Exchange\ Rate_{ijt})$	0.0558	0.0150	3.7176	0.0003	0.1042	0.0108	9.6535	0.00
$Ln(Inflation_{it}*Inflation_{jt})$	-0.0161	0.0083	-1.918	0.0577	-0.0070	0.0052	-1.3293	0.18
$Openness_{ijt}$	0.3047	0.0012	24.824	0.0000	0.0344	0.0006	50.240	0.00
R Squared	0.91				0.89			

According to the test results from table 4, it is clear that the selected independent variables are significant to the volume of trade of BRICS nations. Except for Inflation, all the other independent variables are significant and positive to the volume of trade of BRICS nations.

This means that the GDP, PCGDP, Exchange rate and openness of BRICS countries have a substantial impact on the volume of trade. As far as inflation is concerned, the study found an insignificant relation to VOT of BRICS nations. Other than inflation, all the independent variables have a positive coefficient, meaning that GDP, PCGDP, Exchange Rate and Openness have a significant plus positive association with VOT. Which means, 1 unit increase in GDP, PCGDP, exchange Rate and openness of BRICS nations causes the volume of trade by 0.5961, 0.3936, 0.0558, 0.3047 units, respectively.

Among all the variables, GDP has high coefficient followed by PCGDP, Exchange Rate, and openness. When the result is insignificant, doesn't matter whether the coefficient is positive or negative. Interestingly, the study found more or less similar results from DOLS & FMOLS which can be seen from flanking probability and R squared values.

Comparative analysis of India's Trade with other BRICS nations using DOLS & FMOLS

One of the major objectives of this study is to assess the impact of India's trade relation with other BRICS nations. For that purpose, the present study uses and compares major macroeconomic variables relating to India's foreign trade with BRICS nations using DOLS and FMOLS methods. The long-run output elasticity's results are given in table 5.

Table 5. *Cointegration Regression of India's Trade with other BRICS nations: Dependent Variable (VOT$_{ijt}$)*

Variables	Dynamic OLS Model				Fully Modified OLS Method			
	Coefficient	Std. Error	t-Stat	Prob	Coefficient	Std. Error	t-Stat	Prob
LnGDP$_{it}$	0.8620	0.0229	37.537	0.00	0.8779	0.0131	66.875	0.00
LnGDP$_{jt}$	0.9159	0.0046	194.98	0.00	0.9180	0.0024	372.55	0.00
LnPCGDP$_{it}$	1.8416	0.0186	98.601	0.00	1.8454	0.0124	47.752	0.00
LnPCGDP$_{jt}$	1.4916	0.0200	74.240	0.00	1.5105	0.0097	155.66	0.00
LnPCGDPD$_{ijt}$	-1.5158	0.0190	-79.450	0.00	-1.5465	0.0177	-87.22	0.00
LnExchange Rate$_{ijt}$	1.1817	0.0248	128.07	0.00	3.2801	0.6121	8.6250	0.00
LnInflation$_{it}$	-2.8718	0.4916	11.9421	0.14	-2.9469	0.5080	11.701	0.21
LnInflation$_{jt}$	-2.6211	0.6404	8.7770	0.17	-2.1088	0.5660	9.0249	0.26
LnVOT/GDP$_{it}$	3.7894	0.0747	50.703	0.00	3.7914	0.0654	57.886	0.00
LnVOT/GDP$_{jt}$	3.5961	0.0375	95.807	0.00	3.6014	0.0340	15.762	0.00
LnTA$_{ijt}$	1.1873	0.6481	2.4911	0.71	1.2163	0.6814	2.8142	0.75
LnDistance$_{ijt}$	-1.8622	0.2811	-2.4044	0.01	-1.7313	0.3100	-2.312	0.01
R Squared	0.96				0.91			

Regression results from table 5 clearly pointed out that there is a significant and positive association between GDP, PCGDP, Exchange Rate and Trade-GDP ratio of the country (i) and country (j). Whereas PCGDP differential and distance between country (i) and (j) are significant but inversely correlated to trade. Interestingly, the regression result exposes that the Trade Agreement is insignificant to the volume of trade but Inflation is the only variable which is not only insignificant also inversely related to trade between country (i) and (j). Among all the variables, GDP has high coefficient followed by PCGDP, Exchange Rate, and openness.

When the result is insignificant, doesn't matter whether the coefficient is positive or negative. So, the majority of the selected variables possess significant and positive relation indicates that there is a positive impact on the Indian Economy for trading with BRICS countries. Most of the test results validate several traditional trade theories, especially factor endowment model. The test result for inflation invalidates its importance in

international trade seems to contradictory. This means, inflation and trade among BRICS countries are insignificant but it may occupy significance when they trade with other countries in the world. Once again, the study found more or less similar results from DOLS & FMOLS. Also, the test results validated the suitability of gravity model for international trade.

Conclusions

For the first Objective, the study found that the GDP, PCGDP, Exchange Rate and openness are significant and positively correlated to VOT of BRICS nations. Whereas the inflation rate is concerned, it has insignificant relation to VOT. When the result is insignificant, doesn't matter whether the coefficient is positive or negative.

For the second Objective, the study strongly proved that there is a positive impact on the Indian Economy for trading with BRICS countries. All hypothesis and Granger Causality test results clearly support India's Trade with BRICS countries. The study found Causality for favorable trade variables and no causality for unfavorable or trade deficit.

For the third Objective, the study found a majority of the selected independent variables are significant and positively correlated (coefficients are positive) to the dependent variable (VOT). But Inflation and Trade Agreements are insignificant to the dependent variable. Also, these two variables are negatively correlated with VOT of BRICS.

Most of the literature survey found that there is no significant gain for India and South Africa from other BRICS countries and China & Russia are the real gainers from the bloc. But this study invalidated such observations and proved that there is a significant and positive trade relation between India and other BRICS countries in the short run as well as in the Long Run. Also, this study validated Gravity model for assessing international trade between countries. Finally, the study strongly recommended that India needs to strengthen its trade relation with other BRICS nations by promoting make in India, SEZs, EOUs, and Openness to reap the potential benefits from the global economy.

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Do the macroeconomic indicators influence foreign direct investment inflow? Evidence from India

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Abstract. *This study significantly contributes to the growing literature on the dynamic link between FDI inflow and macroeconomic factors like inflation, trade openness, market size, and exchange rate in the case of India. An Autoregressive Distributed Lag bound testing approach with annual time-series data from 1975 to 2017 employed for modelling the short-run and long-run dynamics. Using Wald coefficients, the study found integration between the variables. It further discovered that variables are correcting the shock-induced disequilibrium at a speed of 86%. In the long-run trade openness and real gross domestic product positively affect the FDI inflow, whereas the exchange rate and inflation are negatively associated with FDI inflow. However, the study failed to detect any short-run association among the variables. Based on the findings, the research suggests better management of inflation and exchange rate volatility through specific policy action for attracting more global capital to the economy.*

Keywords: FDI; ARDL; inflation; GDP; exchange rate; trade openness.

JEL Classification: F21, F63, E22.

1. Introduction

The past few decades have witnessed a remarkable increase of foreign direct investment (FDI) that has surpassed both world output and trade (UNCTAD, 2017). The motive for the better effort to attract more FDI begin from the prevalent belief on the multi-dimensional benefits such as technology transfer and advancement, growth in production and productivity along with labour empowerment and international production network (Sader, 1999). In addition to that, it is a significant source of non-volatile, non-debt financial resource for the economic development of developing countries (Rădulescu and Druica, 2014). Economic liberalisation boosted the flow of capital which gave a win-win strategy for both host and home country, which resulted in the development of institutional and market level. The change in the scale and nature of the FDI inflow to Emerging Market Economies (EMEs) have long been further influenced by continuous waves in the economic, social, political and financial changes.

Identifying the dynamic relationship between macroeconomic variables and FDI inflow into the country is complicated because of its interconnection with social, economic and political conditions of the host countries. But the academic community mentioned specific factors which determine the FDI inflow. For instance, Dunning's (1977, 2013) Eclectic Theory based on the comprehensive framework of Ownership, Location, and Internationalization (OLI) continues the dominant framework for analysing the determinants of FDI and other international operations of Multi-National Enterprises (MNEs). FDI usually fly to the economies where it is easy to converge the ownership advantage with location advantage through the internationalisation of the overseas investment (UNCTAD, 1998). Similarly, other factors like strategic advantage, potential market growth, resources (including natural resources and human resources), technological and infrastructural development also decide the FDI Inflow. In addition, stages in economic cycle, political and economic stability, development of financial markets and institutions, law and order, trade openness and restrictions on capital mobility also determine the capital flow (Blonigen, 2005; Boateng et al., 2015; Petri, 2012; Sethi et al., 2003).

1.1. FDI in Indian scenario

In recent years, FDI is measured to be the yardstick of economic growth, development, and openness, as it promotes the collaboration of different economies for economic development (OECD, 2002). India has been prominent among the world nations as a potential destination for FDI, because of its possible market size, human resources, natural resources, and growth. Despite a 13% drop in global FDI inflow in 2016 (UNCTAD, 2017), Department of Industrial Policy and Promotion (DIPP), Government of India (GoI) showed an 18% jump in FDI inflow to the country. In the second stage of the policy reform in India, foreign investors are authorised to invest in most of the sectors. As a result, some infrastructural projects were initiated with the help of Japan, Germany, and the United States of America (USA) in the last few decades. These projects are designed to surmount the infrastructure bottleneck, which is considered as the major obstacle in attracting further FDI to the economy. Similarly, there are lots of investment-summits which are meant to attract more investors in the manufacturing and service sectors as part of 'Make in India' programme. These activities aim to exploit the global trend of investing in EMEs.

The oil price crisis decline in export and the consequential Balance of Payment (BoP) deterioration in the 1980s lead Indian government to liberalise the economy partially. The failure of the previous policy action leads to a significant BoP crisis in1991, which made a drastic shift from the protective system during the 80s to Liberalisation, Privatisation & Globalisation (LPG) promoting foreign trade and investment during 90s. This radical shift boosted the capital flow from -0.01% in 1975 to 3.65% of GDP in 2008. For achieving such a far-reaching goal, the Government of India implemented the Structural Adjustment Program (SAP) and macroeconomic stabilisation schemes with the help of the World Bank and International Monetary Fund (IMF) (Ahluwalia, 1996). Changes in the institutional, infrastructural and administrative level including removal of the equity ceiling of 40% under Foreign Exchange Regulation Act, 1973 (FEMA act, 1973), lifting the sectorial restriction on entry and expansion of foreign companies, lifting restriction on international brands, liberalizing the rules and regulations on technological transfer and royalty payment contributed to the growth of FDI Inflow. Establishment of Foreign Investment Promotion Board (FIPB) and membership in specialised agencies like Multilateral Investment Guarantee Agency (MIGA) for the protection of the investors also helped to boost the capital flow. Also, opening-up of retail, insurance, and banking sectors along with Small Scale Enterprises (SSEs) contributed to explosive growth in FDI. In recent years, FDI is permitted in most of the industries (fully or partially) with delegated authority to Reserve Bank of India (RBI) under an Automatic Route framework except in case of a few industries where government approval is necessary. Recently, the Government of India abolished FIPB as part of 'Maximum Governance and Minimum Government' principle. Now, processing and approval of the FDI application are delegated to the concerned Ministries and Departments in consultation with DIPP under the Ministry of Commerce, which guide the procedures for handling and consent of the application (Chandran, 2017).

In this backdrop, this paper investigates the macroeconomic factors which drive FDI inflow into India. It also examines the long-term and short-run dynamic relationship between the FDI inflow and these factors. As part of developing the context for the present inquiry, the next section of the paper discusses scholarly literature about determining factors of FDI inflow in different economies. The third and fourth sections of the paper deal with the econometric model and analysis respectively, concluding its findings in the last section.

2. Literature review

Over the past few decades, policymakers and researchers have been trying to identify and explore different aspects of FDI inflow. Numerous empirical studies across the world examine the impact of the FDI inflow on the host and home country. The research on FDI starts from the question of why firms are going abroad for their investment activities. Blonigen (2005) argues that some intangible assets within the firm (like managerial skill, technology) can be used in a larger area generating more wealth without extensive effort. The urge to optimally use such resources to tap potential market motivate firms to invest in a foreign country. Dunning and Lundan (2008) described three kinds of FDI investments. The first form of FDI is called market-seeking FDI in which investors reach out to host countries to tap their potential markets. Secondly, resource seeking FDI aims to acquire

resources which are unavailable in the origin country. Thirdly, efficiency-seeking FDI aspires to explore the foreign market to utilise economies of scale. Mutual existence of these factors makes to identify the specific one.

From the side of the host country, UNCTAD (1998) classified the driving factors of FDI inflow into three: economic factors, political factors, and business facilitation. These theoretical arguments are not easily measurable because of the presence of multiple elements in each category. For econometric analysis, researchers considered exchange rate, GDP growth, size of the potential market, inflation, and trade openness as significant factors of the FDI inflow (Artige and Nicolini, 2006; Koojarroenprasit, 2013; Piteli, 2010; Ramasamy and Yeung, 2010; Singhania and Gupta, 2011). Despite examining the individual influence of these factors on FDI inflow, many empirical studies examined several combinations of these different variables to get a better understanding of the dynamic relationship during different periods in different economies.

According to the majority of studies, potential market size is the most influential determinants of FDI inflow in developed or developing economies (Artige and Nicolini, 2006). Such studies consider GDP or GDP per capita as a variable for measuring market size. Jordaan (2004), argue that economies with the larger potential market and sufficient purchasing power tend to attract FDI as they provide the opportunity to sustain in the market with a higher return for an extended period. Chakrabarti (2001) argued that large market is essential for optimum utilisation of capacity to take advantage of the economies of scale. Studies from countries across the world including Japan, China, and European countries establish that there is a positive relationship between GDP growth and FDI inflow (Ali and Guo, 2005; Hara and Razafimahefa, 2005; Parletun, 2008; Ramasamy and Yeung, 2010). Similarly, Asiedu (2002) and Demirhan and Masca (2008) found a strong binding between GDP growth and FDI inflow in developing countries. They argued that extension of the market size magnetises FDI inflow.

The impact of macroeconomic variables like exchange rate, interest rate, and inflation on FDI also has been examined by many empirical studies. Froot and Stein (1991) first brought out empirical results which challenged the general wisdom was that variation in the exchange rate would not revise the investment decision of the foreign firms. But they found that appreciation of the host countries currency makes the assets costly, so the companies delay or divert their investments. Blonigen (1997) Klein and Rosengren (1994) also supported the argument that depreciation of home currency makes the assets cheaper and boosts the FDI inflow. However, the relationship between exchange rate appreciation and its volatility hurt FDI (Ang, 2008; Koojarroenprasit, 2013). Several researchers have empirically established that higher inflation in the destination country increases the price of investment, reduces the profit and thus reduces FDI inflow (Boateng et al., 2015; Cevis and Camurdan, 2007; Demirhan and Masca, 2008). The interest rate is another macroeconomic variable which determines investment decisions. It has a supportive relationship with FDI (Anna et al., 2012; Cevis and Camurdan, 2007; Singhania and Gupta, 2011). But Koojarroenprasit (2013) and Ramasamy and Yeung (2010) found a negative relationship between these variables.

There is a shortage of studies which used Autoregressive Distributed Lag (ARDL) model for estimating the long-run and short-run relationship among FDI and other macroeconomic variables like exchange rate, inflation, and GDP for minimising the potential information loss. Several studies from emerging Asian and African economies and trade associations like BRICS found that GDP growth rate has a significant long-run affiliation with FDI inflow. Similarly exchange rate, inflation, foreign exchange reserve, and manufacturing growth also contributed to the growth of FDI in different economies (Almsafir et al., 2011; Bekhet and Mugableh, 2012; Chandran and Krishnan, 2008; Goh et al., 2017; Lodhi et al., 2013; Pondicherry and Tan, 2017; Ravinthirakumaran et al., 2015; Vijayakumar et al., 2010).

On a general note, it can be seen that the developing economies around the world have attracted numerous academic interest in terms of understanding the determinants of FDI inflow. However, despite being the 9th largest FDI destination in the world, there are only a few studies which examine the determinants of FDI in India exclusively (UNCTAD, 2017). Studies which analysed the FDI determinants in BRICS countries (Duan, 2010; Jadhav, 2012; Vijayakumar et al., 2010) established that market size, GDP growth, labour cost, exchange rate, and infrastructure are critical factors of increased FDI inflow. Similarly, (Sahoo, 2006) with the help of panel regression method, and (Bhavan et al., 2011) with Generalized Method of Moments (GMM) model found similar results. In addition, both these studies also established a significant positive relationship between trade openness and FDI.

The US trade commission report on Indian FDI highlighted that infrastructure, labour cost, high growth rate and development of capital and financial market enhances FDI inflow (Bloodgood, 2007). However, they concluded that bureaucracy and corruption as hindering forces. Singhania and Gupta (2011) used ARIMA model and found that GDP, inflation and advancement in scientific research influence FDI inflow. Regression analysis by Kaur and Sharma (2013) found that trade openness, GDP, reserve and long-term debt have a positive effect while the exchange rate and inflation has a pessimistic impact on FDI. Parvathi (2015) used multiple regression analysis, to discover that export, wholesale price index, exchange rate changes, and foreign exchange reserve are the significant determinants of Indian FDI.

Table 1. *Summary of major Indian studies*

Authors	Maniam and Chatterjee (1998)	Venkataramany (2002)	Azam and Lukman (2010)	Vijayakumar et al. (2010)	Singhania and Gupta (2011)	Jadhav (2012)	Kaur and Sharma (2013)	Kishor and Singh (2015)	Gupta and Singh (2016)	Baby and Sharma (2017)
Country	India	India	India, Indonesia and Pakistan	BRICS	India	BRICS	India	BRICS	BRICS	India
Sample Period	1962-1994	1991-2000	1970-2005	1975-2007	1991-2008	2000-2009	1990-2011	1994-2014	1983–2013	1994-2015
Market Size (GDP)	Insignificant	(+)	(+)	(+)	(-)	(+)	(+)	(+)	Insignificant	Insignificant
Infrastructure			(+)	(+)				(+)		
Labour Cost				(-)					(-)	
Exchange Rate (Real/ Nominal/REER)	(-)			(-)			(-)	Insignificant	(-)	(+)
Inflation		(-)	(+)	Insignificant	(-)	(+)	(-)		(-)	(+)
Interest Rate		(+)			(+)					(-)
Foreign Exchange Reserve			(+)				(+)			Insignificant
Trade Openness			(-)	Insignificant	(+)	(+)	(+)		(+)	
Gross Capital Formation				(-)					Insignificant	
R&D Expenditure					(+)					
Natural Resource Availability						Insignificant				
Money Growth					(-)					
Long-term Debt							(+)			
Changes in Export		(+)								
Changes in Import		(+)								
External Indebtedness			(-)							Insignificant
Government Incentives			(+)							
Industrial Production Index				Insignificant				Insignificant	(+)	
Trade Balance	Insignificant									
Stock Market Turnover								Insignificant		

Notes: (+) sign shows the positive relation with FDI inflow, (-) sign shows the negative association with FDI inflow.

Existing literature points out different economic factors that influence the growth of FDI inflow. Table 1 shows the significant factors identified by various researchers in the Indian context. Practically it is impossible to include all these potential variables in a single model because of the multicollinearity and stationarity issues. However, for the sake of succinctness, this study incorporated only those variables which have strong proximity to the purpose of the study and current economic scenario. Moreover, trying to examine the influence of all possible factors simultaneously in the present model may not yield a viable outcome due to specific methodological contexts. For this reason, the study, after a rigorous review of significant studies, employed a combination of only those variables which are more sensitive to FDI behaviour in the Indian context. The present study attempts to explore this lacuna by applying an ARDL model on data for 43 years (1975-2017) to understand the long-term and short-term dynamics between the FDI inflow and its determinants.

3.   Data and model specification

3.1.   Data and variable construction

The used annual time-series data on FDI inflow, real exchange rate (INR/USD), real GDP, trade openness and the inflation rate for macroeconomic stability from 1975 to 2017. All data is sourced from World Development Indicator (WDI) and Federal Reserve Bank of St. Louis (Fred). The explained variable in the study is Net. All the explanatory variables are cautiously chosen, after reviewing studies from similar economies. All the variables were changed into the natural log for minimising the problem of heteroscedasticity (Bekhet and Mugableh, 2012; Chen et al., 1986). Keeping in mind the prime objective, the basic econometric model of the described as follows:

$$LFDI_t = \alpha + \beta_1 LEXC_t + \beta_2 LCPI_t + \beta_3 LGDP_t + \beta_4 LT_t + \mu_t \quad \ldots \tag{1}$$

Where LFDI describe net FDI inflow measured in millions of USD, LEXC symbolises real exchange rate (INR/USD), LCPI stands for annual variations in consumer price index measured in terms of constant of 2010=100 index. LGDP is the natural log of real Gross Domestic Product used as a proxy for market size (million USD), LT is trade openness measured as trade ratio to GDP, and μ_t is the white noise error term.

3.2.   Econometric methodology

The Study employed robust ARDL approach introduced by Pesaran and Shin (1999) and further extended by Pesaran, Shin, and Smith (2001) to investigate the possible interaction among the underlined variables. This methodology has several virtues over other similar techniques such as:

(a) This test is based on the single ARDL equation, rather than on a VAR as in Johansen's model. Thus, it reduces the number of parameters to be estimated.

(b) This test is comparably more efficient in small and finite sample data sizes, as is the case in our study.

(c) This test is not restrictive and can apply regardless of whether the regressors in the model are purely I(0), purely I(1) or mutual cointegrated (Pesaran, 1997).

(d) ARDL representation does not call for symmetry of lag length. Each length can have a different number of lag lengths (Laurenceson and Chai, 2003).

The Unrestricted Error Correction Model (UECM) of ARDL approach can be written as:

$$\Delta LFDI_t = a_1 + \sum_{i=1}^{\rho} a_2 \Delta LFDI_{t-i} + \sum_{i=0}^{q_1} a_3 \Delta LEXC_{t-i} + \sum_{i=0}^{q_2} a_4 \Delta LCPI_{t-i} +$$

$$+ \sum_{i=0}^{q_3} a_5 \Delta LGDP_{t-i} + \sum_{i=0}^{q_4} a_6 \Delta LT_{t-i} + \lambda_1 LFDI_{t-1} + \lambda_2 LEXC_{t-1} +$$

$$+ \lambda_3 LCPI_{t-1} + \lambda_4 LGDP_{t-1} + \lambda_5 LT_{t-1} + \mu_t \qquad (2)$$

The model in equation (2) is a "conditional ECM", estimates unrestricted coefficients (Pesaran et al., 2001). a_1 is the drift component, parameters $\alpha_2 - \alpha_6$ estimates short-run coefficients $\lambda_1 - \lambda_5$ represent the long-run coefficients. Δ denotes the first difference operator and μ_t is the white noise error. Optimum lag lengths of the variables are determined through information criteria such as AIC, BIC, HQ, and FPE. The null hypothesis described below is tested by considering the Unrestricted ECM:

$H_0 : \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0$

$H_1 : \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq 0$

The F-statistics is based on the Wald statistics to test the cointegration hypothesis. Critical values (upper and lower critical values, i.e. I(0) and I(1)) describe by Pesaran et al. (2001) for the cointegration test. If the upper bound value lower than calculated F-statistics, confirm the cointegrating relationship among the variables. On the other hand, a critical value higher than calculated F-statistics makes to accept the null hypothesis. Computed F-statistics in the middle of I (0) and I(1) gives an inconclusive result.

Further, short-run parameters are estimated using the ECM as illustrated in equation (3) mentioned below:

$$\Delta LFDI_t = c_1 + \sum_{i=1}^{\rho} c_2 \Delta LFDI_{t-i} + \sum_{i=0}^{q_1} c_3 \Delta LEXC_{t-i} + \sum_{i=0}^{q_2} c_4 \Delta LCPI_{t-i} +$$

$$+ \sum_{i=0}^{q_3} c_5 \Delta LGDP_{t-i} + \sum_{i=0}^{q_4} c_6 \Delta LT_{t-i} + \gamma EC_{t-1} + \mu_t \quad (3)$$

The parameter of the error correction term γ describes how the system adjusts to disequilibrium. It gives details on the speed at which explained variable rush back to the long-run equilibrium diverted due to shocks in independent variables. Likewise, in (Hendry, 1995) the general-to-specific linear modelling approach is pursued by eliminating the insignificant lags in the fitted model.

4. Empirical results and findings

4.1. Testing of the unit root hypothesis

Identifying the Data Generating Process (DGP) of a series is always crucial as deriving a regression model with non-stationary time series data direct to the spurious results (Gujarati and Porter, 2009). Theoretically, the absence of unit root (presence of constant mean and variance) in a time series make series stationery (Hendry, 1995). Therefore, it is essential to know the possible number of unit roots in a series for developing a non-spurious regression model. For checking the unit root, this study applied the conventional Augmented Dickey-Fuller (ADF) test suggested by Dickey and Fuller (1979) and Phillips and Perron's test developed by Phillips and Perron (1988). Summary of the unit root test result is presented below.

Table 2. *Unit root rest*

Variables		ADF			PP		
		Intercept	Intercept & Trend	None	Intercept	Intercept & Trend	None
LFDI	Level	-1.335	-3.355	1.213	-0.952	-3.364	2.305
	Δ	-5.358***	-5.537***	-6.113***	-9.023***	-8.800***	-6.235***
LEXC	Level	-1.921	-0.654	0.693	-1.818	-0.793	-0.736
	Δ	-4.422***	-4.844***	-4.365***	-4.442***	-4.844***	-4.394***
LCPI	Level	-5.884***	-5.821***	-1.407	-5.124***	-5.054***	-2.524**
LGDP	Level	2.475	-2.057	13.55	3.684	-2.035	13.55
	Δ	-5.382***	-6.383***	-1.011	-5.384***	-6.946***	-1.756*
LT	Level	-0.111	-1.840	2.855	-0.162	-1.840	2.828
	Δ	-5.551***	-5.460***	-2.640***	-5.551***	-5.460***	-2.640***

Notes: ***, ** and * denotes significance at 1%, 5% and 10%, respectively. Δ denotes first difference.
Source: Authors calculation.

The results of the unit root test point out that none of the variables except CPI integrated at level, but they are integrated at first difference, i.e. I (1). The necessary condition on the stationarity that none of the variables are stationary at I (2), otherwise the underlying assumptions of the ARDL model would have violated.

4.2. Lag selection of ARDL (p,q) model

Optimum lag length for the ARDL bound testing is identified through equation (2) in the OLS framework to confirm the existence of a long-run association among the variables. The issue of overfitting and underfitting makes choice of optimum lag length arduous and ponderous because overfitting of the lag length unreasonably enhances the mean squared forecast error whereas underfitting of the lag length frequently generates the issue of autocorrelation in the VAR model (Lütkepohl, 1993). Using information criteria like Akaike information criterion, Schwarz information criterion (SIC) and Hannan-Quinn information criterion (HQ).

Table 3. ARDL *lag selection criteria*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-27.87415	NA*	0.553173	2.227891	2.676821*	2.380989
1	-26.77103	1.492461	0.553252	2.221825	2.715648	2.390233
2	-25.98581	1.016166	0.564564	2.234459	2.773175	2.418177
3	-23.53296	3.029996	0.523112*	2.148997*	2.732606	2.348025*
4	-23.52195	0.012951	0.560591	2.207173	2.835675	2.421510

Notes: * indicates lag order selected by the criterion (each test at 5% level); LR: sequential modified LR test statistic; FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.
Source: Author calculation.

The optimum lags were selected on the basis of the lag at which absolute values of information criterion were minimised. Following the arguments of (Gutierrez et al., 2009; Liew, 2004) Gutierrez et al. (2009) and Liew (2004), this study used AIC to incorporate the optimal lag length of three (p = 3) for better and reliable results in contrast to other criteria.

4.3. ARDL bound test

F-statistic developed by (Pesaran et al., 2001) were used for confirmation of the cointegration relationship among the variables. The estimated F-statistics is 16.334 which is larger than the upper bound value I (1) as presented in Table 4. Thus, we reject the null hypothesis of absence cointegration at the 5% level of significance and conclude that they all move together in the long-run.

Table 4. *Cointegration estimation.*

	Bound test F- Statistics computed Value	Bound test F critical Value at 1% level		Decision
		I (0)	I (1)	
$LFDI_t = f(LCPI_t, LEXC_t, LT_t, LGDP_t)$	16.334***	3.81	4.92	Cointegrated

Source: Authors calculation.

4.4. Long-run and short-run estimation

4.4.1. Long-run relationship

All the variables in the long-run are statistically significant with a theoretically expected sign. The results are illustrated in Table 5. The estimated coefficients of trade openness and GDP have positive sign confirm that 1% increase in trade openness and GDP increased FDI inflow by 0.15% and 11.4%, respectively, whereas 1% hike in inflation rate and exchange rate reduced the share of FDI inflow by 4.1% and 0.26% respectively. The R^2 of the model confirm the high power of the coefficient of determination, implying that the explanatory variables explain almost 85.3% variation in the explained variable. The Durbin-Watson value is higher than two which signify the serially uncorrelated errors with their lagged values.

The positive coefficient of GDP and trade openness indicates that India follows a more flexible trade regime and therefore can attract more FDI. The findings on potential market size match with results of Kaur and Sharma (2013) and Jadhav (2012), whereas the positive coefficient on trade openness contradicts the results of Azam and Lukman (2010).

The negative coefficient of the exchange rate and inflation rate is in consensus with the theoretical argument of an inverse association between FDI and these variables. It reveals that depreciation of domestic currency (Indian Rupee) attract more FDI inflow whereas, appreciation dampens the investment inflow. Similar results were found by Ali and Guo (2005) and Dees (1998) that depreciation of Yuan attracts more FDI into China. The present study substantiates the standard theoretical argument that exchange rate is a crucial element to attract more FDI in developing nations. Moreover, our result on inflation rate verifies the findings of Venkataramany (2002).

Long-run estimation results can be concluded that macroeconomic factors like inflation rate, exchange rate, trade openness, and GDP are the key determinants of FDI inflow in India.

Table 5. *Estimated long run coefficients*

Explained variable LFDI

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-347.20	209.3614	-5.458433	0.0001***
LEXC	-0.2646	3.554956	6.142954	0.0000***
LCPI	-4.1023	2.997831	-2.412532	0.0282**
LGDP	11.4088	15.23934	5.414485	0.0001***
LT	0.1507	1.244838	-2.643989	0.0177**
Long-Run Diagnostic Results				
Serial correlation (LM Test) = 0.90(0.63)			R-Square = 0.853	
Heteroscedasticity Test = 15.224(0.70)			Adjusted R-Squared = 0.680	
Normality (J-B Test) = 0.531(0.76)			Durbin-Watson Stat = 2.148	
F-statistic = 4.916			Prob (F-statistic) = 0.000	

Notes: ***' ** and * denotes significant at 1%, 5% and 10% alpha level.
Source: Authors' calculation.

4.4.2. Short-run estimation (lag order: 2, 2, 3, 3, 0 and 1).

Further, this study employed the error correction framework of the ARDL model with lag order of (2, 2, 3, 3, 0 and 1). The results are mentioned in Table 6. Statistically significant negative coefficients of error correction term (ECT_{t-1}) signify the mean reversion speed of the model. It indicates the rate of adjusting the system towards long-run equilibrium, which is 86% in the present model. A highly significant ECT is supplement evidence for the existence of a stable long-run bond among the variables (Banerjee et al., 1998). Diagnostic tests for auto-correlation, normality, heteroscedasticity was conducted as shown in Table 6. This test shows that there is no indication of multicollinearity and heteroscedasticity in the model. In the short-run, trade openness, consumer price index, GDP, and exchange rate do not significantly affect the FDI inflow in India. FDI does not contribute much in the short-run because of its spillover effect as it is a time-consuming process and moreover, no company will invest its permanent capital for short-run. These findings are consensus with the result of (Fosu and Magnus, 2006) except for the trade openness results are contradicting the findings of Saleem, Jiandong, Khan, and Khilji (2018) from China and Hakro and Ghumro (2011) from Pakistan.

Table 6. *Error correction model*

Variables	Coefficients	Std. Error	t-Statistic	Prob.	Results
Constant	1.105059	0.903181	1.223519	0.2347	Insignificant
$\Delta LFDI_{t-1}$	0.517132	0.238974	2.163962	0.0421	Significant
$\Delta LFDI_{t-2}$	0.259214	0.191484	1.353708	0.1902	Insignificant
$\Delta LCPI$	-0.792344	3.626785	-0.218470	0.8292	Insignificant
$\Delta LCPI_{t-2}$	-2.031105	5.324455	-0.381467	0.7067	Insignificant
$\Delta LGDP$	-3.938177	5.095456	-0.772880	0.4482	Insignificant
$\Delta LGDP_{t-1}$	1.951666	8.028756	0.243084	0.8103	Insignificant
$\Delta LGDP_{t-2}$	-6.144761	4.086834	-1.503550	0.1476	Insignificant
$\Delta LGDP_{t-3}$	-6.336821	4.454555	-1.422548	0.1696	Insignificant
$\Delta LEXC$	0.262428	2.492876	0.105271	0.9172	Insignificant
$\Delta LEXC_{t-1}$	-1.351951	2.122194	-0.637053	0.5310	Insignificant
$\Delta LEXC_{t-2}$	-4.315031	3.705998	-1.164337	0.2573	Insignificant
$\Delta LEXC_{t-3}$	-0.392177	1.570168	-0.249768	0.8052	Insignificant

Variables	Coefficients	Std. Error	t-Statistic	Prob.	Results
ΔLT	1.597565	1.362573	1.172462	0.2541	Insignificant
ECT_{t-1}	-0.862566	0.325989	-3.566277	0.0018	Significant
Short-Run Diagnostic Results					
Serial correlation (LM Test) = 1.781 (0.41)			R-Square = 0.597		
Heteroscedasticity Test = 9.675 (0.78)			Adjusted R-Squared = 0.328		
Normality (J-B Test) = 4.877 (0.08)			Durbin-Watson Stat = 1.816		
F-statistic = 2.223			Prob (F-statistic) = 0.002		

Notes: ***’ ** and * denotes significant at 1%, 5% and 10% alpha level.
Source: Authors' calculation.

4.5. Stability test

Further, the cumulative sum of recursive residuals (CUSUM) mean plot (Figure 1) and the cumulative sum of square (CUSUMQ) was exercised to discover the structural break in the model (plotted in Figure 2) and to ensure the stability of the model with the ECT_{t-1} term (Brown, Durbin, and Evans, 1975). The mean plot of CUSUM and CUSUMQ statistic fall inside the critical boundary imply nonexistence of any instability of the coefficients in the model.
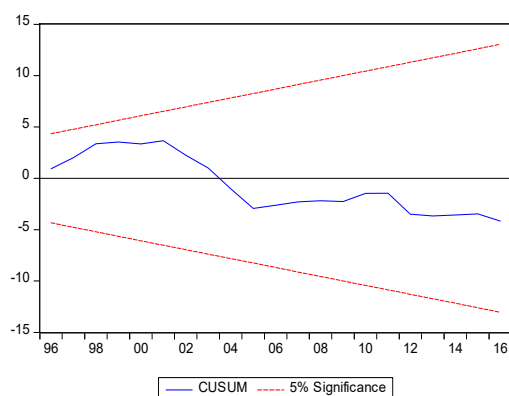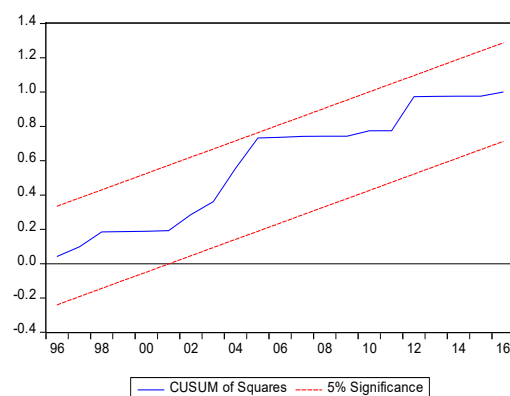
Figure 1. *CUSUM test*   **Figure 2.** *CUSUMQ test*

Source: Authors calculation.

The investor's choice may always be connected to the relative cost of production between India and its competitors like China. Indian market is so vast that it could exploit economies of scale and reduce the cost competitiveness. However, the Rupee appreciation and hyperinflation negatively influence cost competitiveness and FDI inflow. These factors are the biggest challenge for ensuring sustainability and improving the efficiency of FDI inflow in the current scenario. Steps taken for upgrading technology and improving labour productivity were crucial in China's industrial revolution (Dees, 1998). Similar measures are needed in the Indian Scenario also. Opening more sectors along with infrastructural development as part of economic openness will also boost the FDI inflow.

5. Conclusion and discussion

In the present paper, we try to estimate the impact of different variables on FDI in India using Pesaran et al. (2001)approach to cointegration. The result of the ADF and PP unit root test shows that the variables are stationary at I (1), which justified the use of ARDL bound testing approach to test the cointegration between the variables. The finding of bound testing based on F-statistics states that variables are cointegrated when FDI inflow is used as a dependent variable. The associated equilibrium correction speed is also highly significant further confirming the existence of the long-run relationship. The equilibrium correction speed is breakneck and approximately 86% of the disequilibrium of the previous period's shock converge to the long-run equilibrium in the current period. Further, by applying CUSUM and CUSUMQ tests to the model, the study shows that the model is stable and there are no structural breaks in the data.

The results suggested that the decreasing inflation rate in India increases the volume of FDI inflow in the long-run. It indicates that inflation is negatively influencing the investment decision of foreign MNCs as inflation de-stabilise the macroeconomic and financial environment. However, the inflation rate is not significant in the short-run. Growth in GDP expands the market, improves macroeconomic environment which in turn, attracts more capital. Additionally, the negative sign of the exchange rate increased FDI inflow as the depreciation of the currency cause domestic assets and the cost of production cheaper. Trade openness also contributes positively to FDI, and it could be the reason why the FDI inflow of India registers an increase as it follows more liberal trade policies. Finally, our results indicate that all the explanatory variables have a statistically significant effect on FDI inflow in case of India, although the sign and degree of their effectiveness vary across cases. From a policy perspective, keeping tight control over the macroeconomic variables, especially inflation, is vital for the country to attract more FDI inflow. Similarly, the findings suggest that Reserve Bank of India (RBI) should control excessive appreciation and volatility of rupee through intervention measures to enhance confidence among investors, thus facilitating more FDI inflow into the Indian economy.

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Conceptual dimensions regarding the financial contagion and the correlation with the stock market in Romania

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Abstract. *The economy, defined as a set of economic activities, can be described as a network, having as links companies (banking, non-banking), public entities, non-governmental organizations. Of late years, bank accidents have led to a significant disruption of the financial system worldwide. One of the objectives of this paper is to analyze the stock market by measuring the stock indices to evaluate the extent to which events such as the crisis of 2008 or the explosion of the Swiss franc have impacted the stock market and whether a systemic event with impact on the stock market has formed. The stock market in Romania will also be analyzed through the BET-FI stock index to observe the impact of events in other countries and to demonstrate how a shock can spread from one market to other markets such as the domino effect. Another objective is to explain the concept of financial contagion from a theoretical point of view, how it can be transmitted and how we can quantify it. The analysis will be performed in R software. The presented results will be focused around the theme of systemic events with an impact on banking networks.*

Keywords: capital market, financial contagion, systemic risk, financial network, R 3.5.1.

JEL Classification: C00, C10, C58, F36, G01, G15, G32.

1. Introduction

Financial stability is one of the most important means of reducing the economic uncertainty that influences the decision makers in establishing them and the investors regarding the long-term investment funds. Financial resilience needs to be evaluated in terms of its ability to absorb shocks, protecting countries from making costly short-term adjustments in the real economy by employing labor or adjusting inflation. Finding a balance between financial stability and the resilience of the financial system, two competing goals, is a critical path for decision makers.

The world we live in and where we operate is very complex and constantly changing. We face complex agricultural, biological, aquatic, environmental, technological and socio-economic problems that we must understand and manage for sustainable development. In the context of globalization, on the one hand, global warming and its impact on agriculture, energy and the environment are increasingly debated, and on the other hand, it analyzes reports on the economic cycles that cause financial panic, and on a regional level (Chiriță and Nica, 2019). In addition, we often find price fluctuations and food insecurity in poorly developed countries.

The concept of contagion was used for the first time in 1797, by David Ricardo[1], who attributed this concept to the feeling of panic that led to the suspension of the convertibility, i.e. the unfounded fears of the timid part of the community. In 1895, the French sociologist Le Bon wrote that the ideas, emotions and opinions that feed the crowd have as much influence as germs.

The term contagion has been used quite rarely before 1995, after which it occasionally appeared in articles that presented the impact of the Mexican crisis on other Latin American countries.

2. Literature review

Taken from medicine as a concept, contagion means the manifestation or transmission of viruses throughout the body, and subsequently, by passing from virus to disease, transmitting it to other people. Only after the crisis in Thailand occurred when the currency was devalued and other Asian countries affected, affecting global financial markets. These events aroused the interest of the researchers so that in the early 2000s, academic papers began to appear in order to try to study to measure, understand, predict and prevent international financial contagion.

The specialized literature allows us to distinguish two basic approaches for understanding the term of contagion: the spread of financial crises and the limitation of their behavior. As part of the interpretative framework of such phenomena are viral marketing, purchasing decisions or behavior within the supply chain, the concept of contagion being used in the context of limiting behavior. The financial markets approach focuses on the spread of crises, negative shocks or disruptions. However, both cognitive perspectives are sometimes complementary, for example analyzes describing the spread of financial crises take into account the limitation of actual behavior.

Kolb (2010) recommends that we should consider, first of all, the very nature of the metaphor used to describe the contagion phenomenon. We need to be aware that the concepts of epidemic and contagion used in the context of financial crises are very different. Not all crises or epidemics can be due to contagion. The main reason for contagion is the mechanism for transmitting contagion from one financial institution to another.

Allen Franklin and Douglas Gale (2000), in the paper "Financial Contagion", assert that this concept of contagion is defined by the small shocks that affect several institutions or sectors and are then spread throughout the financial sector of the contagion economy.

Caramazza et al. (2004) stated that the spread of problems in the financial sphere from one economy to another, in one region or globally, can be called contagion phenomenon.

Complexity science develops especially since the late 1920s, but became more visible in 1968, when von Bertalanffy published his famous book on general systems theory. Complexity scientists seek to examine patterns and trends in complex systems. In recent decades, this theory has been present in the social sciences as well. Regarding the moment, the achievements obtained within the system approach can be perceived as next steps in explaining the phenomenon of complexity. Therefore, three stages of system theory development can be identified. The first wave, immediately after the Second World War, is connected to the development of computers and the application of feedback. The second phase is associated with the development of cybernetics and system dynamics, and the last phase is based on a new understanding of balance in discontinuity theories.

3. BASEL Agreements

The role of capital in the banking system is crucial because it contributes to maintaining a secure and solid financial environment. When banks retain a sufficient amount of capital, they will be able to fulfill their obligations. In this regard, the banking industry introduced a mechanism for setting minimum capital standards for all international banks in the 1990s under the name Basel Agreement (Balthazar, 2006). The risk-based capital standards called Basel capital agreements have been issued by the Banking Supervisory Committee in Basel (BCBS, 2011).

To establish the financial balance and to predict, prevent or mitigate the effects of bank contagion, the following are necessary (Nica et al., 2018):
A) Applying effective models for systemic risk detection.
B) Early identification of institutions of systemic importance.
C) Formulation of micro-prudential and macro-prudential regulations for systemic risk prevention.

A) These models closely analyze the level of systemic risk and contagion. The focus is on risk estimation models that take into account the aggregate evolution of financial markets, the measurement of the degree of contagion between banking institutions, the establishment of a level of bank capitalization and the maintenance of an adequate degree of liquidity.

The well-known Diamond-Dybvig model (Diamond and Dybvig, 1983) is the foundation of studies that wanted to highlight the connection between the bank's liquidity and its

vulnerability, in the face of considerable withdrawals of deposits prior to maturity. It is based on 3 principles:

- From a probabilistic point of view, the situation of withdrawals of concomitant deposits is reduced because the needs of the clients do not manifest at the same time.
- The liquidity's need for a client is limited by the information it has at a certain moment.
- They primary objective of banks is to obtain as much profit as possible by redirecting liquidity to economic agents in the form of credits because the retention of liquidity is equivalent to obtaining low revenues.

Starting from the Diamond-Dybvig model, a number of researchers have developed a series of optimizations of this model, which have expanded from an individual bank to the entire banking system.

With the collapse of Lehman Brothers (2008) and the increase in contagion in financial and banking systems as a result of the global economic crisis, various financial supervisory authorities have begun to analyze and develop the core principles of the Diamond-Dybvig model.

B) An important aspect is that not all banks can give rise to an economic crisis or financial contagion, but only banks of systemic importance.

An institution is considered to be of systemic importance if a malfunction causes a widespread problem. From the point of view of Federal Reserve Bank, financial institutions are of systemic importance if „their failure to honor obligations to customers and creditors has significant adverse effects on the financial system and the economy as a whole".

The Basel Banking Supervision Committee has developed a document that is characterized by an attempt to develop a methodology for identifying systemically important banks.

They are defined as „dangerous financial institutions because of the size, complexity and systemic interconnections that cannot leave the financial market without causing a major catastrophe".

Although at international level a universally accepted definition of systemically important banks has not yet been developed, several features have been identified that are found in all the documents prepared by the supervisory authorities (Nica et al., 2018):

- Size – the banks are too big to accept their collapse – Too Big to Fail.
- Connections – the banks are too interconnected to accept their collapse – Too Interconnected to Fail.
- Importance – the banks are too important to allow their bankruptcy – Too Important to Be Allowed to Fail.

C) Of the aim of identifying, monitoring and predicting systemic risk, have established international approaches to the prudential regulation of systemic banking risk and the need for continuous optimization of banking supervision.

Liquidity injections and various ways to decrease the effects of bank contagion are not the most effective measures against systemic risk given their ex-post nature. This has raised the issue of measures of an ex-ante nature.

The need for supervision stems from the need for rules to set up a monitoring framework appropriate to the effective operation of each bank and the entire banking system.

The Banking Supervision Committee of Basel is the international banking supervision organization. Its purpose is to strengthen credibility and increase the international banking system's sustainability, striving to provide customers with security against systemic risk.

**Figure 1.** *The chronological evolution of Basel's regulations*
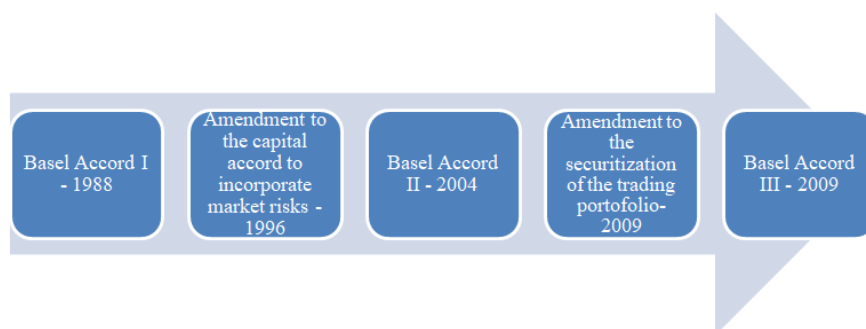
Source: Authors computation.

The first agreement issued was the Basel I agreement, which was conceived in 1988. It deals with the first level of capital adequacy on an international scale. The agreement focused on regulating the adequacy of capital, both off-balance sheet assets and on balance sheets. These are subsequently weighted at risk. More than 100 countries have implemented this regulation, and the results have been as expected. Nevertheless, the economy grew rapidly, as did the commercial bank and the agreement began to show some flaws. One of these was related to credit risk, which he used most in any analysis and the rest of the identified risk categories were then ignored. Another situation identified as a problem was the way in which the risk weights were assigned to the monetary instruments. These were the same for all instruments, whether long-term or short-term.

The Basel II agreement is based on three components called pillars: minimum capital requirements, supervisory actions and market discipline. It was published in June 2006 and aims to promote the adaptation of stricter practices in risk management.

Figure 2. *Three Pillar of Basel II*
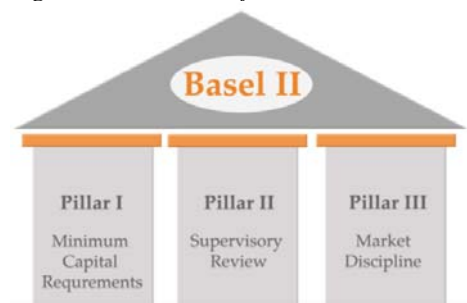
Source: https://www.semanticscholar.org/paper/The-impact-of-the-Basel-(2.-3.)-accords-on-SME-a-Piroli/19cdea1cb1b9ed98b65c3bdf9aca2bbaacd2361e

The Basel III capital agreement introduces extensive quantitative and qualitative capital requirements, new liquidity requirements, a review of the counterparty credit risk and a debt indicator for banks in the member countries of the Basel Committee (BCBS, 2011).

4. BET-FI Analysis

For the analysis proposed in this article, we will consider the evolution of the BET-FI index, to see the impact on the financial network.

The BET-FI index is also launched by BVB, which appeared first, as a sectoral index. It shows the evolution of financial investment companies and other similar companies with their profile.

For the analysis of this case study, we used 3508 observations for the BET-FI index, the period analyzed 03.01.2006 - 30.12.2019 (Bucharest Stock Exchange, 2019).

Figure 3. *The evolution of the BET-FI index*
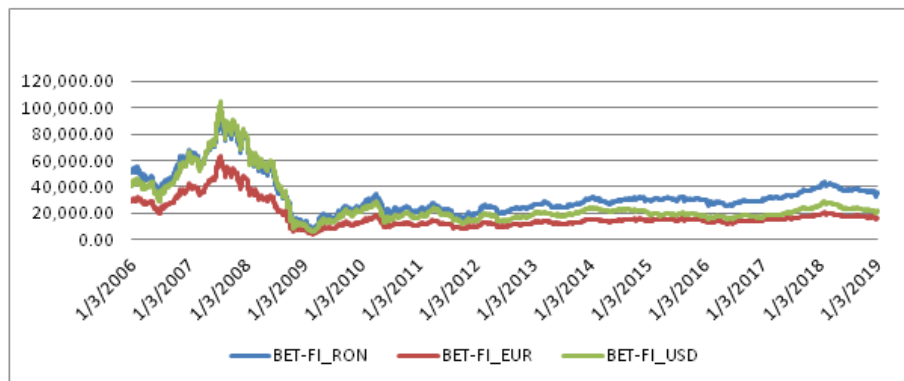
Source: Authors computation.

The first step of the analysis is to perform statistical analyzes using the R Programming software solution. The data used are obtained from the official website of the Bucharest Stock Exchange. The daily values of the BET-FI index in RON, EUR and USD currency will be analyzed.

Figure 4. *Summary statistic in R for BET-FI index*

```
   #----------------------#
> summary(doc$BET.FI_RON)
   Min. 1st Qu.  Median   Mean 3rd Qu.    Max.
   7862   24400   30295  33962   38317   95111
> #----------------------#
> summary(doc$BET.FI_EUR)
   Min. 1st Qu.  Median   Mean 3rd Qu.    Max.
   3995   12197   14859  17895   18290   63788
> #----------------------#
> summary(doc$BET.FI_USD)
   Min. 1st Qu.  Median   Mean 3rd Qu.    Max.
   5949   17917   20649  26771   24578  104864
   #----------------------#
```
Source: Authors computation.

From the above output, we have the following information about the evolution of the BET-FI index. For the national currency RON, the minimum value of the index registered between 03.01.2006 - 30.12.2019 is 7862 registered on 24.02.2009 and the maximum of 95111 on 24.07.2007.

In the case of the BET-FI index for the EURO currency, the minimum value was recorded on the same date, with a value of 3995 and the maximum value registered is 63788. For the USD currency, the minimum is 5949 and the maximum is 104864. For the two extremes, we will analyze these points in the chronological axis to see what influenced them.

Table 1. *Skewness, Kurtosis and standard deviation for BET_FI index*

	Index	Skewness	Kurtosis	Std. deviation
1	BET.FI_RON	1.50514993366243	5.40270095307087	14981.4627926349
2	BET.FI_EUR	2.00256510795469	6.86547271046906	10041.1632428416
3	BET.FI_USD	2.1553325873465	7.14484992316297	17197.0700559707

Source: Authors computation.

Even if our data series is not expected to be normally distributed, we will test this to identify how the variables are distributed. We calculated the Skewness and Kurtosis coefficients, their values being in the above table, output from R. The flattening or arching coefficient, calculated by the Kurtosis test, has the value of 5.40 for the BET-FI index in RON, the value of 6.87 for EURO and for the USD currency the value of the coefficient is 7.14.

Skewness is the asymmetry coefficient and together with the values of the Kurtosis coefficient, we will analyze the shape of the distribution represented graphically by histograms. Skewness coefficient values are given in the tables.

The way in which the variables are scattered in the analyzed sample is given by the standard deviation value, calculated values and found in the table above. Before representing the histograms for each currency analyzed, we will also calculate the coefficient of variation that evaluates the standard deviation from the average value to see the homogeneity of our sample. If the coefficient of variation is less than 10% then the sample is homogeneous, if its value is between 10% and 20% then it is relatively homogeneous, between 20-30% is relatively heterogeneous and greater than 30% the analyzed sample is heterogeneous. We do not expect our data series to be homogeneous so, by analyzing in R, we obtained the following data for the coefficient of variation, noted with CV:

$CV_{BET-FI\_RON} = 44,11\%;$

$CV_{BET-FI\_EUR} = 56,11\%;$

$CV_{BET-FI\_USD} = 64,23\%.$

The values of the coefficient of variation are very high, the series being heterogeneous, ie it reflects large changes in the values of the data series.

Figure 5. *BET-FI_RON, BET-FI EUR, BET-FI USD index histogram*
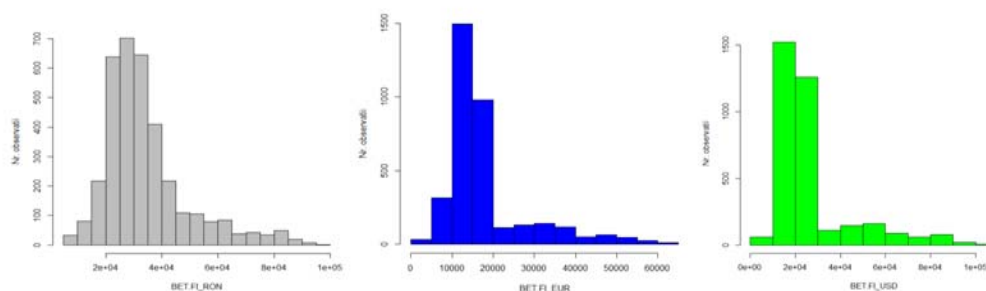
Source: Authors computation.

From the representation of the 3 histograms, but also from the values of the mean, median, standard deviation and coefficient of variation, it follows that the series is not homogeneous, the distribution is not represented by the Gaussian curve, being leptokurtic or asymmetric to the right.

Figure 6. *Boxplot for each currency of the BET-FI index*
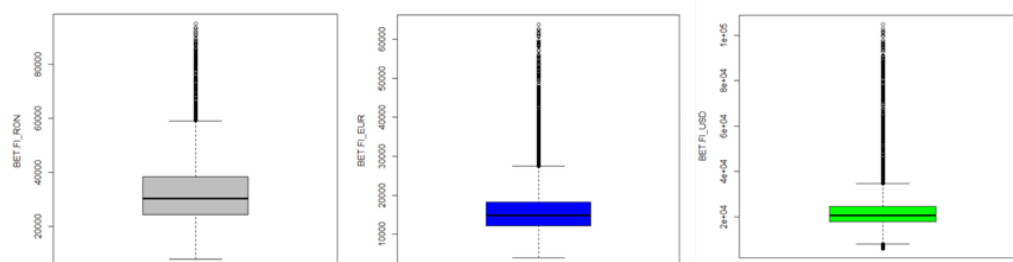
Source: Authors computation.

From the representation of the boxplots, we observe the existence of the outliers being evident for the evolution during the analyzed period, recording the extreme values during the economic crisis of 2007-2008.

The capital market is very complex being made up of several markets such as stocks and bonds, the gold or derivatives market, the futures contract market and the stock market. The most important links are with the money market, the foreign exchange market, the real economy and with the National Securities Commission, which has the role of overseeing securities transactions.

Being closely connected the capital market with the foreign exchange market and because a major event such as the crisis of 2007-2008 took place due to the collapse of Lehman Brothers in the USA and because of the mortgage crisis we will analyze the evolution of the Romanian currency market.

I will consider the most important currencies in terms of the occurrence of contagious events in certain economic markets such as the Swiss franc explosion or the Brexit. We will evaluate the following currencies: USD, EURO, GBP and CHF relative to the national

currency of Romania, RON. The analyzed data series consists of 3542 daily series observations for the exchange rate of the 4 currencies above reported in RON.

Figure 7. *The evolution of the exchange rate for CHF, EUR, GBP and USD*
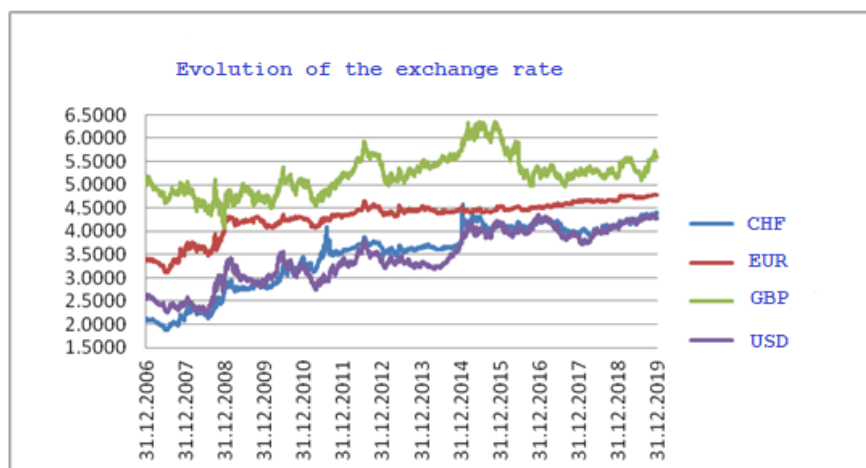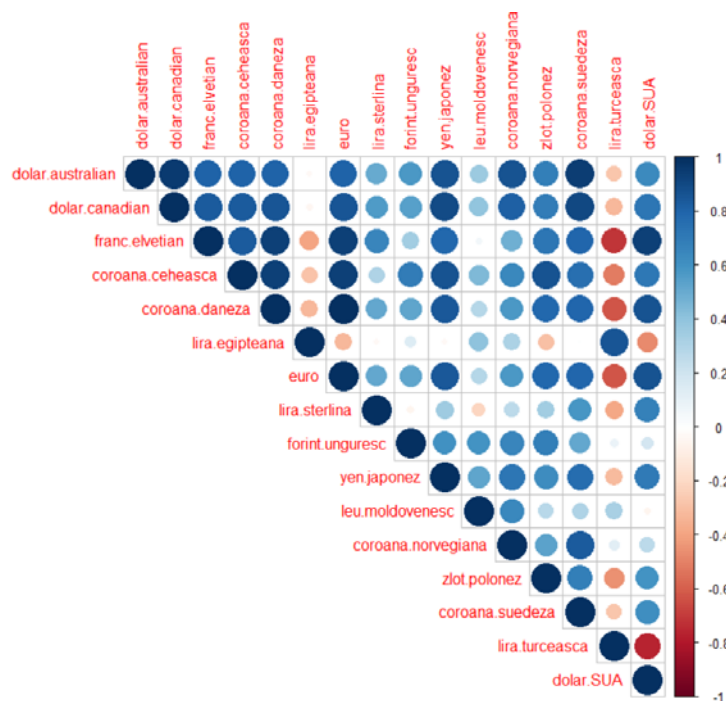

Source: Authors computation.

With the R programming computer solution, we have represented the matrix diagram of the correlations between all pairs of currencies with existing values for the analyzed period.

Figure 8. *Matrix of correlations of currency pairs in Romania existing for the analyzed period*

Source: Authors computation.

The darker the shades in the above representation, the stronger the correlation between the represented currencies. At the opposite end, the tighter the shades, the more the currencies tend to manifest independently of the other currencies. We see a strong correlation between the Australian dollar and the Swedish krone or the Danish krone with the euro.

During the analyzed period, we will specify the following impact event:

▪ On January 15, 2015, the National Bank of Switzerland announced that it would waive the threshold of the CHF/EUR exchange rate set in 2011, that 1 EUR was worth the equivalent of 1.2 CHF. The exchange rate for this parity has exploded, forming a systemic shock on the foreign exchange market, affecting several countries including Romania. The situation was quite severe for that period for some banks in Romania that had granted loans in CHF currency. The actors affected by this contagious bubble were the banking institutions, but also the clients who contracted a credit in this currency. In that, both sides were guilty because on the one hand, the banks did not properly present the clients with the variant of mortgage lending in this currency, did not emphasize a potential currency risk and were not prepared for such events. On the other hand, the clients, perhaps due to the fact that Romania is still on the last places regarding the financial education, were caught by the fever of money and contracted amounts as large as possible, without reading the contractual conditions completely, for the purchase of real estate. On January 14, 2015 the value of the CHF / RON exchange rate was 3.7415 and on the following day it came to 1 CHF worth 4.3287 RON.

Figure 9. *Summary Statistics for pair CHF/RON*

```
> summary(valute$franc.elvetian)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  1.874   2.795   3.619   3.392   4.078   4.582
```

Source: Authors computation.

The minimum value for the period analyzed according to the output of the R software was registered on 24.07.2007, 1 CHF = 1,874 RON and maximum registered on 23.01.2015, immediately after the explosion of the Swiss franc exchange rate reaching the value of 4.5817. According to the correlation matrix represented above, we observe the putative correlations of the Swiss franc with the following currencies: Danish krone, euro, US dollar.

The event generated by an appreciation of the Swiss franc, as we said, generated effects in Romania. The bank, viewed as a complex adaptive system, had to find immediate solutions for the loans granted in CHF. Clients were unable to pay and the portfolio of mortgages in CHF went into default. Banks came up with the solution of converting the loans from CHF to RON, under certain conditions.

5. Conclusions

The failure to regard the banking institution as an individual-independent system, and not as a dependent component of the entire financial-banking system, was caused by the satisfaction of the commercial banks with regard to poor regulation at the banking level

that allowed them to obtain considerable profits. With the fall of Lehman Brothers bank and the start of the domino effect of bank failures, efforts to recover the international economy of international supervisory authorities, along with central banks, government institutions and other financial institutions have been the synergy needed to develop the Basel III Agreement.

The prudential regulations related to Basel III represented a tightening of the conditions related to the level of capital adequacy and the mode of operation specific to the commercial banks, also including an element of novelty compared to the previous agreements, namely, the banks of systemic importance to which they had imposed additional capital requirements, due to the potential impact on the international economy in the event of a bankruptcy.

Starting from the premise that the best treatment for the phenomenon of financial contagion is to prevent its triggering, the financial supervisory authorities have regulated the obligation to use the risk measurement models in order to closely monitor the activity of commercial banks.

In the last period, there have been many events that have had an impact on the Romanian capital market. Starting with Romania's accession to the European Union in 2007, the financial crisis or the CHF explosion are just some of the aspects that have influenced the stock market.

All these events with an impact on the evolution of stock exchange indices have been studied in this paper to analyze whether the stock market can be considered a starting point for the emergence of a contagious event that can influence the financial system, respectively to turn into a financial contagion in Romania.

Considering that the structure of the Romanian stock offering is based on important volumes of the transactions made by banks and financial services, we can say that it is a sensitive point to analyze regarding the forecast of a potential financial contagion. In the analyses carried out on the BET-FI index, we observed the influences of the currencies and the correlations between them. In the following research, it is interesting to apply a Value at Risk methodology to measure the market risk and to correlate if there is a significant connection between it and the stock market.

Note

[1] Was a British political economist, one of the most influential of the classical economists along with Thomas Malthus, Adam Smith and James Mill Source: https://en.wikipedia.org/wiki/ David_Ricardo

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An analysis of poverty among the informal workers of India

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Abstract. *This paper using 68th round National Sample Survey of India data on Employment and Unemployment for 2011-2012 wants to investigate the incidence of poverty, acuteness of poverty and their determinants among the informal workers of India. It is shown that percentage of poverty has been lowest among the self-employed workers and highest among the informal workers in the formal sector in the rural area, while in the urban area the result is just the opposite. Although percentage of poverty-stricken workers has been higher in the rural area compared to that of the urban, acuteness of poverty has been the other way round. The determining factors of incidence of poverty and acuteness of poverty among the informal workers are general educational qualification, social groups, and sectors. These determining factors can be considered as important policy variables to reduce the incidence and acuteness of poverty among the informal workers of India.*

Keywords: Informal sector, labour market, poverty, India.

JEL Classification: I32, J40, O17.

1. Introduction

Indian labour market is dominated by informal employment[1] and the incidence of employment has enhanced leaps and bounds in the post reform period (Marjit et al., 2007; Sanyal et al., 2008 and Narayana, 2015). What is much more striking that, there has been rapid proliferation of informal employment not only in the informal sector but also in the formal sector during this period (Sanyal et al., 2008). Apart from them, informal sector also consists of large number of self-employed (SE) workers (Mukhopadhyay, 1998). Thus, informal employment is vastly heterogeneous in nature (Unni, 2005; Sahoo et al., 2015). The heterogeneity of informal employment is classified into three major types: (i) self-employed workers (SE), (ii) employees of the informal sector (EIS) and (iii) informal employees of the formal sector (IEFS).

Post reform period witnessed informalization of employment due to flexibility of labour market (Unni et al., 2008) leading to wage cut by the employers to withstand international competition. Moreover, in order to implement structural adjustment programme and fulfill International Monetary Fund (IMF) conditionality, public enterprises became privatized. In the process, there has been enhancement of casual, contractual and informal employment (Das et al., 2012). Needless to say, these workers are "working poor"[2] with worse working conditions. Thus, it would be an absolute necessity to discuss about the incidence and depth of poverty of these Indian informal workers.

The paper is organized as follows: Section 2 provides a brief discussion on the available literature related to incidence of poverty among the informal workers during the post reform period in India. The research gap and objectives of the study are spelled out in Section 3. Section 4 talks about the source of data used in the study. Section 5 provides summary estimates of incidence of poverty among the informal workers. Determinants of poverty among the informal workers with the help of Heckman's 2 step regression model will be discussed in section 6. Section 7 shows the estimates of mean poverty gap among poor informal workers across major dimensions; Section 8 describes the determinants of acuteness of poverty among the poor informal workers and the results of the regression analysis. Section 9 summarizes the above discussions and concludes.

2. Brief review of literature

Sundaram (2008) presented estimates of employment in the organized non-agricultural sector in India using 55th to 61st round NSSO data. He found out that head count ratio is highest among the unorganized sector workers than the corporate segment of the organized sector who have lowest head count ratio and head count ratio for the non-corporate factory sector workers which lies between the above two sectors of workers. Papola (2008) based on NSSO employment and unemployment survey concluded that incidence of poverty is highest among the casual workers followed by self-employed workers and least among regular wage earners. Similar picture is also found in the writing of Heintz et al. (2007). He concluded that informal workers are much more impoverished than the formal and regular salaried employees. Wages of the latter are not only considerably higher than the casual workers during the post reform period (Unni, 2005) but also this discrepancy

enhanced further during the post reform period (Dutta, 2005). Thus, all these evidences point out that incidence of poverty is very high among the informal workers in comparison to that of the formal workers.

By contrast, Post reform period enhanced the employment opportunities for the unemployed poor people. Thus, deprivation of the informal workers reduced during this time (Marjit et al., 2009). It is further shown that trade liberalization in import competitive sector increases informal wage across occupational types and expands production and employment in urban informal sectors with or without sufficient capital mobility between formal and informal sector which reduces head count ratio of the urban informal workers (Marjit et al., 2007). Furthermore, it is also revealed that real wage and value added of the informal sector have also increased in different states during the post reform period, which in turn reduces incidence of poverty among the informal workers. Marjit (2003) with the help of a general equilibrium framework explained that enhancement of informalization of the workforce and reduction of the formal sector hardly caused impoverishment of the informal workers. Rather, informal workers are better off because of the increased informalization of the employment during the post reform period. In Pakistan, informal workers are significantly better off in comparison to that of the government employees (Burki et al., 1981). Kazi (1987) also claimed that standard of living of skilled informal self-employed workers is better than the formal sector workers in Pakistan.

Thus, there has been clear contrast of opinion among the researchers and policy makers regarding the deprivation of informal workers[3] which demands further research and study. This study aims to put some light on this contrasting result.

3. Research gap and objective of the study

The above-mentioned literatures only highlighted the incidence of poverty among the informal workers but hardly focus on the incidence and depth of poverty among heterogeneous groups of informal workers. Additionally, the available literatures hardly talk about the possible factors responsible for incidence and acuteness of poverty among the poor informal workers. Based on the research gaps, the objectives of the study are listed below:
i) To investigate the percentages of poor across different types of informally employed people of India.
ii) To investigate the possible factors responsible for the incidence poverty of the informal workers.
iii) To investigate the acuteness of poverty across different types of poor informal workers.
 iv) To investigate the determinants of acuteness of poverty across poor informal workers.

These determinants of the acuteness of poverty can give policy prescriptions which are essential to reduce the acuteness of poverty among marginal poor (their poverty gap is very low), middle poor (their poverty gap is medium) and chronic poor (their poverty gap is sufficiently large) informal workers.

4. Sources of data

This study uses the 68th round NSSO data on employment and unemployment for the period 2011-2012 which is the latest available data till date. The extract contains only own account workers (SE), regular salaried workers and casual workers in public as well as private sectors (indicating IEFS and EIS). To do this we have subtracted all samples whose principal activity status is employer (because this is formal in nature), student, housewife, beggar, retired and handicapped. Thus, the total number of extracted samples is 117,172. Total extracted samples are sub-divided into three types of informal workers, SE, EIS and IEFS, and then want to find out the incidence and depth of poverty among those chosen types of workers. SE workers are own account workers in our data set. EIS are workers of proprietary enterprises, partnership enterprises, domestic enterprises[4] and other enterprises where number of workers are less than 10. On the other hand, in our data set, IEFS are workers of public enterprises, private enterprises and co-operative enterprises who hardly get any social security benefits[5]. The distributions of these three types of informal workers in our data set during 2011-2012 are such that 28.30 percentages are SE, 61.34 percent are EIS while 10.36 percent are IEFS.

5. Discussion of poverty line across states

We briefly represent poverty line and overall poverty percentages across states both rural and urban area. Here incidence of poverty has been measured according to the poverty line estimates prescribed by the Tendulkar Committee report for the year 2011-2012 for respective states as well as union territories. Not only standard of living of different states are different but also it is different across rural and urban area. Therefore, poverty line is different across states and across rural and urban area. Poverty line is highest in Pondicherry both in rural and urban area while it is lowest in Orissa in the rural area and Chattisgarh in the urban area. In the rural as well urban area, percentage of poverty of the informal workers is highest in Manipur, while this percentage is nil in Daman and Diu and islands in the rural area and only in islands in the urban area. Overall percentage of poverty has been highest in Chattisgarh.

Table 1. *Poverty line and percentages of poor of the informal workers across states*

States	Poverty line (Rs.) (Rural)	Poverty line (Rs.) (Urban)	Total Sample of the above-mentioned informal workers (R+U)	Total sample (Rural)	Total sample (Urban)	Poverty Per-centage (R+U)	Poverty Per-centage (Rural)	Poverty Per-centage (Urban)
Jammu and Kashmir	891	988	17,691	11,031	6,660	18.44	21.38	8.69
Himachal Pradesh	913	1064	8,612	7,245	1,367	15.69	16.62	8.21
Punjab	1054	1155	14,380	7,571	6,809	14.26	14.67	13.54
Chandigarh	1054	1155	1,218	295	923	19.74	4.75	15.93
Uttaranchal	880	1082	7,884	4,830	3,054	18.23	16.44	23.21
Haryana	1015	1169	12,623	7,450	5,173	13.14	14.63	9.75
Delhi	1145	1134	3,981	284	3,697	8.34	4.38	8.67
Rajasthan	905	1002	20,172	12,995	7,177	24.62	26.96	17.10
Uttar Pradesh	768	941	49,513	33,738	15,775	38.67	40.57	31.80
Bihar	778	923	23,508	17,363	6,145	41.32	42.19	33.25

States	Poverty line (Rs.) (Rural)	Poverty line (Rs.) (Urban)	Total Sample of the above-mentioned informal workers (R+U)	Total sample (Rural)	Total sample (Urban)	Poverty Per-centage (R+U)	Poverty Per-centage (Rural)	Poverty Per-centage (Urban)
Sikkim	930	1226	2,967	2,431	536	15.25	17.26	6.23
Arunachal Pradesh	930	1060	7,600	5155	2,445	41.29	45.13	24.82
Nagaland	1270	1302	4,879	3,273	1,606	22.32	23.13	20.82
Manipur	1118	1170	12,567	7,040	5,527	43.17	46.53	33.80
Mizoram	1066	1155	7,002	2,824	4,718	23.02	36.04	9.62
Tripura	798	920	7,197	5,277	1,920	14.14	15.74	5.86
Meghalaya	888	1154	6,246	4,306	1,940	12.15	12.47	10.92
Assam	828	1008	15,803	12,455	3,348	33.43	34.72	22.79
West Bengal	783	981	25,521	15,268	10,253	25.57	29.04	16.18
Jharkhand	748	974	12,992	8,682	4,310	37.24	41.05	23.80
Orissa	695	861	17,149	13,031	4,118	36.46	38.75	23.15
Chhattisgarh	738	849	10,075	7,037	3,038	45.49	49.92	29.37
Madhya Pradesh	771	897	21,869	12,952	8,917	38.88	43.47	25.45
Gujarat	932	1152	15,710	8,498	7,212	25.19	33.42	12.98
Daman and Diu	861	1000	575	258	317	2.83	0	9.07
Dadra Nagar Haveli	861	1000	851	470	381	26.47	41.92	7.38
Maharashtra	967	1126	35,364	18,460	16,904	23.39	34.13	10.55
Andhra Pradesh	860	1009	25,658	14,991	10,667	13.40	16.17	7.80
Karnataka	902	1089	18,092	9,561	8,531	26.44	31.78	17.14
Goa	1090	1134	1,813	683	1,130	10.31	13.12	7.46
Lakshadweep			967	325	642	11.67	7.90	15.69
Kerala	1018	987	17,957	10,659	7,298	13.82	15.65	8.86
Tamil Nadu	880	937	24,281	12,669	11,612	16.83	24.77	6.96
Pondicherry	1301	1309	2,135	509	1,626	11.66	17.22	8.33
Islands	861	1000	2,147	1,147	1,000	0	0	0

Source: Calculated by the authors on the basis of NSSO data.

6. Analysis of the incidence of poverty of the informal workers of India

Here a brief estimate of the incidence of poverty among the SE, EIS as well as IEFS are given. We find out the percentages of poor and non-poor informal workers attached with three kinds of employment across major dimensions. We have identified those workers as poor whose MPCE is less than the poverty line estimates based on the Tendulkar Committee report as prescribed for the year 2011-2012 for respective states[6] and union territories as well as rural and urban area. That is instead of taking a single poverty line estimates for all India level, we have taken different poverty line estimates for different states, union territories and sector as prescribed by the Tendulkar committee report during 2011-2012[7].

6.1. Incidence of poverty among the informal workers

Table 1 has displayed the percentages of poor informal workers during 2011-2012 in rural, urban as well as all India level. It is found that concentration of poor people has been higher in the rural areas compared to the urban areas across all types of informal workers. This is due to lack of sufficient employment opportunity in the rural areas. It is further revealed

that in the rural areas IEFS contains highest percentages of poor people, which is followed by EIS. SE are the least poor category in the rural area. On the other side in both the urban area and all India level, highest percentages of poverty-stricken people work as SE, while lowest percentages of poverty-stricken people work in IEFS in the urban area and a EIS.

Table 2. *Percentages of poor and non-poor informal workers across rural, urban as well as all India level*

Type of employment	Rural		Urban		All India	
	Poor	Non poor	Poor	Non poor	Poor	Non poor
SE	24.96	75.04	18.94	81.06	24.74	75.26
EIS	26.29	73.71	17.06	82.94	21.87	78.13
IEFS	29.57	70.43	9.81	90.19	22.98	77.02

Note: Poor and non-poor workers add up to 100.
Source: Calculated by the authors on the basis of NSSO unit level data.

6.2. Incidence of poverty among the informal workers across different states

Table 2 indicates incidence of poverty across all the states and union territories of India. The top five most poverty-stricken states are Manipur, Jharkhand and Chhattisgarh. In Manipur more than 57 percent, 41 percent and 48 percent of SE, EIS and IEFS are poverty stricken respectively. Jharkhand follows Manipur in terms of incidence of poverty where percentages of poor SE, EIS and IEFS are 41.29, 31.34 and 30.3 respectively. In Chhattisgarh, 38.57 percent of SE, 38.55 percent of EIS and 37.73 percentages of IEFS live below the poverty line estimates. In this state, percentages of poor among the SE workers have been lower compared to the other two states while that of EIS and IEFS have been higher than Jharkhand. On the other hand, in the states of Chandigarh, Delhi, Daman and Diu, Lakshadweep, Pondicherry and islands, percentages of poor SE workers are nil. Apart from that, among the EIS and IEFS, incidence of poverty has been lowest in the Islands. In fact, among these workers, incidence of poverty is zero in the islands. Incidence of poverty has been highest among the SE in the states of Sikkim, Arunachal Pradesh, Nagaland, Manipur, Tripura, Meghalaya, Assam, Chhattisgarh, Gujarat, Dadra Nagar Haveli and Maharashtra. While incidence of poverty has been highest among the EIS in the states of Punjab, Chandigarh, Uttaranchal, Haryana, Delhi, Uttar Pradesh, Bihar, Meghalaya, Daman and Diu, Goa and Kerala. Again, incidence of poverty has been highest among the IEFS in the states of Jammu and Kashmir, Himachal Pradesh, Rajasthan, Mizoram, West Bengal, Orissa, Madhya Pradesh, Andhra Pradesh, Karnataka, Lakshadweep, Tamil Nadu and Pondicherry.

Table 3. *Percentages of poor and non-poor informal workers across different states*

States	SE		EIS		IEFS	
	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor
Jammu and Kashmir	14.99	85.01	16.22	83.78	20.96	79.04
Himachal Pradesh	13.4	86.6	12.49	87.51	14.14	85.86
Punjab	2.26	97.74	16.48	83.52	6.9	93.1
Chandigarh	0	100	22.08	77.92	15.21	84.79
Uttaranchal	12.59	87.41	19.16	80.84	12.38	87.62
Haryana	4.75	95.25	17.29	82.71	7.91	92.09
Delhi	0	100	8.78	91.22	6.48	93.52
Rajasthan	17.7	82.3	20.14	79.86	29.85	70.15
Uttar Pradesh	27.7	72.3	37.06	62.94	30.41	69.59
Bihar	27.32	72.68	35.94	64.06	34.84	65.16
Sikkim	26.87	73.13	7.56	92.44	10.66	89.34
Arunachal Pradesh	50.24	49.76	26.79	73.21	41.81	58.19

States	SE		EIS		IEFS	
	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor
Nagaland	34.24	65.76	23.51	76.49	4.97	95.03
Manipur	57.13	42.87	40.52	59.48	48.53	51.47
Mizoram	31.9	68.1	10.77	89.23	39.52	60.48
Tripura	16.13	83.87	10.1	89.9	15.65	84.35
Meghalaya	8.5	91.5	9.84	90.16	5.26	94.74
Assam	30.6	69.4	28.38	71.62	23.27	76.73
West Bengal	13.83	86.17	20.97	79.03	21.48	78.52
Jharkhand	41.29	58.71	31.34	68.66	30.3	69.7
Orissa	32.03	67.97	29.83	70.17	38.58	61.42
Chhattisgarh	38.57	61.43	38.55	61.45	37.73	62.27
Madhya Pradesh	31.08	68.92	34.06	65.94	45.35	54.65
Gujarat	28.72	71.28	15.51	84.49	10.64	89.36
Daman and Diu	0	100	6.34	93.66	0.9	99.1
Dadra Nagar Haveli	34.54	65.46	26.52	73.48	9.64	90.36
Maharashtra	26.28	73.72	15.13	84.87	10.73	89.27
Andhra Pradesh	11.61	88.39	11.06	88.94	16.12	83.88
Karnataka	25.04	74.96	21.84	78.16	28.11	71.89
Goa	3.6	96.4	11.98	88.02	8.27	91.73
Lakshadweep	0	100	6.62	93.38	8.82	91.18
Kerala	5.32	94.68	14.08	85.92	10.53	89.47
Tamil Nadu	13.24	86.76	11.23	88.77	24.99	75.01
Pondicherry	0	100	9.54	90.46	92.26	7.74
Islands	0	100	0	100	0	100

Note: Poor and non-poor workers add up to 100.
Source: calculated by the authors on the basis of NSSO data.

6.3. Incidence of poverty among the informal workers across heterogeneous groups

In order to grasp the heterogeneity of the informal employment and incidence of poverty among them, we try to estimate the incidence of poverty among the informal employment across workers' status as well as location of work. Status of the informal employment may be subdivided into self-employed employed (SE), regular salaried workers (RS), casual workers in the public sector (CP) and casual workers in another sector (CO). Again, location of the workers may be subdivided into workers working without any fixed location (WWFL), workers working in own household (WWIOH), workers working in own office (WWIOF), workers working in employers' household (WWIEH), workers working in employers office (WWIEF), workers working in street with fixed location (WWISFL) and workers working in other location (WWIOL). Tables 4 and 5 provide information on the incidence of poverty across informal workers based on their status of employment and location of employment.

It is found that incidence of poverty has been higher in the rural area compared to that of urban area. Needless to say, that incidence of poverty among the casual workers has been highest while that of regular salaried workers has been lowest. More specifically, incidences of poor workers have been highest among the casual workers in the public workers. This is true for rural, urban as well as all India level. Furthermore, it is also found that incidence of impoverishment among the SE workers has been higher than the RS workers but it is lower than that of the casual workers in both public and other sectors.

Additionally, informal employment has been measured on the basis of location of the workers. It is found that incidence of poverty among the informal workers has also been different on the basis of location of the workers. In the rural area, incidence of poverty has

been highest among the WWFL while in the urban area and in the all India level, incidence of poverty has been highest among the WWIOL. On the other hand, incidence of poverty has been lowest among the WWIOF. This is true for all the rural, urban as well as all India level. Just like before, irrespective of all locations, incidence of poverty has been higher in the rural area than urban area.

Table 4. Percentages of poor informal workers across status of employment

Status of employment	Rural		Urban		All India	
	Poor	*Non-Poor*	*Poor*	*Non-Poor*	*Poor*	*Non-Poor*
SE	24.27	75.73	16.11	83.89	22.21	77.79
RS	17.4	82.6	10.97	89.03	13.18	86.82
CP	47.71	52.29	39.94	60.06	46.99	53.01
CO	38.99	61.01	34.34	65.66	38.33	61.67

Note: Poor and non-poor workers add up to 100.
Source: Calculated by the authors on the basis of NSSO data.

Table 5. *Percentages of poor informal workers across location of employment*

Location of employment	Rural		Urban		All India	
	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor
WWFL	33.45	66.55	24.64	75.36	27.61	72.39
WWIOH	21.76	78.24	17.07	82.93	19.99	80.01
WWIOF	17.73	82.27	11.19	88.81	13.98	86.02
WWIEH	26.89	73.11	18.61	81.39	21.67	78.33
WWIEF	24.77	75.23	13.85	86.15	18.71	81.29
WWISFL	27.65	72.35	24.89	75.11	26.17	73.83
WWIOL	33.09	66.91	25.17	74.83	31.3	68.7

Note: Poor and non-poor workers add up to 100.
Source: Calculated by the authors on the basis of NSSO data.

7. Determinants of incidence of poverty among the informal workers in India

Initially we want to find out the determining factors of incidence of poverty among the informal workers in India. Here we consider both household specific and individual specific factors. Sample is drawn from the NSSO 68th round where we have the information of both formal and informal workers. But here we want to identify the factors which are responsible for the incidence of poverty among the informal workers only. Hence there may be some quantitative or qualitative factors responsible for a factor to be informal in nature according to our definition. So, for this investigation we have to take the help of Heckman 2 step regression model to tackle the sample selection bias situation. We have to consider two equations simultaneously; the original equation and the selection equation. In the original equation, the dependent variable y_i^* is taking binary values 1 and 0 where 1 indicates that the informal worker is poor while 0 indicates that the informal worker is non-poor[8]. However, statistical analysis based on non-randomly selected samples consisting of informal workers only can lead to erroneous conclusions and poor policy. Thus, we use Heckman corrections which is a two-step statistical approach provides a means of correcting the non-randomly selected samples and sample selection bias.

It is true that we have subdivided informal employment into three major types viz. SE, EIS and IEFS and would like to focus on the determinants of poverty among these three types of informal workers. However, this paper also aims to capture the heterogeneity of informal

employment in Indian labour market. To do so, we have further subdivided informal employment based on work status and work location. Based on work status informal employment is divided into four major types viz. RS, SE, CP and CO. Based on work location informal employment is divided into WWFL, WWIOH, WWIOF, WWIEH, WWIEF, WWISFL and WWIOL. This paper aims to endeavor the determinants of poverty among different types of informal workers based on work status and work location as well. However, the problem of multicollinearity would arise if we accommodate these three divisions of informal employment in a single model. In order to avoid this problem, we use Model 1, Model 2 and Model 3[9] separately after considering informal employment based on workers types, status and location respectively. Besides, we do not consider the regression analysis separately for rural and urban area. Rather workers' sector has been considered as an explanatory variable in the following models.

Model 1
$$y_i^* = F(techedu_i, age_i, hh_i, caste_i, finan_i, satisfied_i, rural_i, informal\ workers\ types_i)$$
(Eq. 1)

Model 2
$$y_i^* = F(techedu_i, age_i, hh_i, caste_i, bank_i, satisfied_i, rural_i, informal\ workers\ status_i)$$
(Eq. 2)

Model 3
$$y_i^* = F(techedu_i\ age_i, hh_i, caste_i, bank_i, satisfied_i, rural_i, informal\ workers\ location_i)$$
(Eq. 3)

Here "$techedu_i$" represents the technical education among the ith informal worker. It is treated as dummy variable. Incidence of poverty of a technically educated people may be less because technical education helps a prospective worker to work as a skilled formal worker in his working age and earn better wage.

The second explanatory variable is the "age_i" of the ith informal workers. Age, which is generally considered as a proxy of experience, is found to have a negative relationship with the poverty. Thus, this paper endeavors to find out whether experiences reduce incidence of poverty

"Hh_i" represents household head of the ith informal worker. We create its dummy variable. This paper thus aims to investigate the influence of poverty among the ith female-headed household, where male headed household is the reference group.

"$Caste_i$" represents the social group of the ith informal worker. This paper thus seeks to investigate the incidence of poverty among different social groups. Three dummy variables are separately constructed for scheduled tribe (ST), scheduled caste (SC) and other backward classes (OBC). General category worker is in the reference group.

"$Finan_i$" represents financial inclusion of the ith worker. We shall try to investigate whether financial inclusion has any impact on poverty of the ith worker.

"$Satisfied_i$" represents the ith informal workers who hardly seek for alternative job where "Unsatisfied"[10] worker is the reference group. Our aim is to find out that whether "Satisfied" informal workers have lower incidence of poverty.

"Rural$_i$" represents rural sector in which the ith informal worker works. Urban area is the reference group. Since there are lesser employment opportunities in the rural area, incidence of poverty is presumed to be higher in the rural area. This paper thus aims to investigate incidence of poverty among the ith informal worker who lives in the rural area compared to that of the urban area.

"Informal workers types$_i$" represents of types of informal employment of the ith informal worker. We have constructed dummy variables each for SE and IEFS whereas EIS is the reference. Since informal worker is not homogeneous, incidence of poverty among different groups of informal workers may vary a lot.

"Informal workers status$_i$" represents heterogeneity of the ith informal workers in terms of their work status. Three dummy variables are constructed. These are RS, CP and CO while regular salaried SE is the reference group. Our objective is to find out incidence of poverty among the ith informal workers who are working as SE, or CP or CO compared to RS workers.

"Informal workers location$_i$" again represents heterogeneity of the ith informal workers in terms of location of work. We have constructed six dummy variables. These are WWIOH, WWIOF, WWIEH, WWIEF, WWISFL and WWIOL. The reference group is WWFL. This paper endeavors to find out the incidence of poverty among the ith informal workers working in each of the location compared to the reference groups.

Now we present the selection equation that helps to identify the determining factors for the workers to join informal employment. The selection equation is given by

$$\mathbf{I_i^*} = F(Edu_i, rel_i, voc_i) \tag{Eq. 4}$$

Where $\mathbf{I_i^*}$ represents type of employment (i.e. formal/informal) of the ith worker which is dummy in nature.

Here "Edu$_i$" represents years of education among the ith worker. "rel$_i$" represents religion of the ith worker. voc$_i$ represents vocational training of the ith worker.

Initially we have to estimate the selection equation on the basis of Probit model, On the basis of the estimation, we can have estimated value of Inverse Mill's ratio represented by $\hat{\lambda}$ of each sample 'i'. In the Heckman two step estimation, this $\hat{\lambda}_1$ is to be treated another explanatory variable of the original Equation, mentioned in Model-1, Model-2, Model-3. If it is observed that the parameter estimates of $\hat{\lambda}$ is statistically significant, then we can become sure that Heckman two step estimation procedure is appropriate to address our research problem.

Table 6. *Factors responsible for poverty of the informal workers (Heckman 2step procedure)*

Dependent variable: Poor informal workers			
	MODEL 1	MODEL 2	MODEL 3
	Co-efficient	Co-efficient	Co-efficient
Constant	0.01	0.02*	0.06***
	(0.01)	(0.01)	(0.01)
No technical worker	0.16***	0.14***	0.15***
	(0.01)	(0.01)	(0.008)
Age	-0.002***	-0.002***	-0.002***
	(0.0001)	(0.0001)	(0.0001)

Dependent variable: Poor informal workers			
Female headed household	0.001	0.005	-0.01
	(0.01)	(0.01)	(0.01)
Scheduled Tribe	0.14***	0.12***	0.12***
	(0.005)	(0.005)	(0.004)
Scheduled caste	0.09***	0.12***	0.13***
	(0.004)	(0.004)	(0.004)
Other backward classes	0.05***	0.07***	0.07***
	(0.003)	(0.003)	(0.003)
Workers without bank account	0.06***	0.05***	0.06***
	(0.01)	(0.01)	(0.01)
Alternative job seekers	0.05***	0.04***	0.04***
	(0.01)	(0.01)	(0.01)
Rural workers	-0.04***	-0.05***	-0.05***
	(0.003)	(0.003)	(0.003)
IEFS	-0.03**		
	(0.004)		
SE	-0.03***		
	(0.003)		
Regular salaried workers		-0.05***	
		(0.004)	
Casual workers in public sector		0.14***	
		(0.01)	
Casual workers in another sector		0.12***	
		(0.004)	
WWIOH			-0.02***
			(0.004)
WWIOO			-0.09***
			(0.004)
WWIEH			0.02***
			(0.008)
WWIEO			-0.06***
			(0.004)
WWISWFL			0.02
			(0.009)
WWIOL			0.04***
			(0.005)
$\hat{\lambda}$	0.06***	0.06***	0.06***
	(0.007)	(0.007)	(0.007)
Dependent variable: Informal worker			
Constant	-1.27***	-1.27***	-1.27***
	(0.004)	(0.004)	(0.004)
Years of education	-0.04***	-0.04***	-0.04***
	(0.0009)	(0.0009)	(0.0009)
Muslim	0.07***	0.07***	0.07***
	(0.01)	(0.01)	(0.01)
Christian	-0.16***	-0.16***	-0.16***
	(0.01)	(0.01)	(0.01)
Other religions	0.04***	0.04***	0.04***
	(0.01)	(0.01)	(0.01)
No vocational training	0.52***	0.52***	0.52***
	(0.005)	(0.005)	(0.005)
rho	0.14	0.16	0.12
sigma	0.42	0.41	0.43
Number of Observations:	456,992	456,992	456,992
Wald χ^2	2771.46	4230.74	3560.02
Prob>χ^2	0.00	0.00	0.00

* => significant at 10 percent level ** => significant at 5 percent level ***=> significant at 1 percent level.
Source: Calculated by the authors from NSSO data.

7.1. Results and discussions

We have used Heckman 2 step regression model in order to identify the factors which can influence incidence of poverty of the ith informal workers in Indian labour market. In all the models the parameter estimates of $\hat{\lambda}$ is statistically significant which establishes the fact that Heckman Two step estimation procedure is appropriate for our investigation.

Model 1 is a basic model, which considers the personal characteristics of the workers including types of informal employment. It is found that compared to EIS, IEFS and SE face significantly less probability of being poor. Furthermore, technical education, reduces the chance of being poverty-stricken. Moreover, compared to the workers without bank account and unsatisfied workers, ith workers with financial inclusion as well as that of satisfied workers have significantly lower chances of remaining poverty-stricken respectively. Besides, compared to that of the general workers, ith workers with all other social groups have significantly higher chances of remaining impoverished. STs are the most deprived social groups followed by SCs and OBCs. Furthermore, it is also found that compared to that of the urban area, ith informal workers residing in rural areas have lower chances of being poor. This is undoubtedly due to the lack of sufficient income earning opportunities in the rural area.

To check the validity of this result across different types of heterogeneous informal workers we have used **Model 2.** We have substituted types of the informal workers with status of the informal workers. It is observed that compared to that of the ith SE workers, chance of impoverishment among the ith CP and CO has been significantly higher while that of ith RS workers have been significantly lower. What is much more interesting is that probability of impoverishment is the most among the ith CP workers. This only signifies that during the post reform there has been major deterioration in the quality of jobs in the public sector.

In **Model 3,** we have substituted status of the ith informal workers by location of the workers. This again captures the heterogeneity of the informal workers in terms of their place of work. In other words, the informal workers hardly have a homogeneous place of work. A SE worker might be working in the street with or without any fixed location. Besides, a RS worker might have a place of work in the employers' household or employer's office or even street with or without fixed location. Compared to WWFL, which is the reference group, chance of remaining poor is significantly lower across WWIOH, WWIOO and WWIEO while higher across WWIEH and WWIOL.

So far as the determinants of informal employment are considered, we find that compared to Hindus, Muslims face significantly higher chance and Christians face significantly lower chances of being informally employed. Enhancement of years of education and increase in vocational training reduces the chances of being informally employed.

8. Analysis of the depth of poverty among the poor informal workers

Besides identifying the responsible factors for the incidence of poverty among informal workers, our next objective is to investigate the causes of poverty gap (acuteness of poverty) among the poor informal workers. In order to do so, we deal with the poor informal workers only. Initially we have deleted all non-poor informal workers from our samples.

Poverty gap for i^{th} individual residing in any particular state 's' (G_{is}) is defined as the difference between the official estimates of poverty line (p_s) for that state minus MPCE for i^{th} individual residing in states ($MPCE_{is}$). That is $G_{is} = (p_s - MPCE_{is})$, ($MPCE_{is} < p_s$). Clearly G_{is} shows the depth of poverty of the ith worker residing in s^{th} state. Clearly, G_{is} is positive for all the poor informal workers because $MPCE_{is} < p_s$. Higher the value of G_{is}, higher is the acuteness of poverty among the poor informal workers.

8.1. Mean poverty gap among the informal workers

We shall now measure the mean poverty gap across different types of informal workers in order to compare the acuteness of poverty across SE, EIS as well as IEFS and the results are displayed in Table 7. It is found both in the rural as well as urban areas; acuteness of poverty is almost same among the workers working as SE and in EIS. However, acuteness of poverty among the IEFS is lower than the SE and EIS in the urban area and the other way around in the rural area. Unlike the incidence of poverty, acuteness of poverty has been higher in the urban area as compared to that of the rural area for all types of workers. In all India level on the other hand, acuteness of poverty has been lowest among the SE, while that among the workers working in EIS and IEFS has been more or less same.

Table 7. *Mean poverty gap across types of poor informal workers*

Poverty gap among types of informal worker (in Rs.)	Rural	Urban	All India
SE	159.78	193.01	160.71
EIS	159.92	192.3	172.01
IEFS	174.93	189.06	176.94

Source: calculated by the authors on the basis of NSSO data.

9. Determinants of acuteness of poverty among marginal, medium as well chronic poor informal workers

Apart from finding out possible factors which can influence poverty of the informal workers, this paper further endeavors to illustrate the determinants of G_{is} among the ith poor informal workers. We have to identify the possible factors, which can reduce acuteness of poverty (G_{is}) among the poor informal workers of India. Initially using OLS it is tried to find out the factors which influences G_{is} among the Indian informal workers. Here, the dependent variable is G_{is} and all the explanatory variables are almost same of the previous model. However, unlike the previous model this regression also considers a quadratic relationship between age and depth of poverty. The model of OLS is given below:

$G_{is} = F$ (edu$_i$, age$_i$, age^2_i, hh$_i$, caste$_i$, finan$_i$, satisfied$_i$, rural$_i$, informal workers types$_i$) (Eq. 5)

As there has been wide disparity of G_{is}, the effectiveness of a certain policy variable will not create equal influence on G_{is}. That is the poor informal workers whose MPCE is far below the official estimates of poverty line may be regarded as chronic poor while some of the poor workers whose MPCE is just below the poverty line may be regarded as marginal poor. On the other hand, the poor informal workers who MPCE is between the marginal poor as well as chronic poor may be regarded as medium poor. Thus, our analysis would be incomplete if we aim to investigate the determinants of G_{is} for all the poor informal workers as a whole. Rather we can get a complete picture of G_{is} if we separately discuss

the determinants of G_{is} for marginal, middle and chronic poor informal workers. The reason is that the policy variables which are required to reduce G_{is} might significantly create different types of influence across marginal, medium and chronic poor people. Hence, we use "Quantile Regression"[11] to detect whether the partial effect of a regression on the conditional quantiles is same for all quantiles and differ across quantiles. We use Quantile regression for 25th, 50th and 75th quantiles respectively. Clearly 25th quantile represents marginal poor, 50th quantile represents middle poor and 75th quantile represents chronic poor. Actually, this regression allows the possibility that how important predictors may be different depending on the quantiles of the outcome variables i.e. G_{is}. It is also to be remembered that mean of the G_{is} has been consistently above than that of the median G_{is}, which undoubtedly indicates that the distribution of poverty gap has been rightly skewed. Hence, there has been an absolute necessity to investigate changes in G_{is} at different points of the distribution. It is easily understandable that it would not be enough to investigate the changes in mean when the entire shape of the distribution changes dramatically. This paper therefore provides empirical estimation G_{is} at 25th, 50th and 75th quantiles.

Model of the Quantile regression

$$y_i = \alpha_\theta + \beta_\theta edu_i + \delta_{\theta 1} age_i + \delta_{\theta 2} age_i^2 + \mathbb{I}_\theta hh_i + \text{\euro}_\theta caste_i + \eta_\theta finan_i +$$
$$\lambda_\theta satisfied_i + \pounds_\theta rural_i + \mu_\theta informal\ types_i + u_i \qquad \text{(Eq.6)}$$

Where i = 1, …, N (N being total number of informal workers lying below poverty line), θ = .25, .50, 0.75 quantiles where $\theta \in (0,1)$.

Table 8. *Determinants of poverty Gap: Estimated results using quantile regression and ordinary least square*

MODEL1	25% quantile	50% quantile (median)	75% quantile	OLS
Workers' characteristics	Coefficient	Coefficient	Coefficient	Coefficient
Constant	72.3***	172.70***	291.71***	199.27***
	(15.75)	(31.36)	(22.6)	(13.67)
Years of education	-2.37***	-5.22***	-6.49***	-4.38***
	(0.69)	(0.92)	(1.21)	(0.4)
Age	-0.46	-1.23	-2.43*	-1.34***
	(0.61)	(0.1)	(0.89)	(0.31)
Age square	0.00001	0.01	0.03*	0.01***
	(0.01)	(0.01)	(0.01)	(0.0001)
Female headed household	5.3	15.50***	-5.03	4.34
	(9.22)	(4.16)	(14)	(4.55)
ST	36.67***	61.74***	85.15***	57.31***
	(5.42)	(5.2)	(9.74)	(2.85)
SC	7.23	24.76***	25.96***	18.27***
	(4.41)	(5.49)	(7.71)	(2.55)
OBC	5.4	20.41***	26.79***	14.72***
	(4)	(4.66)	(6.6)	(2.33)
Workers without bank account	-3.4	1.79	-9.95	0.44
	(8.22)	(14.45)	(20.37)	(3.47)
Alternative job seekers	-7.42	-5.07	-2.72	-3.36
	(7.56)	(8.19)	(8.9)	(3.1)
Rural	-20.64***	-29.83***	-42.47***	-30.39***
	(2.97)	(4.15)	(5.29)	(2.12)
Self employed worker	-1.42	-14.56***	-23.28***	-10.93***
	(4.46)	(4.45)	(5.8)	(3.03)
IEFS	-2.2	-2.98	-1.49	-0.12
	(4.28)	(6.27)	(12.33)	(2.15)

MODEL1	25% quantile	50% quantile (median)	75% quantile	OLS
Workers' characteristics	Coefficient	Coefficient	Coefficient	Coefficient
Number of observations	24896	24896	24896	24896
Pseudo R^2	0.01	0.02	0.02	
R^2				0.18
Root MSE				125.72
$F(13,24882)$				65.1***

* => significant at 10 percent level ** => significant at 5 percent level ***=> significant at 1 percent level.
Source: calculated by the authors on the basis of NSSO data.

9.1. Results and discussions

The results of the Quantile regression as well as ordinary least square regression have been displayed in Table 8. The results of 25th, 50th and 75th quantile regression and ordinary regression differs a lot which indicates that acuteness of poverty has not been homogeneous across marginal, medium as well as chronic poor workers. It is found that in all the three situations of Quantile regression, increase in the years of education is associated with lower depth of poverty among the ith worker. More specifically, with the increase of education, depth of poverty among the ith worker is reduced in a greater extent among the higher quantiles i.e. among the chronic poor. Overall depth of poverty also falls with the increase in years of education. It is also observed that age of the informal worker is a cause of his/her acuteness of poverty. Illiterate workers have significantly higher depth of poverty among the ith marginal poor, chronic poor and overall poor. Compared to the male-headed household, depth of poverty has been significantly higher among the ith middle poor informal workers coming from female-headed households. Compared to the general workers, depth of poverty among the ith poor is significantly higher among all other castes. More specifically, for all social groups, acuteness of poverty is highest among the ith chronic poor followed by medium poor and least among the marginal poor. Among the scheduled caste and other backward classes, depth of poverty has been more or less same among the ith chronic poor and middle while insignificant among the marginal poor. ST effect is stronger among ultra-poor informal workers i.e. at highest quantiles. Furthermore, it is also found that compared to that of the urban area, depth of poverty among the ith poor has been lower in the rural area among all types of poor informal workers.

Lastly, compared to the EIS, i^{th} SE face significantly lower acuteness of poverty among the middle, chronic as well as overall poor. But the result is insignificant among the marginal poor workers. Not only is that, compared to that of EIS, depth of poverty among the IEFS is also insignificant. Therefore, these significant determining factors may be treated as important policy variables to reduce the acuteness of poverty.

10. Conclusions and policy prescriptions

This paper shows that incidence of poverty among the informal workers of India is more in the rural area as compared to that of urban area. This is also true for all the social groups. Unlike the incidence of poverty, acuteness of poverty has been higher in the urban area as compared to that of the rural area. Furthermore, it is also observed that Manipur is the most poverty-stricken state where percentages of poor workers across SE, IEFS and EIS are the highest.

It is also found that technical education, social groups, financial inclusiveness, workers satisfaction, status of employment, types of employment and location of employment are important determinants of incidence of poverty. More specifically, it is found that compared to that of the EIS, IEFS and SE have significantly lower incidence of poverty. Besides, compared to that of the SE, CP and CO workers have significantly higher incidence of poverty while RS workers have significantly lower incidence of poverty. Furthermore, compared to WWFL, higher incidence of poverty is observed among WWIEH and WWIOL while lower among workers with all other types of location excepting WWISWFL.

In both the rural and urban area, mean poverty gap has been more or less same across SE and EIS while the mean poverty gap has been highest among the IEFS. Furthermore, the acuteness of poverty has been highest among the ST followed by SC and OBC workers in the rural area while in the urban area depth of poverty of the general workers is higher than the OBC workers.

Lastly, as far as the determinants of the acuteness of poverty among the poor informal workers are concerned, it is found that years of education, technical education, social groups, and sectors may be treated as the important policy prescriptions to reduce the acuteness of poverty among the poor. Moreover, it is also found that these policy prescriptions significantly vary across marginal, medium and chronic poor informal workers. Poorest workers will be benefitted most through enhancing the educational qualifications and technical qualifications. Thus, government of India must spread various schemes like "Sarba Siksha Abhijan", "Kanyasree" so that the literacy rate and educational qualifications can be increased which will in turn help in reducing chronic poverty to a great extent. Consequently, marginal poverty and middle poverty can also be reduced by enhancing educational qualifications. However, mere implementation of such educational schemes would not be enough. Government of India should take proper steps so that literacy and educational qualifications can be spread at that grass root level in order to reduce the acuteness of poverty.

Notes

[1] Informal employment is not only generated only in informal sector. Informal employees work in both the formal as well as informal sectors in unhealthy working conditions with long working hours and devoid of any social security benefits (GOI, 2007; ILO, Standing, 1999).
[2] The term "working poor" has been highlighted by Papola (2008) and Heintz et al. (2007). They are mostly referred to as the informal workers living below the poverty line.
[3] The casual workers, contractual workers, workers of the unorganised sectors are undoubtedly informal workers (by ILO definition of informal workers and GOI (2007 who mostly are deprived of any social security benefits.
[4] Domestic enterprises by definition are unorganised or informal in nature.
[5] All definitions based on GOI (2007).

(6) We have measured poverty based on poverty line estimates as provided by Tendulkar Committee report for respective states, union territories as well as sector. Although Tendulkar Committee provides poverty line estimates as a whole for India and state specific poverty line, but we have taken the measure for respective states, union territories and sector. The reason is that if we would have taken the estimate of poverty as a whole for all India level, then the estimate of poverty would have been over-estimated in some of the states and under-estimated in some other states.

(7) This is because poverty is a relative concept.

(8) Here poor and non-poor is identified on the basis of Tendulkar Committee Report for respective states, union territories as well as sector.

(9) All the three models are original equations which are required to estimate and analyze incidence of poverty among the informal workers.

(10) Whenever a worker is ready and available for alternative job that means he is unsatisfied with his present work.

(11) The Quantile Regression model estimates the differential effects of the covariates on full distribution.

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Financial stress index, growth and price stability in India: Some recent evidence

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Abstract. *This paper examine aggregate financial stress index for India is constructed by taking monthly data from different segments of the financial market like money market, bond market, equity market, foreign exchange market, and the banking sector, for the period March 2007 to December 2016. The interrelationship and feedback effect between financial stress, economic growth and price stability are tested by using correlation and an unrestricted VAR model. The impulse response function of the VAR model shows that financial stress leads to decline in growth after a lag period and higher growth rate for a longer period of time increases stress in the financial system. The variance decomposition result shows that the contribution of FSI to the variation of other variables are not much high but other variables can contribute to the variation in FSI to some extent.*

Keywords: financial stress, economic growth, price stability, VAR.

JEL Classification: C32, E31, G10.

1. Introduction

Maintaining financial and monetary stability are the most important factors for an effective or smooth functioning of a market economy and for achieving higher economic growth. The financial system all over the world has been undergoing significant changes over the last few decades. The nature and function of the financial system has been changed due to significant expansion in financial transaction, growing financial liberalization, increasing financial integration, and introduction of complex financial instruments. With all of these changes, the possibility of larger financial instability has been increasing, which can have adverse effect on the overall economic performance.

Safeguarding the stability of financial system has become an increasing concern of policy makers since the early 1990s and especially after the global financial crisis of 2008-2009 it has become one of the crucial central bank objectives. During 1980s the main focus of the central bank monetary policy was to maintain price stability or inflation targeting. The issue of financial stability had not gotten much importance then. The concern about the issue was taken into consideration only if imbalances in the financial system affected the objective of inflation stabilization. In addition, under this framework, it was believed that achievement of price stability was necessary and sufficient condition of the overall economic and financial stability. But the financial crisis of 2008-2009 has changed this view as the crisis has occurred during the period when the global economy was in a state of low and stable inflation. Thereafter, financial stability has witnessed increased attention all over the world. The 2008-2009 crises revealed that instability in the financial system not only affects the financial sector but also adversely affects the real economy by decreasing production, investment and growth. The adverse consequences of the financial crisis compel the policy makers and researchers all over the world to think more about financial stability and of later on defining and, measuring financial stability and examining linkages between financial stability and the macro economy. There is yet no universally accepted definition of financial stability. Some authors define it in terms of its absence i.e. financial instability or stress. According to Crockett (1997) financial stability is the stability of both financial markets and institutions. According to The South Arabian Reserve Bank (SARB), financial instability can be seen through systemic risk, failure of banks, large asset price volatility, exchange rate and interest rate volatility and the collapse of market liquidity. In addition, financial stability can be described as a situation where there is absence of macroeconomic cost of financial system disturbances. Gadanecz and Jayaram (2009) define "financial stability is a situation when there is absence of excess volatility, stress or crises".

For analyzing and monitoring of the risk in the financial system one needs a measure or indicator of financial (in)stability, which will help to identify the stress in the financial system and can show when the system is relatively stable, and when it is unstable. A financial system consists of different financial institution and different types of financial market like stock market, money market, and exchange market and so on. A single indicator representing a specific sector of the financial system may not be able to indicate the health of the overall financial system. Therefore, it will be better to use an aggregate measure, which should include indicators from different segment of the financial market to measure

the health of the financial system or to measure its stability. A good example of such a systemic measure of financial (in) stability is a financial stress index. An FSI (financial stress index) is a composite index which combines different market specific indicators of financial stress like asset price volatilities, risk spreads, credit growth etc. into a single index to measure financial stress.

According to Cardarelli et al. (2011) a financial system can be said to be in a period of stress when there is large fluctuation in asset prices, rapid increase in uncertainty, financial illiquidity, and problem in the banking system.

The above discussion implies that financial stability is now receiving greater attention since the global financial crisis. The debate of late has evolved around this broader concept of financial stability at global level. Many works have been done in construction of FSI and testing its interrelation with real economic variables at national and international level. But in case of India very few works has been done.

In view of this gap in research, in this paper an attempt is made to construct a composite indicator that is Financial Stress Index (FSI) for India. The interrelationship and feedback effect between financial stress, economic growth and price stability are also tested by using correlation and an unrestricted VAR model. The rest of the paper is organized as follows: Section 2 describes literature review, Section 3 discusses the data and methodology, Section 4 describes in detail the construction of a Financial Stress Index for India, Section 5 presents the empirical results and analysis. Finally, section 6 concludes the paper.

2. Review of literature

Financial in(stability) and real economic growth:

The global financial crisis has shown that instability in the financial system can have an adverse effect on not only the financial system but also overall economic system. Period of financial crisis are always followed by high recession in the economy. As there is high interconnectedness between the financial and real sector the problem in one sector can hamper the other sector.

In their paper Hakkio and Keeton (2009) has identified three important channels through which increasing stress in financial system can lead to a decrease in overall economic activity or growth. *First*, due to the uncertainty in the economic outlook and return on asset prices. *Second* channel is through the increasing financing cost for the businessman and households due to higher financial stress. The *third* channel is that, during the stress period banks tighten their credit standards which may adversely affect economic activity.

In his famous financial instability hypothesis, Minsky (1991) explained about the interrelation between economic prosperity or growth and financial instability. He claimed that during period of higher economic growth or economic prosperity there will be higher flow of cash to the corporate sector which develops a speculative euphoria and encourages the financial institution to take more risky activity. Such speculative activity increases the amount of debt. And such an excess leveraged situation can lead to financial crisis.

Financial sector risk can affect the real sector through the balance sheet channel which is explained by Bernanke and Gerterler (1989) through the financial accelerator mechanism. According to them the shock due to financial instability decreases the asset prices and deteriorates the balance sheet and net worth of borrower and increases the external finance premium. This reduces the ability of the borrower to borrow and invest and again this leads to decrease in their net worth further. The financial accelerator in this way creates a vicious cycle of decrease in asset price, tightening credit condition, fall in economic activity and prices. Miskin (2000) also explain the balance sheet channel through which financial instability affect the real economic activity.

According to Demirgugkunt and Detragiache (1997), banking crisis can have an adverse effect on the economy. They explained that the crisis in the banking sector hamper the well-functioning of payment system and leads to disruption in the credit flow to the household and enterprises which reduces the consumption and investment activity in the economy and adversely affect the economic growth.

Financial (in)stability and price stability

Papademos (2006) defines Price stability as a state in which the general level of price is stable or the rate of inflation is sufficiently low and stable.

There are two approaches regarding the relationship between price stability and stability of the financial system. One approach is called the conventional approach which believes that these two types of stability supports and reinforce each other or they have a positive relationship. And the second approach is the new environment hypothesis who's profounder believes that price stability may not lead to financial system stability. They said that controlling of inflation at a lower level may not guaranty the stability of the financial system.

The conventional wisdom regarding the relationship between price and financial stability has been given by Schwartz (1995) which is popularly known as Schwartz hypothesis. She has explained two channels, both a micro and macro channel through which inflation affects financial condition of household, business firm, financial intermediaries and the whole financial system. Inflation creates uncertainty about the future value of assets, future return on investment, affects the stock market valuation of firms, and leads to increase in speculative investment and thereby increasing the risk in the financial system. So she advocated that a regime of monetary stability or price stability is the root of stability in the financial system.

Bordo and Wheelock (1998) was the supporter of the conventional approach. According to them the relative shock in the prices especially the sharp fall in the commodity and real estate market following several years of price increase were the cause of distress in the financial system. So they said that a central bank can contribute to the financial stability by focusing on price level stability. Bordo, Duker and Wheelock (2001), constructed a financial condition index for the period 1790-1997 and by using a dynamic Probit model they found that aggregate price shock can contribute to financial sector instability.

It was stated by Demirguckunt and Detraiache (1997) that most of the crisis has occurred under weak macroeconomic condition of higher inflation and lower growth. The higher inflation increases the banking sector risk because higher inflation is always associated with higher interest rate which creates difficulty for the banking sector to perform their maturity transformation. Thus, the higher rate of interest associated with the high rate of inflation increases the likelihood of crisis in the banking sector.

Papademos (2006) in a speech said that price stability also contribute to the stability and efficiency of the financial system by anchoring inflation expectation and eliminating market uncertainty which may arise due to inflation. In another way monetary policy by maintaining stability of prices, reduces the balance sheet problem of banks and the borrowers which may be caused by unexpected deflation. Unanticipated deflation increases the debt burden which leads to loan default and ultimately creates financial instability. Issing (2000) also supports the conventional approach and states that in long run both price and financial stability reinforce each other.

Many authors of the new environment hypothesis have criticized the conventional wisdom of the relation between price stability and financial stability. They advocated that price stability or lower inflation may not guarantee stability of the financial system. Borio and Lowe (2002) said that the price stability or lower inflation may increase the imbalances in the financial system. The credible stabilization policy by anchoring price expectation generates optimism about future economic prospects which leads to credit and asset price boom which are the seeds of future problem. Lower inflation leads to a loose monetary policy which can create situation of imbalances.

Leijonhufvud (2007) advocated that maintaining of the stability of CPI or its growth rate does not assure the financial system stability. Rajan (2005) also pointed out that monetary stability can create problem in the financial system stability in the sense that low inflation allows the interest rate to be low which may incentivize the participants in search for higher yield and increasing risk taking. This lower interest rate can create the asset price bubble which is riskier for financial stability.

Empirical literature on Measuring financial (in) stability and its relation with growth and inflation (price stability)

Attempts have been made over the last two decades by researchers to measure the condition of the financial system stability with the help of different indicator of financial risk. Gadanecz and Jayaram (2009) have discussed in their paper about different measures of stability of financial system. According to them aggregate measure of stability or stress are helpful to the policy makers and participants in the financial system because it helps to monitor the level of stability or instability of the whole system and predict the sources of stress and its impact.

Illing and Liu (2006) were the first to develop a FSI for Canada by taking high frequency variables from banking sector, foreign exchange, and equity and debt market and by using different weighting methods like factor analysis, credit weight and variance equal weights method. They stated that there is not much significant differences between the indices constructed by using different methods of weighting. Balakrishnan et al. (2009) have

constructed an Emerging Market Financial Stress Index (EMFSI) using a variance equal weighting method. Sandahl et al. (2011) have constructed a financial stress index for Sweden using the same method. Hakkio and Keenton (2009) constructed the Kansas City Financial Stress Index (KCFSI) by using PCA method taking 11 variables. Morales and Estrada (2010) have constructed a financial stability index for Colombia using 3 different weighting methods like variance-equal approach, the principal components method and count data models. The index presents the similar behaviour under the three methodologies. Cardarelli et al. (2011) developed a financial stress index by using variance equal weighting method for 17 advanced economies. Brave and Butter (2011) constructed a high frequency financial condition index for USA by using PCA method and taking100 indicators of financial health. Van Roye (2011) developed a Financial Market Stress Index (FMSI) by applying dynamic factor model for German and Euro area. Dhal, Kumar, and Ansari (2011) used CAMEL indicators for the period 1997 Q: 1 to 2012 Q: 3 for constructing Financial Stability Index. Hollo et al. (2012), developed a Composite Indicator of Systemic Stress (CISS) for Euro area by using portfolio theory approach. Aboura and Roye (2013) construct a FSI for France using 17 financial variables through the dynamic approximate factor model. SHANKAR (2014) has constructed a financial condition index for India by taking monthly data from Jan 2004 to Aug. 2013 using PCA method. Cevik, Dibooglu and Kenc (2016) construct a financial stress index by using dynamic factor model for some south-east Asian economies for the period 1995-2013. Stolbov and Shchepelevab (2016) constructed a FSI for 14 emerging countries for the period Feb 2008 to Sept 2015 using a principal component analysis method. Venkateswarlu (2017) constructed a FSI for India using credit weight method and taking quarterly data of 4 variable including NIFTY index, govt security index, NIFTY bank index and exchange rate for the period 2002 to 2014.

Most of the empirical findings shows that financial stress have a negative relation with growth or economic activity (Hakkio and Keenton, 2009; Cardarelli et al., 2011; Van Roye, 2011; Hollo et al., 2012; Aboura and Roye, 2013; Mallik and Sousa, 2013; Mittnik and Semmler, 2013; Shankar, 2014; Apostolakis and Papadopoulos, 2015; Cevik et al., 2016; Stolbov and Shchepelevab, 2016; Venkateswarlu, 2017).

The empirical literature on the relationship between financial stability and price stability is very rare. Some of the studies found that financial stress have a negative impact on inflation (Van Roye, 2011; Apostolakis and Papadopoulos, 2015; Venkateswarlu, 2017). Blot et al. (2015) investigate the relationship between price stability and financial stability by using 3 different methods such as simple correlation, VAR and a DCC method for US and Euro zone. Against the conventional hypothesis they find that all the three method show negative relation or no significant positive relationship between price and financial stability and DCC method shows unstable relationship between price and financial stability where the correlation change sign over time.

3. Data source and empirical methodology

Data sources

For the purpose of this study secondary time series data are taken from three sources i.e., RBI's Handbook of statistics on Indian economy, National stock exchange of India (NSE) and Economic and Political Weekly (EPW) publication on time series data for the Indian economy. Monthly data for the period March 2007 to December 2016 is used in the study. For the construction of Financial Stress Index (FSI) the following variables are used. They are monthly average call money rate, policy repo rate, exchange rate of rupee vis-à-vis dollar, foreign exchange reserve, credit to private sector, NSE nifty-fifty price index, NSE bank index and the Govt. yield spread data. For real economic variable monthly average of WPI and IIP are taken. I have used log changes in IIP and log changes in WPI as a proxy for economic growth and inflation respectively.

Empirical methodology

Methodology of FSI construction

To construct the FSI we have used the variance equal weighting method which is used by (Balakrishnan et al., 2009; Carderelli et al., 2011 etc.). In this method first all the variables included in the composite index are standardized and then given equal weights. For standardization all the variables are demeaned and then divided by their standard deviation.

$$X_s = (x - \mu_x) / \sigma_x \tag{1}$$

Where:
X_s = standardized variable;
μ_x = mean of the variable;
σ_x = standard deviation of the variable.

And the final FSI is calculated as the weighted average of these standardized variables.

$$\text{So, FSI} = \sum_{i=0}^{n} wix_{si} \tag{2}$$

A simple correlation and an unrestricted VAR model is used to empirically analyze the interaction between financial instability (stress), growth (IIP) and price stability (inflation). Before running the VAR model the stationarity of all the variables are tested by using Augmented dickey fuller test(ADF), and Phillips-Perron test (PP test). GARCH(1,1) model is used to measure the volatility of stock market. The maximum lag of the variables to be included in the VAR model are decided by various lag length selection criteria like LR, FPE, AIC, SIS, and HQ. The impulse responses are tested to show responsiveness of one variable to a unit shock in another variable in the VAR system. The variance decomposition of the VAR model shows how many percentage of the variation in one variable is explained by the other variable.

4. Construction of a financial stress index for India

The aggregate financial stress index for India is constructed by taking monthly data from different segments of the financial market like money market, equity market, bond market, foreign exchange market, and the banking sector. The selection of the variables is done according to the literature on the financial stress index and by taking into account the availability of data. There are six variables which are aggregated to construct the index of financial stress and the six variables include- a call spread, growth rate of credit to the private sector, a yield spread, stock market volatility, beta of the banking sector, and an exchange market pressure index (EMPI). The data are collected from RBI website, NSE website and from EPW time series data. All the variables are of monthly frequency and data period is from March 2007 to December 2016. A brief description of the variables included in the construction of the FSI is given below.

Call spread

The call spread (Shankar, 2004) is used for calculating the money market risk. It is the difference between weighted average call money rate and the official repo rate. Usually during normal times the call rate moves around the policy rate but during stress period the call rate becomes higher than the policy rate. Hence higher the call rate from the policy rate higher will be stress in the money market. A higher call spread may indicate the shortage of liquidity or liquidity risk in money market and thus affect the cost of funds.

So call spread = weighted average call rate – policy repo rate.

Inverted yield spread

To take into account the bond market risk an inverted yield spread is used which is proposed by (Carderelli et al., 2011). A yield spread is basically the difference between yields on two different debt instruments of different maturities, different credit rating, and risk. Inverted yield spread is the difference between short-term govt. security yield and long-term security yield. According to Carderelli et al., banks usually earn income in the form of intermediating short-term liabilities into longer-term assets. So, when there is a negative sloping yield curve or in other words when there is negative term spread the profitability of banks is seriously jeopardized. The confidence of the investor and economist and the overall health of the economy can be judged from the slope of the yield curve.

Inverted yield spread = short term yield – long term yield

For calculating this we have used one year and ten year govt. security yield.

Banking sector beta

The most commonly used measure of systemic risk in the banking sector is the banking sector beta which is used by many authors in constructing their financial stress index (Illing and Liu, 2006, Balakrishna et al., 2009; Cardarelli et al., 2011; VanRoye, 2011). Beta of a stock measures the volatility of the stock's return in relation to the overall market return. The beta of the banking sector is calculated by dividing the covariance between the banking sector equity return and overall stock market return by the variance of the overall market return.

Mathematically:

$$\beta = cov(br, mr)/var(mr) \tag{15}$$

Where, β= banking sector beta; br = banking stock return; mr = overall stock market return.

In accordance with the CAPM (capital asset pricing model) when the value of beta exceeds 1 this indicates that the banking stock is more volatile than the overall stock market which can be interpreted that the banking sector is in risk and there can be a higher likelihood of banking crisis. So higher is the value of beta more risky is the banking sector.

Credit growth

Credit related indicator like credit to GDP gap or growth rate of credit are often used as indicator of financial fragility. According to Fouejieu (2017) rapid credit growth may lead to declining loan standard, and increasing macroeconomic and financial instability. Higher credit growth may increase speculative activity, asset price bubble or may lead to increase in loan default. So here we have used the growth rate of credit to private sector (percentage change in non-food credit to the private sector) as an indicator of financial instability.

Exchange market pressure index

To capture the risk in the foreign exchange market most of the authors (Balakrishnan et al., 2011; Cevik et al., 2013) used an aggregate index which is the EMPI which captures not only changes in the exchange rate but also changes in the foreign exchange reserve. Fluctuation of exchange rate has an impact on macroeconomic variables like output, trade balance, inflation etc. The exchange rate of a currency comes under pressure when there is selling pressure of domestic currency or excess demand for foreign currency. With the help of EMPI, currency crisis can be defined as a period in which an attack on domestic currency leads to either depreciation of domestic currency or loss in foreign exchange reserve or a combination of the two. When there is significant increase in EMPI, the currency market is said to be in stress period.

The EMPI is calculated as:

$$empi = \frac{\Delta ex - \mu \Delta ex}{\sigma \Delta ex} - \frac{\Delta res - \mu \Delta res}{\sigma \Delta res} \tag{16}$$

Where Δex and Δres are the month-over-month changes in the exchange rate and the total foreign exchange reserve respectively and the symbols μ and σ stands for the mean and the standard deviation of the relevant series. The exchange rate is taken as the exchange rate of rupee vis-a-vis dollar.

Stock market volatility

Rapid growth or fluctuation in the share prices can be considered as a source of financial stress because it may be a signal of creation or amplification of a financial bubble. Stock markets affect the economy through the wealth and the confidence channel. Higher fluctuation in the stock market may affect the investors' confidence in the market and may adversely affect domestic and foreign investment.

To capture the stock market movement we have used the volatility of the month over month changes in the return of the NSE S&P CNX Nifty index. The stock market volatility is calculated by using GARCH (1, 1) model which is proposed by Bollerslev (1986). The model can be represented as

$$\sigma_t^2 = \lambda_0 + \lambda 1 \mu_{t-1}^2 + \lambda_2 \sigma_{t-2}^2 \qquad (17)$$

Where, σ_t^2 is the conditional variance of stock return which depends not only on the previous year return square but also on the previous year variance.

Estimation of the financial stress index for India

Various methods have been used by different authors for the construction of financial stress. The two main methods are variance equal weighting method and the method of principal component analysis. Illing and Liu (2006) have stated that there are not much significant differences between the indices constructed by using different methods of weighting. So in this paper the FSI is constructed by using the most commonly used and simple method of constructing the financial stress index which is the variance equal weighting method used by many authors (Balakrishnan et al., 2009; Carderelli et al., 2011 etc.)

The main advantage of using this method is that it is simple to construct and can be easily interpreted. In variance equal weighting method all the variables are first standardized so that they can be expressed in the same units and then they have given equal weights. The standardization is done by subtracting each series from their respective mean and then divided by their standard deviation. The aggregate FSI is the weighted average of the different variables where each variable has given equal weights.

And the final FSI is weighted average of these standardized variables.

$$\text{So,} \quad \text{FSI} = \sum_{i=0}^{n} wix_{si} \qquad (18)$$

Since here we have taken six variables for FSI so,

$$\text{FSI} = W_1 * X_{S1} + W_2 * X_{S2} + W_3 * X_{S3} + W_4 * X_{S4} + W_5 * X_{S5} + W_6 * X_{S6} \qquad (19)$$

Here $W_1 = W_2 = \ldots\ldots = W_6 = 1/6$

Here for equal weight

$$\text{FSI} = 1/6 * \text{CL} + 1/6 * \text{YS} + 1/6 * \text{BETA} + 1/6 * \text{CREDIT} + 1/6 * \text{EMPI} + 1/6 * \text{NIFTY} \qquad (20)$$

Here,
CL = call spread;
YS = yield spread;
BETA = banking sector beta;
CREDIT = growth rate of private sector credit;
EMPI = exchange market pressure index;
NIFTY = time varying volatility of S&P CNX Nifty index.

The interpretation of the financial stress is very simple. In this case a higher value of the FSI will indicate period of higher financial stress or instability and the lower value of the FSI will indicate that there is lower stress in the financial system or the financial system is relatively stable.

5. Empirical results and analysis

Trend of FSI of India

The trend of FSI of India is shown in the Figure 1 given below. In this Figure 1, it can be shown that during most of the period the FSI hover around its mean value showing normal periods, but there are also some stress periods where the value of FSI increases. During period of 2007 the financial sector was at lower stress where there was higher growth in the economy.

The FSI has increased during the second quarter of 2008 and remain high till the first quarter of 2009 which is due to the effect of global financial crisis. The adverse impact of GFC on Indian financial market is felt especially after the collapse of Lehman brothers in Sep 2008 when there was withdrawal of funds from equity market and reduction of access of Indians to funds from international market putting pressure in the domestic foreign exchange market.

The index shows that, the effect of the crisis remains for a longer period. Then the FSI decreases and remain within its average. In Dec 2010 there was slight increase in FSI because during this period the interest rate was high and also some liquidity problem was there. Another peak is in Sep 2013 where there was higher volatility in the financial market due to the US tapering announcement which created pressure in equity and foreign exchange market.

Figure 1. *Trend of FSI*
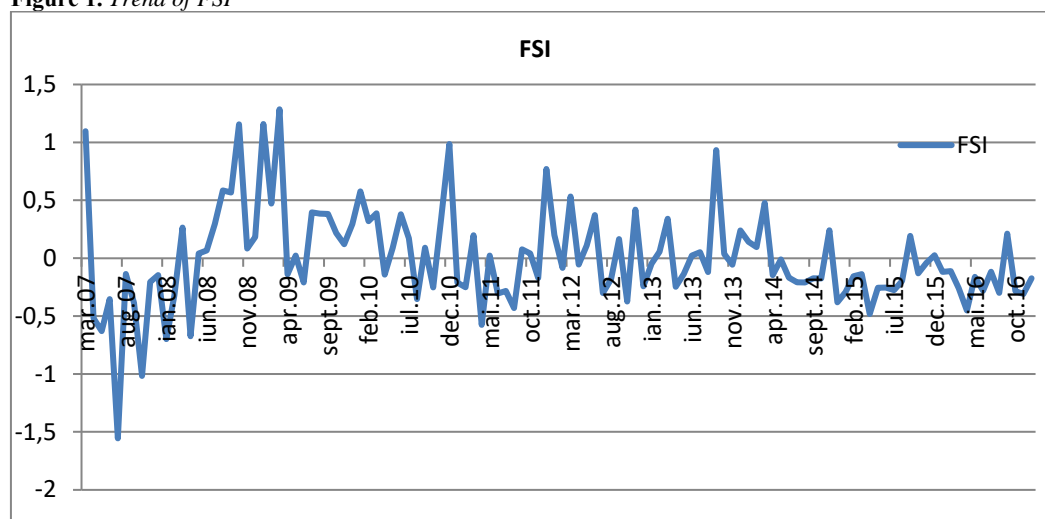
Source: Author's estimation.

Figure 2. *Trends of the individual variables*
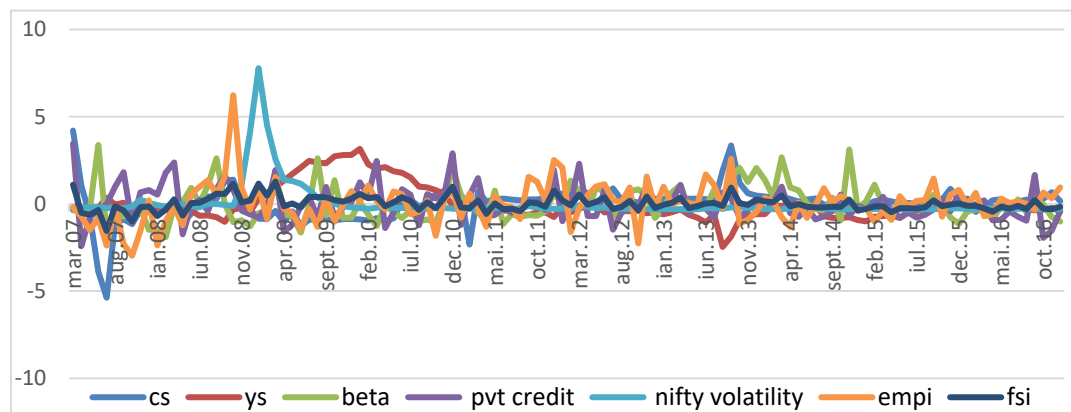
Source: Author's estimation.

This Figure 2 shows the trend of the aggregate FSI and its individual components. All the variables have high value during 2008-09 crisis periods.

Table 1. *Descriptive statistics of all the variables*

VARIABLES	FSI	GIIP	INF	R
Mean	0.002541	0.003898	0.003709	6.706017
Median	-0.070122	0.000453	0.003649	7.125000
Maximum	1.286090	0.139244	0.025459	12.42000
Minimum	-1.555480	-0.150016	-0.019094	0.510000
Std. Dev.	0.419438	0.058268	0.007859	1.906598
Skewness	0.368196	-0.192005	-0.325660	-0.672214
Kurtosis	5.177700	3.272330	3.525641	3.755945
Jarque-Bera	25.98287	1.089671	3.444204	11.69646
Probability	0.000002	0.579937	0.178690	0.002885
Sum	0.299797	0.459975	0.437689	791.3100
Sum Sq. Dev.	20.58362	0.397234	0.007226	425.3084
Observations	118	118	118	118

Note: FSI is the financial stress index, GIIP is the log changes in the IIP, INF is the log changes in WPI to calculate inflation, R is the monthly average short term interest rate.
Source: Author's estimation.

Table 2. *Correlation between price stability, financial stability and GIIP*

Variables	GIIP	INF	FSI	FSIL1
GIIP	1.000000 ----- -----			
INF	-0.126168 [-1.363902] (0.1753)	1.000000 ----- -----		
FSI	0.276449 [3.084803] (0.0026)	-0.003438 [-0.036869] (0.9707)	1.000000 ----- -----	
FSIL1	-0.186214 [-2.032468] (0.0444)	0.033605 [0.360582] (0.7191)	0.256290 [2.843373] (0.0053)	1.000000 ----- -----

Note: Value in [] and () represents t-statistics and p-value respectively.
Source: Author's estimation.

The result of the correlation test shows that the correlation between FSI and GIIP is positive that is 0.28 but the correlation between FSI at one lag period and GIIP is negative i.e. -0.19. This can be interpreted in this way that the stress in the financial stability can have an adverse effect on the growth after a lag period. The positive correlation can be interpreted in accordance with the Minsky instability hypothesis that higher growth or prosperity increases speculative activity and thereby increases risk in the financial system. The correlation between FSI and INF is negative i.e. -0.0034 which is very negligible. But the relation between INF and FSI at one period lag is positive (0.03) which is also very negligible. While the relation between FSI and GIIP is significant but the relation between INF and FSI are not significant.

Table 3. *ADF and Phillips-Perron test @ level*

Varia-bles	ADF test statistics	Proba-bility	95% critical ADF value	Re-mark	PP test statistics	Proba-bility	95% critical PP value	Re-mark
FSI	-8.594432	0.0000	-3.448681	I(0)	-9.668784	0.0000	-3.448681	I(0)
GIIP	-4.225522	0.0058	-3.452764	I(0)	-39.53194	0.0001	-3.448681	I(0)
INF	-6.292844	0.0000	-3.448681	I(0)	-6.306224	0.0000	-3.448681	I(0)
R	-4.501129	0.0023	-3.448681	I(0)	-4.811976	0.0008	-3.448681	I(0)

Source: Author's estimation.

It is also clear from the ADF and Phillips-Perron test that all the variables are stationary at 5% level of significance as their test statistics are higher than their 95% critical value.

VAR model

Following the literature an unrestricted VAR model is used to empirically analyze the interaction between financial instability (stress), growth (IIP) and price stability (inflation). A conventional macro VAR model which was used for monetary policy transmission mechanism includes mainly three variables like output, inflation and interest rate. So to include the shock of financial stress a FSI is included in the VAR model. So in this model there are four endogenous variables such as, IIP growth, inflation, and interest rate and FSI. So the VAR model represented as:

$$\text{VAR (P)} = f\,[\text{GIIP}_t, \text{INF}_t, \text{R}_t, \text{FSI}_t] \tag{21}$$

The ordering of the variables are done following the literature such that GIIP, INF and R shocks can have contemporaneous effect on FSI while FSI shock impact others with a lag.

Table 4. *Lag order selection criteria of the VAR model*

Lag	LogL	LR	FPE	AIC	SC	HQ
0	279.1671	NA	7.89e-08	-5.003038	-4.904838	-4.963208
1	446.1952	318.8718	5.07e-09	-7.749003	-7.258007*	-7.549853
2	471.8838	47.17369	4.25e-09*	-7.925161*	-7.041367	-7.566689*
3	486.5699	25.90090	4.37e-09	-7.901271	-6.624680	-7.383479
4	495.5196	15.13318	5.00e-09	-7.773084	-6.103696	-7.095972
5	516.5966	34.10635	4.60e-09	-7.865393	-5.803208	-7.028959
6	528.3273	18.12932	5.03e-09	-7.787770	-5.332788	-6.792016
7	539.1155	15.88801	5.64e-09	-7.693009	-4.845230	-6.537934
8	563.5889	34.26275*	4.96e-09	-7.847070	-4.606494	-6.532675

* indicates lag order selected by the criterion.
Source: Author's calculation.

LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion.

The result of the lag length selection criteria is given in the Table 4 which shows that the appropriate lag length to be included in the model is two.

System equations of the VAR model

GIIP = - 0.810*GIIP (-1) - 0.265*GIIP (-2) - 2.179*INF (-1) + 0.957*INF (-2) –

– 0.004*R(-1) + 0.002*R(-2) + 0.013*FSI(-1) - 0.012*FSI(-2) + 0.027   (22)

INF = 0.015*GIIP (-1) - 0.012*GIIP (-2) + 0.525*INF (-1) + 0.012*INF (-2) +

+ 0.0002*R (-1) - 0.001*R (-2) - 0.0008*FSI (-1) - 0.0007*FSI (-2) + 0.006   (23)

FSI = - 2.075*GIIP (-1) - 1.347*GIIP (-2) - 9.905*INF (-1) + 7.038*INF (-2) +

+ 0.065*R(-1) - 0.080*R(-2) + 0.239*FSI(-1) + 0.305*FSI(-2) + 0.123   (24)

R = - 3.352*GIIP (-1) - 2.996*GIIP (-2) + 3.869*INF (-1) - 3.552*INF (-2) +

+ 0.973*R (-1) - 0.140*R (-2) - 0.524*FSI (-1) - 0.209*FSI (-2) + 1.117   (25)

Impulse response analysis of the VAR model

Figure 3. *Impulse response of GIIP AND INF TO FSI*

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.
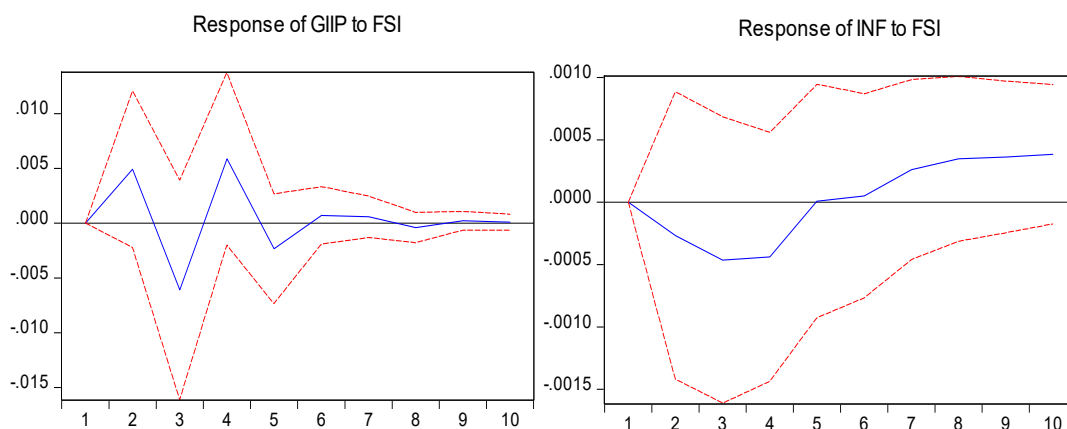
Source: Author's estimation.

From this Figure 3 it is shown that with a one unit shock in FSI the GIIP first increases then falls and after 5 month period it is stabilized. The result shows that increasing financial stress does not have immediate negative impact on the growth rate. Therefore it can be concluded that financial instability or stress can adversely affect the growth rate but with certain time lag. Here financial stress negatively affects growth after two month period. The shock is absorbed after 5 month period.

This Figure 3 also shows the impulse response of inflation to one standard deviation shock to financial stress. This result shows that a positive shock to financial stress leads to a negative impact on inflation for a long period of time. This result is similar to the result of Bolt et al. (2015) who said that higher financial fragility leads to decrease in inflation and debt deflation. We can interpret it in other way that stress may negatively affect inflation in indirect way by lowering growth rate and thereby prices.

Figure 4. *Impulse response of FSI to GIIP and INF*

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.
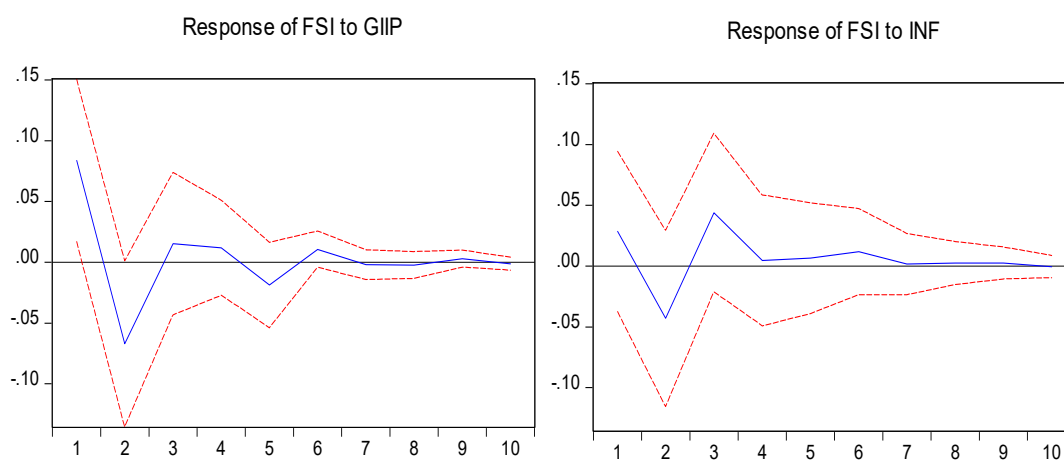
Source: Author's estimation.

This Figure 4 shows the impact of Cholesky one standard deviation shock to growth rate of IIP on financial stress. The figure shows that with a one standard deviation shock to GIIP, the FSI first falls, and then slightly increase and after 5 month period it is stabilized. The immediate impact of GIPP on FSI is negative. Which indicate that higher growth rate can lead to lower financial stress or instability.

This result is in confirmation with the result of many other papers in empirical literature. It can be explained that higher growth may increase the net worth of borrower, may strengthen the balance sheet of borrowers and reduces loan default and thereby reduces financial stress and foster stability. But after some time lag higher growth leads to increase in stress or instability in the financial system. This may be due to the fact that prolonged period of economic growth may lead to higher risk taking and thereby increasing financial stress.

This Figure 4 also shows the response of financial stress to one standard deviation shock to inflation. The result shows that inflation shock has an immediate negative impact on FSI and after two lag period in has positive impact on FSI and the shock is absorbed after four month period.

From this result it can be concluded that higher inflation leads to lower FSI or in other way lower inflation leads to higher FSI in short run, which is in accordance with the new environment hypothesis that lower inflation corresponds with lower interest rate and

increases risk taking (Rajan, 2005; Leijonhufvud, 2007). But after 2 lag period increase in inflation leads to increase in financial stress. This may be due to the fact that increase in inflation leads to increase in uncertainty as described by Schwartz (1995). So it is concluded that price stability or lower inflation leads to financial instability in the short run but in the long run price stability leads to financial stability.

Result of the variance decomposition of the VAR model

Table 5. *Variance decomposition of GIIP*

Period	S.E.	GIIP	INF	R	FSI
1	0.039938	100.0000	0.000000	0.000000	0.000000
2	0.054507	92.63227	6.320134	0.340715	0.706883
3	0.057249	90.15287	8.054965	0.310806	1.481360
4	0.057580	89.14064	8.235361	0.336546	2.287451
5	0.057952	89.09449	8.195930	0.332237	2.377339
6	0.058191	89.00989	8.287947	0.333945	2.368215
7	0.058235	88.95597	8.337023	0.336544	2.370466
8	0.058239	88.94869	8.340057	0.336493	2.374763
9	0.058249	88.94878	8.339379	0.337159	2.374677
10	0.058254	88.94745	8.341120	0.337144	2.374283

Source: Author's estimation.

It is clearly shown in the Table 5 that most of the variation in IIP is explained by its own shock over the 10 month period. The variable which explained the second most variation in GIIP is inflation.

However our intention here is to see how many % of variation in GIIP is explained by FSI. The contribution of FSI to the variation in GIIP is 0.7% in the 2nd month and gradually it increases though it is not very high. In the 10th month the contribution of FSI is 2.37%.

Table 6. *Variance decomposition of inflation*

Period	S.E.	GIIP	INF	R	FSI
1	0.006424	2.224448	97.77555	0.000000	0.000000
2	0.007324	3.931198	95.85492	0.065347	0.148539
3	0.007577	4.281791	94.01879	1.197860	0.501563
4	0.007779	4.364526	91.46549	3.378972	0.791012
5	0.007878	4.269586	89.41414	5.544888	0.771387
6	0.007949	4.200252	87.83933	7.194896	0.765527
7	0.007999	4.181762	86.75288	8.196303	0.869052
8	0.008033	4.146671	86.02694	8.777779	1.048608
9	0.008057	4.122564	85.52343	9.115508	1.238494
10	0.008075	4.106362	85.15031	9.304707	1.438623

Source: Author's estimation.

In the Table 6 it is shown that most of the variation in inflation is explained by its own shock. The contribution of FSI in the total variation in inflation is very low. The contribution of FSI in total variation in inflation is increasing, in 2nd month it is 0.14%, in 3rd month it is 0.50% and in the 10th month its contribution is 1.43%.

Table 7. *Variance decomposition of FSI*

Period	S.E.	GIIP	INF	R	FSI
1	0.365286	4.566022	0.582492	7.455371	87.39611
2	0.393162	6.701621	2.324988	11.19782	79.77557
3	0.410328	6.186341	2.896962	11.06333	79.85336
4	0.414331	6.153449	2.845363	11.10691	79.89428
5	0.417147	6.278034	2.813259	10.95903	79.94968
6	0.418228	6.299469	2.845495	10.93656	79.91848
7	0.419258	6.270358	2.831647	10.96534	79.93265
8	0.419852	6.254700	2.824230	11.03348	79.88759
9	0.420417	6.242124	2.817848	11.09239	79.84764
10	0.420835	6.230228	2.812707	11.14374	79.81332

Source: Author's estimation.

The above Table 8 shows the variance decomposition of FSI. In the first maximum % of the variation in FSI is explained by its own shock but other variables also contribute to its variation. In first month the variation of FSI explained by FSI, GIIP, inflation and interest rate are 87.39%, 4.56%, 0.58% and 7.45% respectively. Excluding its own shock the other variable which explain large % of variation in FSI is interest rate, next GIIP and the least is the inflation. In the 10th month period the variation in FSI explained by GIIP, inflation, interest rate and its own shock is 6.23%, 2.81%,11.14% and 79.81% respectively. The result shows that financial stability in India can be influenced by growth, inflation and interest rate.

6. Conclusion

In this paper an attempt is made to construct an aggregate financial stress index for India by taking monthly data from different segments of the financial market like money market, bond market, equity market, foreign exchange market, and the banking sector, for the period March 2007 to December 2016. An FSI (financial stress index) is a composite index which combines different market specific indicators of financial stress like asset price volatilities, risk spreads, credit growth etc. into a single index to measure financial stress. The FSI of India effectively pointed out the period of instability in the financial system. The period of global financial crisis is captured by the FSI.

So this FSI can be used as a leading indicator of financial instability. Hence it will benefit the participants in the financial market and policy makers to monitor the functioning or working of the financial system, as it gives information about the stress events which were not captured by the stress indicator of individual sector or market and it can also tell about the sources of financial stress.

The interrelationship and feedback effect between financial stress, economic growth and price stability are also tested by using correlation and an unrestricted VAR model. The correlation result indicates that financial stress can have negative relation with growth after one period lag. And inflation has a negative relation with FSI and a positive relation with 1 period lag of FSI, though the result is not significant. The impulse response function of the VAR model shows that financial stress leads to decline in growth after a lag period and

higher growth rate for a longer period of time increases stress in the financial system. The result also shows that in short run price stability or lower inflation increases financial stress but in the long run the result is opposite. The variance decomposition result shows that the contribution of FSI to the variation of other variables are not much high but other variables can contribute to the variation in FSI to some extent. So it is clear that instability in the financial sector can have an adverse effect on growth and price stability. Hence emphasis should also be given to the objective of maintaining financial stability like other objective such as price stability and growth.

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Testing Wagner's Law for sub-Saharan Africa:
A panel cointegration and causality approach

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Abstract. *Wagner's law relates the positive relation between public spending and economic activity, where greater economic activity leads to increased public spending. Using Panel unit root, cointegration, Fully Modified Ordinary Least Squares (FMOLS) and Granger causality procedures this paper seeks to test the validity of Wagner's law for a group of sixteen sub-Saharan African countries during the period 2002-2015. The findings show validity for Wagner's law when "productive" government expenditure is taken as the measure of public spending. Compared to "productive" government expenditure, total government expenditure shows weaker evidence for the validity of Wagner's law. Therefore governments in SSA should direct more spending towards productive expenditures if they seek to exploit growth benefits in the long run.*

Keywords: Wagner's law, Panel cointegration, Sub-Saharan Africa, FMOLS Granger Causality.

JEL Classification: E62, O40, O55.

1. Introduction

On the role of the economic policy in the short run macroeconomics management of an economy, classical economists believe that the economy is inherently stable and any deviations from the long run equilibrium level of employment and output should be allowed to 'self-correct' and any outside interferences may create instability. So, there is no role for government short run stabilization policy except to promote the efficient functioning of the market. However, Keynesians are of the view that the economy is inherently unstable and once left alone will not quickly correct deviations in the short run. So, they see role for government in promoting employment and growth through its expansionary policies. This latter view is called the Keynesian hypothesis- that public expenditure promotes growth of the economy.

Adolf Wagner (1983, 1912) however has a different view of the relationship between public expenditure and the growth of the economy. Wagner's law, like the Keynesian hypothesis, relates a positive association between public expenditure and economic growth. However, instead of public expenditure triggering growth as believed by the Keynesians, Wagner's law holds that economic growth leads to increased public expenditure. The law is attributed to Adolph Wagner from his 1983 work published in "Grundlegung der politischen Ökonomie", and presents one of the first models of the determination of public expenditure.

According to the literature (Henrekson, 1993; Halicioglu, 2000) the law rests on the following three reasons. Firstly, as the economy grows government involvement will increase in an attempt to counter the displacement effect of the private sector, which is the direct result of the industrialization process. Secondly, technological progress requires government's taking over of natural monopolies to increase and enhance efficiency. Finally, increased real income, which comes with economic development, boosts the income elasticity for 'public' expenditures, which is better provided by the government.

This papers attempts to test the validity of Wagner's law for a group of sub-Saharan African countries for the period 2002-2015 using econometric techniques of panel unit roots, cointegration and granger causality tests. This paper adds to the few sporadic evidence for individual SSA countries are available (Keho, 2015; Babatunde, 2006), and differs from the extant literature in approach to uncover evidence for Wagner's law through panel cointegration and causality analysis. In addition, our measure of government expenditure has been augmented to capture 'productive' expenditure, which refers to total expenditure less general government consumption expenditure. Versions of Wagner's law is presented next before the literature review in section 3. Sections 4 and 5 present the econometric methodology and empirical results respectively. The final section has the conclusion and recommendations.

2. Versions of Wagner's Law

While Wagner himself was not specific on the nature of the functional form, several researchers attempt to test the law utilizing different functional forms. All in all, six common forms of the law are used.

$$GE = f(GDP) \tag{1}$$

$$GCE = f(GDP) \tag{2}$$

$$GE/GDP = f(GDP) \tag{3}$$

$$GE = f(GDP/N) \tag{4}$$

$$GE/N = f(GDP/N) \tag{5}$$

$$GE/GDP = f(GDP/N) \tag{6}$$

In the above representations, GDP is the gross domestic product, GCE is the total consumption expenditure of the government, GE is the total expenditure of the government, and N is the total population. Functional forms (1), (2), (4), (5), and (6) are developed by Peacock-Wiseman (1961), Pryor (1968), Goffman (1968), Gupta (1967) and Musgrave (1969) respectively. The version in (3) is the modified version of Peacock-Wiseman (1961) as shown in Mann (1980).

Models (1) and (2) relates government total and consumption expenditures to economic activity respectively. Government size, measured by government expenditure in total output is related to the level economic activity in Mann (1990) version in model (1), and to the per capital output level in Musgrave (1969) version in model (6). Grupta (1967) and Michas (1975) interpret the law in terms of per capital government expenditure and per capita output level, as shown in model (5). Finally, Goffman (1968) interprets the law in terms of government expenditure versus per capita output level.

While all representations are used in the empirical literature with some papers employing all version (Bagdigen and Beser, 2009; Verma and Arora, 2010) and in some a single version, the most widely applied single version is the Musgrave (1969) as found in (Henrekson, 1993; Halicioglu, 2000). This paper seeks to investigate the validity of the law utilizing Musgrave version for a sample of 18 Sub-Saharan African countries from 2000-2015, wherein an elasticity greater than one validates the law.

3. Literature review

Many empirical studies of the validity of Wagner's law have been conducted in both the developed and developing countries and the results of these studies are not unanimous. One of the first studies that employed modern cointgeration methods to avoid the problem of spurious regression in testing Wagner's law literature is the work of Henrekson (1993) for Sweden from1861 to 1988. Applying unit root and cointegration techniques, Henrekson (1993) finds no support for the law. However, Kumar et al. (2009) for New Zealand finds support for the Wagner's law.

Karagianni, Pempetzoglou and Strikou (2002) examined the validity of Wagner's law for 15 EU countries for the period 1949-1998 using Engle- Granger and Johansen cointegration techniques and Granger causality method. The results are sensitive to the technique used. While Engle-Granger (E-G) technique of cointegration mainly invalidates the law, papers

that employ Johansen technique of cointegration mainly validate the law. The results from granger causality analysis are not unanimous for all countries. All in all, Wagner's law is clearly validated for only Finland and Italy.

Magazzino (2012) for EU-27 for the period 1970-2009 examines the validity of Wagner's law in its pure form and a public deficit-augmented version of the law. Times series econometric techniques of cointegration and causality analysis and panel GMM methods are used in the investigation process. Using six versions of the law, the empirical result is sensitive to the technique employed in both its pure and augmented version. The paper divided the countries into 'rich'-corresponding to old EU member- and 'poor'-referring to the new member, and the findings tend to show the validity of the law for the 'poor' than the 'rich', showing the appropriateness of the law for developing countries.

In addition, Anotmis (2013) studied the validity of Wagner's versus Keynesian hypotheses for pre-WWII Greece using ARDL cointegration and causality analysis for the period 1833-1938. The result favors Wagner's Law. Jaen-Garcia (2011) investigated the validity of Wagner's law for Spain's regions employing panel data techniques of unit root and cointegration. Using both static (FMOLS and DOLS) and dynamics (PMGE) panels this study show that Wagner's law is validated for Spain's region. This study is important in that it avoids the compromising effect of differing cultures and institutions in panel data studies. Moreover, Moore (2016) employed ARDL bounds testing approach to test Wagner's law for Ireland for the period 1970-2012. The results show that Wagner's cannot be validated for most of the specifications.

Bojanic (2013) tested the validity of Wagner's law for Bolivia for the period 1940 - 2010 using cointegration and causality analysis. The result of the study shows bidirectional causality between income and government expenditure in six of the nine versions of Wagner's law. In addition the five standard versions above, Bojanic (2013) further modeled version (1) in four disaggregated forms: government infrastructure, health, defense, and education expenses.

In Turkey, evidence for Wagner's law is found in Halicioglu (2003) for a budget deficit augmented version for the period 1960-2000 using cointegration and Toda and Yamamoto (1995) causality test. Similarly Oktayer and Oktayer (2013) also found evidence for Turkey in a trivariate causality analysis between non-interest government expenditure, inflation and economic growth for 1950-2010 using bounds test and causality analysis.

Verma and Arora (2010) tested the validity of Wagner's law for India for the period 1950-2007 using all six versions of the law. While their results validate the law in the long run, the short run evidence refutes the law. Afzal, M and Abbas, Q (2010) tested Wagner's Law in Pakistan for the period 1960- 2007 using time series econometric techniques of cointegration and causality analysis. The result largely did not validate the law for the period under study between aggregate pubic spending and income and no long run relationship exist between disaggregated expenditures and income as well. In addition, Pahlavani, Abed and Pourshabi (2011) validated Wagner's law for Iran for the period 1960-2008 using empirical methods of ARDL cointegration and causality analysis.

Keho (2015) recently studied studies Wagner's law for 10 African economies using frequency domain causality analysis and his results show validity for only three countries: Cameroon, Ghana and Nigeria. While the law holds for Cameroon and Nigeria only in the medium and long term respectively, it holds for Ghana in the short, medium and long term. Biyase and Zwane (2015) used panel fixed effect, random effect and pooled regression to test the economic growth- government expenditure nexus for 30 African countries from 1995-2005. Their results show evidence for Wagner's law.

Babatunde (2006) used bound test and Toda and Yamamoto (1995) Granger non-causality approaches to test Wagner's law for Nigeria for the period 1970 - 2006 and found it invalid during this period. In addition, Ibok and Bassey (2012) studied the validity of Wagner's law for agricultural sector of Nigeria, 1961-2012. Using Johansen and Juselius cointegration method in conjunction with granger causality analysis, they show that long run relationship exist between government spending and national income and that causality runs from the latter to government spending validating Wagner's law. A summary table of the review of literature is given below.

Table 1. *Summary empirical results on Wagner's Law*

Author(s) and Date	Data	Method	Countries (Year)	Validity
Henrekson (1993)	TS	OLS	Sweden – 1861-1990	Yes
Kumar et al. (2009)	TS	ARDL, E-G, FMOLS	New Zealand – 1960-2007	Yes
Halicioglu (2003)	TS	Cointegration and Non-causality test	Turkey – 1960-2000	Yes
Verma and Arora (2010)	TS	Co-integration test	India 1950-2007	Yes
Keho (2015)	TS	Frequency Domain Causality	Ten African Countries	Yes (Three)
Karagianni, Pempetzoglou and Strikou (2002)	TS	Cointegration and Granger causality test	EU-15 – 1949-1998	Yes (Two Countries)
Anotmis (2013)	TS	ARDL and causality	Greece – 1833-1938	Yes
Jaen-Garcia (2011)	PD	FMOLS, DOLS, PMGE	Spain – 1984-2003	Yes
Bojanic (2013)	TS	Cointegration and causality	Bolivia – 1940-2010	yes (Five Versions)
Afzal and Abbas (2010)	TS	Cointegration and causality	Pakistan – 1960-2007	No
Pahlavani, Abed and Pourshabi (2011)	TS	Bounds Test and Toda and Yamamoto causality	Iran – 1960-2008	Yes
Babatunde (2006)	TS	Bounds Test and Toda and Yamamoto causality	Nigeria – 1970-2006	No
Ibok and Bassey (2012)	TS	Cointegration and causality	Nigeria – 1961-2012	Yes

In the table TS, PD, FMOLS, DOLS, E-G and PMGE refers to times series, panel data, fully modified ordinary least squares, dynamic ordinary least squares, Engle- Granger, and panel mean group estimator respectively.

4. Model and econometric methodology

4.1. The model

In line with the literature, the paper estimates a long run relationship between public expenditure and economic growth as given below, where lowercase letters represent natural logarithms. This paper estimated the Musgrave (1969) version of Wagner's law for SSA-16 in two models, one for general government expenditure and the other productive government expenditure. The specifications are as follows:

$$gey_{it} = a_{0i} + a_{1i}py_{it} + e_{it} \tag{7a}$$

$$pgey_{it} = a_{0i} + a_{1i}py_{it} + e_{it} \tag{7b}$$

In (7a-b) $pgey_{it}$ is productive government expenditure, gey_{it} is general government expenditure as a percentage of GDP for country i in time t, py_{it} is the real GDP per capita and e_{it} is the classical error term. The data is extracted from World Development Indicators database for the period 2002-2015 for sixteen Sub-Saharan African countries. Validity of Wager's law is indicated by $b_i > 1$- an elasticity greater than one and a positive coefficient a_{1i}.

4.2. The econometric methodology

The empirical methods of Fisher type-ADF panel unit root analysis by Maddala and Wu (1999), Pedroni (1999) panel cointgeration analysis, Fully Modified OLS (FMOLS) and finally Granger causality in panel vector error correction (PVECM) set-up. This is a sequential analysis where the applicability of the text method depends on the result of the previous method's result. In other words, we test for cointegration upon finding that our variables are integrated at first difference from the results of ADF test. In addition, the running of FMOLS regression is based on the finding that there exists cointegration between the variables in the second stage of the analysis. Finally, Granger causality in PVECM is applicable to a cointegration system. The rest of this section gives a description of each stage of the analysis followed in this paper.

4.2.1. ADF Fisher Panel Unit Root Test

This test is proposed by Maddala and Wu (1999) based on the original work of Fisher (1932) where the test statistics for individual cross sections is added to form the panel test-statistic

$$\lambda = -2 \sum_{i=1}^{N} log_e \pi_i \qquad (8)$$

In (8) π_i represent the p-value of the test statistic in each country unit$i$. With two degrees of freedom, λ is χ^2 –distributed. This method is applicable irrespective of whether the null hypothesis is unit root or stationarity.

4.2.2. Pedroni (1999) Panel Cointgeration Test

The Pedroni (1999) method of panel cointegration is similar to the Engle –Granger time series cointegration approach. It works by storing the estimates of the residuals from a panel cointegration equation like the one below.

$$y_{it} = \alpha_i + \rho_i t + \beta_{1i} X_{1it} + \cdots + \beta_{Mi} X_{Mit} + \xi_{it} \qquad (9)$$

In the second stage, the estimate of the residual from the differenced regression is calculated from the difference regression. This is the difference version of (9) given in (10) below. The variance of the estimate of η_{it} is calculated using a kernel estimator, and it is denoted$\ddot{L}_{11i}^2$.

$$\Delta y_{it} = \delta_{1i} \Delta X_{1it} + \cdots + \delta_{Mi} \Delta X_{Mit} + \eta_{it} \qquad (10)$$

In the final stage a suitable autoregressive model is estimated from the residual of equation (9), which is then used to estimate the long run variance of the residual from the AR model. These long run variances are denoted $\ddot{\sigma}_i^2$ and $\ddot{s}_i^{\,2}$ for non-parametric and parametric

statistics respectively. The estimate of λ, $\ddot{\lambda}$ is given by $\ddot{\lambda}_i = 1/2(\ddot{\sigma}_i^2 - \ddot{s}_i^2)$. Using the above procedure, Pedroni (1999) constructs the followings test statistic for decision making[1].

Panel v-statistics

$$Z_v = T^2 N^{3/2} \left[\sum_{i=1}^{N} \sum_{t=1}^{T} \ddot{L}_{11i}^{-2} \ddot{\xi}_{i,t-1}^2 \right]^{-1}$$

Panel ρ-statistics

$$Z_\rho = T\sqrt{N} \left[\sum_{i=1}^{N} \sum_{t=1}^{T} \ddot{L}_{11i}^{-2} \ddot{\xi}_{i,t-1}^2 \right]^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \ddot{L}_{11i}^{-2} \left(\ddot{\xi}_{i,t-1} \Delta \ddot{\xi}_{i,t} - \ddot{\lambda}_i \right)$$

Panel t-statistics

$$\bar{\bar{Z}}_t = \ddot{S}_{N,T}^2 \left[\sum_{i=1}^{N} \sum_{t=1}^{T} \ddot{L}_{11i}^{-2} \ddot{\xi}_{i,t-1}^{*2} \right]^{-1/2} \sum_{i=1}^{N} \sum_{t=1}^{T} \ddot{L}_{11i}^{-2} \ddot{\xi}_{i,t-1}^{*} \Delta \ddot{\xi}_{i,t}^{*}$$

Group ρ-statistics

$$\tilde{Z}_\rho = TN^{-1/2} \sum_{i=1}^{N} \left[\sum_{t=1}^{T} \ddot{\xi}_{i,t-1}^2 \right]^{-1} \sum_{t=1}^{T} \left(\ddot{\xi}_{i,t-1} \Delta \ddot{\xi}_{i,t} - \ddot{\lambda}_i \right)$$

Group t-statistics

$$\bar{\bar{Z}}_t = N^{-1/2} \sum_{i=1}^{N} \left[\sum_{t=1}^{T} \ddot{s}_i^{*2} \ddot{\xi}_{i,t-1}^{*2} \right]^{-1/2} \sum_{t=1}^{T} \ddot{\xi}_{i,t-1}^{*} \Delta \ddot{\xi}_{i,t}^{*}$$

In addition to these Eviews return panel PP-statistics and group PP-statistics. In the above equations $\ddot{L}_i$ is used to correct for autocorrelation in the parametric model. $\ddot{\xi}_{i,t}^{*}$ and $\ddot{\xi}_{i,t}$ are the residuals estimated from the non-parametric and parametric models respectively. $\ddot{L}_{11i}$ is the estimate of the long run variance of $\Delta \ddot{\xi}_{i,t}$, the lags of which are determined by Newey-West method.

4.2.3. FMOLS Panel Estimates

FMOLS is efficient estimation method for cointegration system proposed by Philips and Hansen (1992). For the panel in (7) where i = 1, 2, …, 16 and t = 2002, …, 2015, consider system

$$gey_{it} = a_{0i} + a_{1i} py_{it} + e_{it} \quad \& \quad py_{it} = py_{it-1} + \mu_{it}$$

where the vectors $Z_{it} = (gey_{it}, py_{it})' \sim I(1)$ and $\tilde{\omega}_{it} = (e_{it}, \mu_{it})' \sim I(0)$. For L_i representing the lower triangular decomposition of Ω_i, the long run covariance matrix is of the above system is $\Omega = L_i L_i$. Ω_i is given as $\Omega_i = \Omega_i^0 + \Gamma_i + \Gamma_i'$ where the first term is the

contemporaneous covariance and the later term denotes the weighted sum of the auto-covariances. The FMOLS estimator for a_1 is

$$a_{1NT}^* = N^{-1} \sum_{i=1}^{N} \left(\sum_{i=1}^{T} (py_{it} - \overline{py}_i)^2 \right)^{-1} \left(\sum_{i=1}^{T} (py_{it} - \overline{py}_i) gey_{it}^* - T\ddot{\tau}_i \right)$$

Where

$$gey_{it}^* = (gey_{it} - \overline{gey_i}) - \frac{\ddot{L}_{21\,i}}{\ddot{L}_{22\,i}} \Delta py_{it} \text{, and } \ddot{\tau}_i = \ddot{\Gamma}_{21\,i} + \ddot{\Omega}_{21\,i}^{\,0} - \frac{\ddot{L}_{21\,i}}{\ddot{L}_{22\,i}} (\ddot{\Gamma}_{22\,i} - \ddot{\Omega}_{22\,i}^{\,0}$$

4.2.4. Granger causality

In this part of the econometric investigations, efforts are geared towards establishing the nature of directional causality between public spending and economic growth. A unidirectional causality from economic growth to public spending serves as evidence for the validity of Wagner's law. In a co-integrated system the appropriate way to derive Granger causality results is from a vector error correction not VAR in difference (Engle and Granger, 1987). Accordingly, an error correction term is added to VAR in difference to capture the long run effects. The VECM for the (7-a) is presented below.

$$\Delta gey_{it} = \pi_{1g} + \sum_{\rho} \pi_{11i\rho} \Delta gey_{it-\rho} + \sum_{\rho} \pi_{12i\rho} \Delta py_{it-\rho} + \psi_{1i} ECT_{t-1}$$

$$\Delta py_{it} = \pi_{2g} + \sum_{\rho} \pi_{21i\rho} \Delta py_{it-\rho} + \sum_{\rho} \pi_{22i\rho} \Delta gey_{it-\rho} + \psi_{2i} ECT_{t-1}$$

Long run causality from economic growth to public spending is established when ψ_{1i} is negative and significant. Similarly, the negative significance of ψ_{2i} is supportive of the Keynesian view that public spending spurs economic growth. Short run causalities are derived based on the joint significance of $\pi_{12i\rho}$ terms for Wagner's law and the joint significance of $\pi_{22i\rho}$ for the Keynesian hypothesis. The same procedure is valid for model (7-b).

5. Empirical results

The data we use in this study is sourced from World Bank's World Development Indicators (WDI) and the IMF World Economic Outlook 2016 databases available online. Productive government expenditure is derived by subtracting government consumption expenditure from its total expenditure. The per capita gross domestic output at market prices (at 2010 constant $) is used to measure economic growth and all variables are converted into their natural logarithms to allow for easy interpretation in growth terms. The period under study is 2002-2015.

The results are shown in the Appendix. Table 1 shows the result of the ADF- Fisher unit root for all three variables in their level and difference. Clearly all variables are integrated of order one by according to the model with no trend. As for the model with trend, except

for output per capita all others are integrated of order one. Therefore, it can concluded that all variables are integrated of order one.

In Table 2, the Pedroni cointegration test result is shown. In model 1 cointgeration is established by all statistics except for panel group-rho in no trend model and panel rho and panel group rho in model with trend. However, since four out of seven statistics agree that cointegration exist we conclude the long run relationship exist in public spending and economic growth in model 1. For model 2, where productive public spending is related to economic growth, the results are even stronger with all statistics indicating cointegration for a model with no trend, and only panel v and rho failing to indicate cointegration in model with trend. Hence, it is clearly evident that cointegration exists in both models depicted in (7a-b).

Long run elasticities are estimated by the FMOLS and DOLS estimators in Table 3. Accordingly, Wagner's law is supported with elasticities of 1.3 and 1.7 in the FMOLS and DOLS results of model. Model 1 results are weaker with elasticities closed to but less than one. This shows that productive government expenditure responses more to economic growth than total expenditure. All coefficients are statistically significant.

Finally, Granger causality test result is conducted using optimal lags of 2 advised by AIC. The long run causality results depicted in ECM show a unidirectional causality from economic growth to output per capita for both specifications. That is, the ECM term for difference public spending variable is negative and significant for both models. However, the short run causality results given by the joint significance of the lags variables in each equation is not the same for both models. Short run unidirectional causality from economic growth to public expenditure exist in only model 2. Here again model two beats model 1. In summary, the validity of Wagner's law can be established for SSA-16 from 2002-2015 from the elasticities and Granger causality analysis; but we can even say more- that productive government expenditure is what seems to matter than total expenditure in test for Wagner's law.

6. Concluding remarks

We tested for the validity of Wagner's law for sixteen Sub-Saharan African countries (SSA-16) during the period 2002 to 2015. This was conducted in spirit of panel data methods of cointegration and causality. The results show that the validity of Wagner's law for these countries cannot be rejected, and this finding is even more robust when 'productive' government expenditure is taken as the measure of public spending. Therefore, African countries should not only boost government spending but also channel more spending towards productive expenditure than consumption expenditure. These results are in line with Biyase and Zwane (2015) for 30 African countries and Ibok and Bassey (2012) for the agricultural sector for Nigeria.

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Appendix

Table 1. *ADF – Fisher unit root test results*

Series	No Trend	Trend
Gey	29.10 (0.61)	39.41(0.17)
Δgey	82.13 (0.00)***	52.47 (0.01)***
Py	27.74 (0.68)	51.65 (0.01)***
Δpy	78.78 (0.00)***	66.79 (0.00)***
pgey	32.25 (0.45)	31.60 (0.48)
Δpgey	70.26 (0.00)***	48,73 (0.02)**

***, ** and * indicate 1%, 5% and 10% level of significance respectively.

Table 2. *Panel cointegration test results*

Test Statistics	Model 1: No trend		Model 1: Trend		Model 2: No trend		Model 2: Trend	
	statistic	p-value	statistic	p-value	statistic	p-value	statistic	p-value
panel v-statistics	1.706972	0.0439**	-1.38743	0.9173	1.484224	0.0689*	-1.28904	0.9013
panel rho-statistics	-2.267395	0.0117***	0.45232	0.6745	-2.22987	0.0129***	0.089409	0.5356
panel pp-statistics	-3.867446	0.0001***	-2.92034	0.0017***	-3.52532	0.0002***	-3.8753	0.0001***
panel adf-statistics	-4.060107	0.0000***	-2.86533	0.0021***	-2.35823	0.0092***	-1.54635	0.061*
group rho-statistics	-1.090288	0.1378	1.201713	0.8853	-0.51796	0.3022	1.699118	0.9554
group pp-statistics	-5.754579	0.0000***	-4.13519	0.0000***	-3.47187	0.0003***	-3.76843	0.0001***
group adf-statistics	-3.96396	0.0000***	-2.70745	0.0034***	-3.26617	0.0005***	-2.41614	0.0078***

***, ** and * indicate 1%, 5% and 10% level of significance respectively.

Table 3. *Long run elasticities*

	FMOLS	DOLS
Model 1	0.5354 (0.00)***	0.7127 (0.00)***
Model 2	1.3526 (0.00)***	1.7704 (0.00)***

***, ** and * indicate 1%, 5% and 10% level of significance respectively.

Table 4. *Granger causality test results*
Model 1

Dependent variable	Δgey	Δpy	ECMt-1
Δgey	-	1.9112 (0.16)	0.0316 (0.01)***
Δgey	0.6405 (0.42)	-	0.0009 (0.21)

***, ** and * indicate 1%, 5% and 10% level of significance respectively.

Model 2

Dependent variable	Δpgey	Δpy	ECM$_{t-1}$
Δpgey	-	3.7179 (0.05)**	0.1497 (0.04)**
Δpy	0.1613 (0.68)	-	0.0040 (0.92)

***, ** and * indicate 1%, 5% and 10% level of significance respectively.

A review of international Fisher's effect focusing on inflation in Indian context for corporate decisions

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Abstract. *Any economic phenomenon is an outcome an unidentified robust and complex model than researched ones till date. One among such phenomena is inflation. There are many economic theories for inflation by classical economists till modern economist. This study tries to ease out the corporate decision by finding the causal relationship between inflation and macroeconomic variables. The basis of selecting the predictor variables is on a renowned theory called International Fishers Effect. Theory believes that disparity in the interest rates of two countries is adjusted by exchange rate of the currencies. Thus study intendeds to find the causal relationship of selected variables with inflation to make corporate decisions.*

Keywords: corporate decision, causality, interest rate, exchange rate, inflation etc.

JEL Classification: E31, E32, E43, C32.

Introduction

Inflation is firmly identified with financing costs, which can impact trade rates. Nations endeavour to adjust debt rates and inflation, yet the interrelationship between the two is intricate and regularly hard to oversee. Low loan costs goad purchaser spending and monetary development, and by and large positive effects on money esteem. On the off chance that purchaser spending increments to the point where request surpasses supply, inflation may result, which isn't really an awful result. Yet, low financing costs don't regularly draw in outside speculation. Higher loan fees will in general draw in outside venture, which is probably going to build the interest for a nation's currency.

A definitive assurance of the value and exchange rate of a country's cash is the apparent attractive quality of holding that country's currency. That observation is impacted by a large group of financial components, for example, the dependability of a country's legislature and economy. Speculators' first thought concerning money, before whatever benefits they may understand, is the wellbeing of holding money resources in the cash. On the off chance that a nation is seen as politically or financially flimsy or if there is any noteworthy plausibility of an unexpected cheapening or other change in the estimation of the nation's currency, speculators will in general withdrawn far from the money and are hesitant to hold it for huge periods or in huge sums.

Exchange rates are relative, particularly in the cutting edge universe of fiat monetary forms where basically no monetary standards have any natural esteem, say, as characterized as far as gold, for which the money could be exchanged. The value of any nation's currency has is its apparent esteem in perceived value to the cash of different nations or its domestic purchasing power. This circumstance can influence the impact that information, for example, inflation has on a nation's exchange rate. For instance, a nation may have an inflation rate that is for the most part thought to be high by business analysts, yet in the event that it is still lower than that of another nation, the general estimation of its money can be higher than that of the other nation's currency.

Literature review

Perera et al. (2016), in their study about analyzed the connection between Interest rate and the Exchange rate and to discover the impact of changes in Interest rate on Exchange rate volatilities. After-effects of the examination are steady with Interest Rate Parity hypothesis that uncovers a solid positive connection between Interest rate and Exchange rate. This examination broadens the writing on universal financing and gives profitable data to chiefs in little open economies and to the scholarly world.

Asari et al. (2011), in their study have broken down the connection between interest rate, inflation rate and exchange rate unpredictability in Malaysia covering the period 1999-2009. The outcomes demonstrate that the exchange rate impacts the interest rate as shown by Granger-cause. In this way the financing cost impacts the swapping scale as appeared by the Granger cause test. Considering a long haul relationship, interest rate moves emphatically while exchange rate goes contrarily towards swapping scale instability in Malaysia.

Berument (1999), in his study have surveyed the impact of expected inflation and inflation hazard on interest rate inside the Fisher hypothesis framework. Autoregressive Conditional Heteroscedastic models are utilized to gauge the contingent fluctuation of inflation as an intermediary for risk. It is discovered that both the normal inflation and the conditional variability of inflation decidedly influence the UK three month Treasury charge rate.

Need for the study

Every businessman would have key macroeconomic indicators in his watchlist to take major business decisions at micro level. Among the major macroeconomic indicators, inflation is one such indicator. It is important to know the independent variables which have a significant impact on the inflation. Such predictor variables are domestic and foreign interest rates and exchange rates. Businesses which transact cross borders would be curious to know the relative strength of the home currency to take decisions like remitting money from foreign subsidiaries, investing in foreign subsidiaries for its factors of production, strategic alliances initiatives etc. Hence it is in need in deed to understand the causal factors that relates to inflationary trends.

Objective of the study

1. To verify the presence of long run between interest rates (domestic and foreign) and currency exchange rate on inflation.
2. To establish the causal relationship between interest rates (domestic and foreign), currency exchange rate and inflation.

Scope of the study

The study confines understand the interrelationship between selected variables like interest rates (domestic and foreign) and currency exchange rate on inflation the basis of International Fisher's Effect theory. It considers only India as home country and US as foreign country. The data is compiled to analyse is from 2013 to 2018 on a monthly basis. Interest rates in the study mean 364 days T-Bill interest rate and one year T-Bill interest rate in US.

Data source

Monthly CPI from 2013-18 was extracted RBI website under time series publication. One year Fed T-bill rate from 2013-18 with monthly frequency is compiled from official website of Federal Reserve Bank of St. Louis. Monthly 364 days T-bill rate was extracted RBI website under time series publication. Monthly aggregated Exchange rate of Indian Rupee to US Dollars is extracted from a Global Financial Portal and Internet Brand Owned by Fusion Media Limited, registered in the British Virgin Islands.

Methodology

The methodology adopted to conduct this research is descriptive. The study tries to elaborate the interrelationship among the variables used in the International Fisher's Effect and validate the same. In the later part the study intends to find the empirical evidence for having causal relationship between inflation and predictor variables like,

interest rates(domestic and foreign) and currency exchange rate. The study is done in three stages. First stage is to bringing the data to stationary. Second, finding the existence of cointegration among the variables and lastly verifying the causal relationship.

Tools and techniques

Initially ensuring the stationary condition for all the four time series variables [i.e. N ~ (0,1)] before modelling. Stationarity is been confirmed using Augmented Dickey Fuller Test. Second stage being checking the cointegration between inflation and all other predictor variables like interest rate (India and US) and Exchange Rate individually. Cointegration assumptions are checked by Engle and Granger Cointegration hypothesis. Third Stage is verifying the causality between inflation and all other predictor variables like interest rate of India and US and Exchange Rate individually. Granger's Causality is used to confirm the causal relationship with the direction of causality. Eviews version 7 is used to run the above said procedure.

Data analysis & interpretation

Data collected from the authenticated sources are processed with the Eviews version 7 to run the laborious procedures of finding unit root issues, cointegration and causality. As a pre-requisite condition of eliminating the unit root in the time series data, initially, stationarity test is performed to test the presence of unit root at levels. The tests are run aging an integrated value of "1" [i.e. I(1)] to confirm stationarity.

Unit Root Tests

The results of stationarity test are given below;

Unit root condition for a stochastic trend is well explained with a following equation

$$\Delta Y_t = \alpha + \rho \Delta Y_{t-1} + u_t \qquad \qquad \{-1 \leq \rho \leq 1$$

Hypothesis to test unit root is as follows,

H_0: There exist unit root ($\rho = 0$)

H_1: There exists no unit root ($\rho \neq 0$)

The above hypothesis is tested for all the four variables Consumer Price Index Number, 364 days T-Bill rate, one year T-Bill rate of US and exchange rate. The test results of Augmented Dickey Fuller test is given below.

Table 1. *Table showing results of Augmented Dickey Fuller Test*

SL No	Variable	Order of Integration [I(x)]	t-statistic @ 5%	p-value	Result
1	CPI	0	-1.843529	0.3569	H_0 Accept
2	CPI	1	-5.907575	0.0000	H_0 Reject
3	EXUSD	0	-2.491857	0.1217	H_0 Accept
4	EXUSD	1	-8.324245	0.0000	H_0 Reject
5	ITB	0	-1.528160	0.5136	H_0 Accept
6	ITB	1	-7.467703	0.0000	H_0 Reject
7	LNUSTB	0	0.812600	0.9936	H_0 Accept
8	LNUSTB	1	-8.322385	0.0000	H_0 Reject

Source: Eviews output.

Where:
CPI – Consumer Price Index (a)
EXUSD – Exchange rate of US Dollars in Indian Rupee (x)
ITB – 364 days T-Bill rate in India (y)
LNUSTD – Natural Log of One year T-Bill rate in US (z)

The above table describes the behaviour exhibited by all the variables at different order of integration. It is observed that all the variables CPI, EXUSD, ITB are LNUSTB suffer with unit root problems (non-stationary) at levels i.e. me(0). Whereas all the variables are able to undergo the transformation of differencing at first level i.e. I(1). As stationarity is achieved first difference for all the variables, there stands a fair chance to check the cointegration among the variables.

Note: *It is observed that USTD is not stationary at levels and first difference but it is stationary at second difference i.e. I(2). As is it inconvenient to cointegrate the variable with other variable at first difference, USTD is transformed with natural log and named LNUSTD. LNUSTD is non stationary at levels and stationary at first difference.*

Cointegration Tests

Cointegration is defined between two variable when the variables are having linear relationship between them at first difference and residuals are stationary at levels i.e. I(0). Cointegration is tested for all the predictor variables with dependent variable at an integrated order of "1" as stationarity of the variables is achieved at first difference.

General form of OLS models at levels are given below;

OLS Regression between CPI(a) and EXUSD (x)   i.e. $a = \alpha_1 + \beta_1 x + \varepsilon_1 t$

OLS Regression between CPI(a) and ITB (y)   i.e. $a = \alpha_2 + \beta_2 x + \varepsilon_2 t$

OLS Regression between CPI(a) and LNUSTD (z)   i.e. $a = \alpha_3 + \beta_3 x + \varepsilon_3 t$

Modelling the variables at levels is given below.

Table 2. *Table showing results of OLS models at levels*

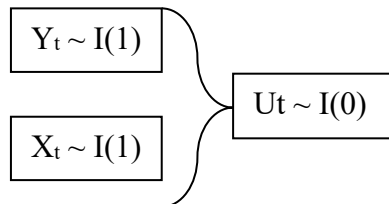| Dependent Variable	a	a	a
Independent Variable	x	y	z
R Square	0.6916	0.5290	0.8999
DW Stat	0.2515	0.1355	0.1680
Intercept	-38.8508	199.6529	138.1514
p-value	0.0052	0.0000	0.0000
Slope	2.6228	-9.4134	10.8011
p-value	0.0000	0.0000	0.0000

Source: Eviews output.

The above table describes the parameters, r-square, Durbin Watson statistic and p-value of different sets of OLS regression. It is observed that when models at level exhibits spurious relationship in all the sets i.e. a = f (x), a = f(y) and a = f(z). The models are said to be exhibiting a non-sense regression even though there is significance and adequate explanatory power because Durbin Watson's Statistic is less than R^2 in all the models. On the basis of this criterion the regression models at levels are confirmed to be spurious and long term equilibrium cannot be established between the variables. This phenomenon is

seen due to non stationarity behaviour of the variables. To test the presence of long term equilibrium, the variables are brought to stationarity by differencing method.

Engle and Granger Cointegration test is performed to check to establish long term relationship exist between the variables in the models.

General form of cointegration is explained below;

$$Y_t \sim I(1)$$

$$X_t \sim I(1)$$

$$U_t \sim I(0)$$

Cointegration between CPI(a) and EXUSD (x)   i.e. $\Delta a = \alpha_1 + \beta_1 \Delta x + \varepsilon_1 t$

Cointegration between CPI(a) and ITB (y)   i.e. $\Delta a = \alpha_2 + \beta_2 \Delta x + \varepsilon_2 t$

Cointegration between CPI(a) and LNUSTD (z)   i.e. $\Delta a = \alpha_3 + \beta_3 \Delta x + \varepsilon_3 t$

Cointegration is tested for all the three combination with dependent variable (CPI = a) and independent variables (EXUSD = x, ITB = y, LNUSTD = z) at its first difference and tested respective residuals to verify the long run equilibrium between the variables for all the three sets. Cointegration results of the variables with three sets are given below;

Table 3. *Table showing results of OLS models and ADF test of residuals*

Dependent Variable	a	a	a
Independent Variable	x	y	z
R Square	0.0050	0.0254	0.0139
DW Stat	1.4134	1.4312	1.3923
Intercept	0.6492	0.6576	0.6713
p-value	0.0000	0.0000	0.0000
Slope	0.0250	0.2352	-0.4041
p-value	0.5582	0.1844	0.3279
ADF t-stat	-6.0913	-6.1576	-6.0223
Granger Critical Value	3.6700	3.6700	3.6700
p-value	0.0000	0.0000	0.0000
Residual I(0)	N ~ (0,1)	N ~ (0,1)	N ~ (0,1)

Source: Eviews output.

It is observed in that OLS regression models in all the three sets, R-square is less than Durbin Watson's statistic and respective residuals are stationary at levels. This confirms there exist cointegration between the predictor variables and dependent variable in all the three sets of simple regression models. Thus it is confirmed that there exist long run equilibrium with the help of Engle and Granger hypothesis. Hence it is understood that CPI is cointegrated with Exchange Rate of Indian and US currencies, 364 days T-Bill rate and one year T-Bills of US.

Cointegrations allow finding the causality of variables on each other. Granger's causality test is used to find the causality direction on both the sides. General Granger's Causality model for all the possibilities of the variables in the study is expressed below.

Table 4. *Table showing possible causal relationship among variables*

dCPI→dEXUSD	dEXUSD→dCPI
$da_t = \alpha_1 + \sum_{i=1}^{n} \beta_1 \, da_{t-i} + \sum_{j=1}^{n} \delta_1 dx_{t-j} + \varepsilon_{1t}$	$dx_t = \alpha_2 + \sum_{i=1}^{n} \beta_2 \, da_{t-i} + \sum_{j=1}^{n} \delta_2 da_{t-j} + \varepsilon_{2t}$
dCPI→dITB	dITB→dCPI
$da_t = \alpha_3 + \sum_{i=1}^{n} \beta_3 \, da_{t-i} + \sum_{j=1}^{n} \delta_3 dy_{t-j} + \varepsilon_{3t}$	$dx_t = \alpha_4 + \sum_{i=1}^{n} \beta_4 \, da_{t-i} + \sum_{j=1}^{n} \delta_4 da_{t-j} + \varepsilon_{4t}$
dCPI→dLNUSTD	dLNUSTD→dCPI
$da_t = \alpha_5 + \sum_{i=1}^{n} \beta_5 \, da_{t-i} + \sum_{j=1}^{n} \delta_5 dx_{t-j} + \varepsilon_{5t}$	$dx_t = \alpha_6 + \sum_{i=1}^{n} \beta_6 \, da_{t-i} + \sum_{j=1}^{n} \delta_6 da_{t-j} + \varepsilon_{6t}$

Causality tests are presented in the following table.

Table 5. *Table showing results of Granger's Causality*

Hypothesis	D(EXUSD) does not Granger Cause D(CPI)	D(CPI) does not Granger Cause D(EXUSD)	D(ITB) does not Granger Cause D(CPI)	D(CPI) does not Granger Cause D(ITB)	D(LNUSTD) does not Granger Cause D(CPI)	D(CPI) does not Granger Cause D(LNUSTD)	Lags	Obser-vation
t-stat	2.7276	2.5757	1.3408	2.8905	0.5565	0.8888	2	69
p-value	0.073	0.084	0.2689	0.0628	0.576	0.4162		
t-stat	1.5643	2.0863	0.7083	2.9294	1.3523	1.4045	3	68
p-value	0.2072	0.1113	0.5508	0.0406	0.2659	0.2501		
t-stat	1.228	2.0118	0.7516	3.8424	1.2464	1.2853	4	67
p-value	0.309	0.1047	0.561	0.0077	0.3015	0.2863		
t-stat	1.1229	1.5827	1.0377	3.1615	1.3867	0.9907	5	66
p-value	0.3591	0.1803	0.4049	0.014	0.2436	0.432		
t-stat	1.3409	1.4295	0.3459	0.931	1.3275	1.2489	6	65
p-value	0.2561	0.2213	0.9091	0.4808	0.2618	0.2972		
t-stat	1.0425	0.2318	0.7932	2.0027	1.6705	0.9681	7	64
p-value	0.4144	0.9756	0.5966	0.0737	0.1384	0.4648		
t-stat	0.8954	0.3747	0.9396	2.6235	2.2282	0.8375	8	63
p-value	0.5282	0.9287	0.4939	0.0187	0.0423	0.5747		
t-stat	1.2118	0.2253	0.6437	1.7732	1.7829	1.0192	9	62
p-value	0.313	0.9891	0.7535	0.1017	0.0997	0.4403		
t-stat	1.1772	0.2101	0.5833	1.549	1.4993	1.8062	10	61
p-value	0.3343	0.9941	0.8177	0.1582	0.1756	0.0909		

Source: Eviews Output.

The above table denotes the causality between two variables at various lags with its t-stat and p-values. The null hypothesis pronounces that there is no Granger Causality between variables. Causality can be tested only after the variables are cointegrated. As it is observed in the above cointegration models all the models observe the cointegration between the variables. Observing the above tables is understood that there is not causal relationship between CPI and EXUSD in both the direction as there is no significance observed in the test statistic. That means CPI doesn't cause Exchange Rate and vis-a-vis.

Whereas between ITB and CPI, ITB doesn't cause CPI but CPI cause ITB as it is significant with test statistic. That means causality between CPI and 364 days T-Bills rate

have a unidirectional causality i.e. only CPI cause domestic interest rate of 364 days T-Bills and vis-a-vis in not true as it is not significant with the test statistic. It is also important to note that CPI is Cause ITB only at 3rd, 4th, 5th and 8th lags.

With respect to causality between CPI and LNUSTD, it is experiential that only log of one year T-Bill rate cause CPI and vis-a-vis is not true. It is also noted that LNUSTD Granger Causes CPI only at 8th lag.
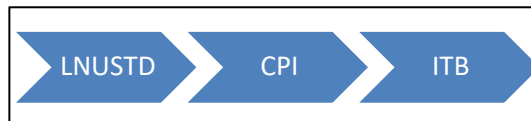
Study outcomes

1. The obtained data for all the 4 variables, Inflation, Dollar Exchange Rate, and Indian Interest Rate are US Interest Rate suffer with unit root problems (non-stationary) at levels i.e. I(0). This means the data of all the variables are non-stationary at level.
2. All the variables except one year T-Bill rate are stationary at first difference i.e. I(1). Hence one year T-Bill is transformed into natural log and found stationary at first difference.
3. CPI is regressed with Dollar Exchange Rate, Indian Interest Rate and US Interest Rate individually at the first order i.e. I(1) with their respective residuals being stationary at levels i.e. I(0). Hence all the predictor variables are said to be cointegrated with CPI individually.
4. It is observed that CPI is Cause ITB only at 3rd, 4th, 5th and 8th lags. This means monetary transmission is initiated for every 3rd, 4th, 5th and 8th month after inflation is observed in the economy to regulate it. It is also found that US Interest Rate Granger Causes CPI only at 8th lag. Which means, after changes in US Interest Rate, 8th month post changes cause inflation in India.
5. It is found that a chain movement in the causality among Inflation, Indian Interest Rate and US Interest Rate at exactly in the 8th lag.

Conclusions

The study intended to validate if any long run equilibrium existed among the variables Inflation, Dollar Exchange Rate, Indian Interest Rate and US Interest Rate and to find their causal relationship among them. As it is difficult to model the non-stationary time series data, first difference data are modelled to find the long run relationship among the study variables. It is found that all the predictor variables, namely exchange rate of USD, 364days T-Bills and one year T-Bill in US are individually cointegrated with Consumer Price Index of India. This shows there is a long run relationship between Inflation and US Interest Rate, Indian Interest Rate are US Interest Rate as their first difference regression model finds linear relationship and respective residuals are stationary at levels. It is also seen that Indian Interest Rate cause inflation at 3rd, 4th, 5th and 8th lag. That means Changes made RBI to 364days T-Bill finds its impact on Inflation only after 3rd, 4th, 5th and 8th. It is also seen a causal relationship between Inflation and US Interest Rate, where changes in US Interest Rate triggers inflation in India after 8 months.

The chain causality among Inflation, Indian Interest Rate and US Interest Rate is found at exactly in the 8th lag. This explains Changes in one month US T-Bills rate triggers inflation in India after 8 months, this caused inflation is addressed by RBI only after 8 months. The representation of the chain model is shown in the above figure. Hence it is significant to consider these inter-relationships of macroeconomic variables to take strategic decisions like remitting money from foreign subsidiaries, investing in foreign subsidiaries for its factors of production, strategic alliances initiatives etc.

Changes in US interest would trigger inflation, hence better to take decisions following decision procurement, plan for forward contracts for raw materials, take up more orders to have a competitive edge over compotators and pile up stocks for the next cycle. Inflation triggering Indian interest rate is due to monetary transmission, hence the firms shall plan for invest in financial products to get maximum return. These mentioned global strategies would have a better financial control among the firms transacting cross border. Thus any manager will be in a position to take a tactical decision against risk of inflation using the inter-relationships with exchange rate, Indian interest rate and US interest rate established in the study.

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Factors that influence wages differences in formal sector on male and female workers in Palembang City

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Abstract. *This study was conducted to analyze the effect of education, age, working hours, work experience and risks on the wages in formal sector on male and female workers in Palembang city. The data used in this study is primary data in the form of questionnaires or questions that are asked directly to respondents from 6 industrial companies at risk with 164 respondents consisting of 104 male respondents and 60 respondents from the total population 211 people. Data analysis methods used are different test analysis and multiple regression analysis. The results showed that male respondents on education, working hours, work experience had a positive and significant effect on the wages of male workers while age had no effect on the wages of male workers while female respondents showed that education, age and risk had a positive effect and significant effect on the salary of women workers. While work experience and working hours have a positive and not significant effect on the salary of women workers. Then for the different parameters test results showed that education, age, working hours and work experience have different parameters between men and women while for risk there is no difference between men and women.*

Keywords: wages of male workers, wages of female workers, education, age, working hours, work experience, risk.

JEL Classification: J31, J24, L25, J2.

1. Introduction

Differences in labor wages by gender are still a topic of discussion and problems in every country in the world, one of which is in Indonesia. Differences in labor wages by gender are differences in the average wages that occur between men and women or differences that show female workers' wages are lower than men. According to Vakulenko and Leukin (2017) said that women's wages are lower than men's occur in almost all countries in the world, and the difference in wages occurs in all wages patterns both daily, weekly, and monthly and occurs in almost all non-agricultural sectors and manufacturing sectors separately. World Economic Forum (2015) conducted an evaluation in 145 countries in the world with consideration of participation in the fields of economy, health and education to measure and see differences in wages between genders. The results reveal that no country has succeeded in erasing wage differentials between genders (Henigusnia, 2014). The difference in gender wages in Indonesia itself is still a problem that is often discussed. The problem of wage differentials in Indonesia is still confronted by the problem of the labor force, which is larger of low quality due to low levels of education.

Apart from that the high labor force participation rate in Indonesia is not followed by high productivity as well, so that those who work often get low wages and incomes (Ananta, 1990). There are significant inequalities in the application of wages in Indonesia. It can be proved by looking at and using data from the National Secretariat of 1996, 1999, 2002 and 2004 which showed that factors that cause disparities to occur, one of which is due to differences in characteristics in terms of employment (Primana, 2006). This wage difference also occurs in provinces and cities in Indonesia, namely South Sumatra. The difference in gender wages in the province of South Sumatra according to BPS (2017) continues to increase every year is evidenced in 2013 the difference in wages by gender only amounted to 0.20% and in 2017 increased to 0.29%. The difference in wages between genders in South Sumatra has a direct impact on one of the cities, Palembang.

The average wage rate for female workers in Palembang in 2013-2017 though the increase was 23.69%, but was still far higher than the increase in the wages of male workers, which was 30%. So, the ratio of women's wages to males decreases from 73% to 69%. The lowest female wage ratio occurred in 2014, which was 62% (Pusdatinaker, 2018). This, of course, raises some characteristic factors that cause the difference in the application of wages. Based on the explanation above, this study aims to analyze the influence of education, age, working hours and work experience of male workers and women's wages on the formal sector in Palembang.

2. Review of literature

According to Jacobsen (2004), the low wage of female workers compared to male workers is due to differences in human capital, namely Education. Because education is one of the important factors in developing human resources (Tarmizi, 2012). According to the theory of human quality capital, education and training can not only improve one's knowledge but also improve skills, thereby increasing work productivity.

Borjas (2016), older workers will earn more income, because they are enjoying result of investment and in the end the curve shows the level of income received by workers slower in line with the development of time spent by workers, then age affects it. This income is also caused by several factors that influence it, namely young workers usually have limitations in terms of skills and experience so that the marginal product produced will be much lower than older workers and someone who works at a job at risk will receive a higher wage that higher than someone who works in a job that has no risk at all. Someone who has work experience will receive higher and higher wages than someone who has no work experience at all. Furthermore, these working hours greatly affect the level of wages received, if the wage offered is high, the hours of work to be provided by workers also increase, which means that the more wages provided by employers, the more hours of work to be provided by workers (Borjas, 2016; Tanzel and Bircan, 2010; Hennigusnia, 2014). In general, a person will work if the wage level in the labor market is equal to or higher than the reservation wage, which is the minimum wage that encourages the owner of the workforce to enter the labor market by offering several of hours of work (McConell, 2015).

Becker (1995) states the differences in the application of wages between women and men workers can also be caused by the choice of workplaces. Research conducted by Adrireksombat and Sakellarion (2010), explains that the largest wage gap between genders is caused by a person's human capital factors, namely education and work experience. In other words the level of wages received is determined by the investment of human capital that is in him. Another study conducted by Susilowati (2005) showed that differences in wages by gender are more due to the choice of place of work. The results of research conducted by Oaxaca (1973) revealed that the gender gap between wages was largely influenced by factors of education, health problems, work experience and migration. Firdaus (2011) found that differences in endowments caused wage differences or determinants of wage rates between men and women in the formal and informal sectors.

Ismail and Jajri (2012) in their observations in Malaysia found that the difference in wages or income received by the workforce was caused by race, human capital and job characteristics say that workers who receive training, higher education will be able to receive higher salaries when compared to uneducated workers as well as workers who have more work experience for the various sectors of the work it does. Likewise with Tanzel and Bircan (2010) indicates that the working sector has an influence on the gap in revenue determination received. Which is the case of the Turkish state showed or described someone working in the public sector will be much greater received remuneration in terms of money compared to someone working in the private or special sector.

Miswar (2018) analyzed wage levels in Aceh showed that education, the employment sector and working hours have a positive effect on the wage levels of workers in Aceh, which in this study education refers to the length of time a person experiences education. Another study conducted by Susilowati (2015) showed that wage differences by gender were mostly caused by family role constraints then he also said that differences in the application of labor wages were greatest in the agricultural sector while the smallest occurred in the non-agricultural sector in a state of normal employment status. According to Adireksombat and Sakellarion (2010) said that the wage gap between genders in

Thailand is most dominant due to discrimination factors (factors that cannot be explained significantly) when compared to endowment factors namely education, age and employment status and also found that the level of gender inequality in the labor market increased each year from 1991 to 2007 or for the past 16 years. Picchio (2006) in his research which aims to estimate the gap in obtaining wages between workers viewed from their employment status in Italy, using household data in 2002 through income welfare surveys showed that workers with honorary status will receive lower income compared to with workers who are permanent employees.

Analysis by Ruhiyat (2008) using Sakernas 1998 data stated that in general, the wages of female workers are still below the wages of male workers, where the wages of female workers whose status is employees or laborers only get wages of 29.6% to 90, 22% compared to the wages of male labor as well as later. Kapsos analysis (2008) based on data from the Bangladesh Bureau of Statistics shows that the income received by women per hour is only 21% than men and the difference that is distinguished by age, education, industry, work, and geographical location is only 15.9% affect the gender wage gap. A study done by Lamazi (2018) revealed that the variable hours of work, education levels, and non-agricultural sectors have a significant influence on women's income in South Sumatra. Then the non-agricultural employment variable has a negative effect on the wages received by women workers, suggesting that the wages received by women working in the non-agricultural sector will be lower than the wages of women working in the agricultural sector. Furthermore, the status variable and having children under five did not significantly influence the wages of female workers in South Sumatra.

Reshid (2016) in his study of university graduates in Sweden in the period 1996-2012 revealed that the role of job mobility and the chosen occupation greatly affected the level of wages to be received, this led to a wage gap between genders. Then the study also found that this gender wage gap had increased over the past 10 years when entering the labor market which is equivalent to a gender gap in annual wage growth of 1%. Furthermore, research conducted by Jacob (2006) using the Oaxaca Blinder decomposition analysis concluded that the labor wage gap could not be explained even though control had been carried out with variables thought to affect the application of labor wage levels, namely: employment, industry, workers and job's characteristics.

Berardi (2013) states that work experience as a classic determinant of wages is in line with expectations, namely to increase wages significantly. Marital status does not significantly influence wages in the informal sector but is significant in the formal sector and gender and regional origin do not significantly affect wage levels. Furthermore, research done by Hossain and Haque (2015) found that education, age, gender and place of work had a significant effect on differences in daily wages and annual wages received by workers in Bangladesh. Study done by Hafid (2014) showed that the number of hours worked, the work system and the number of dependents had a positive effect on the level of nominal wages received by textile workers and their derivatives. Whereas the length of service, education, and gender do not affect the nominal wage level received by textile industry workers.

Study conducted by Ghazali, Wahyuddin, and Trisnawati (2012) showed that the variable position, company location, employment status and age significantly influence wage levels. While experience, education level and gender do not significantly influence wage levels in the public sector. Then, study done by Bhattarai and Winiewsky (2002) found that age, gender, and length of the school were the most significant factors affecting the level of wages received by workers in the United Kingdom. While the vocational qualification factor does not have a significant effect on wage levels.

3. Methodology

Based on the literature review and previous studies, the framework of this study is shown in the following figure:

Figure 1. *Analytical framework*
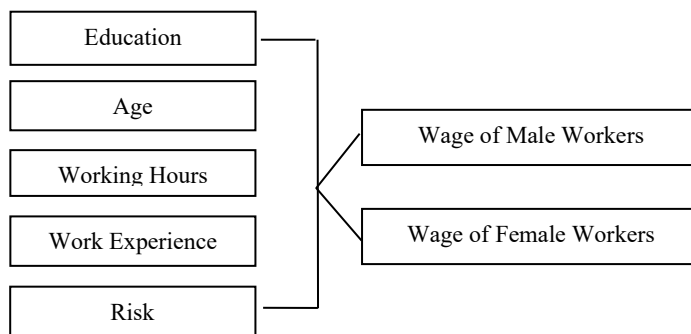
This study was conducted in Palembang city, as the object of study were male and female workers who worked in the formal sector. According to BPS criteria the formal sector has 2 employment statuses, namely permanent workers/employees/laborers and workers assisted by permanent workers. The problems to be examined are the factors that influence the difference in the wages of male and female workers, including: education, age, working hours, work experience, and risks that are suspected to affect the wages of formal sector male and female workers in city Palembang city. The data used is primary data in the form of questionnaires or questions directly asked respondents directly related to the production process, while secondary data came from BPS (Statistics Indonesia) of South Sumatra in 2018 and the Directory of Large and Medium Industrial Company in South Sumatra Province in 2018.

The number of respondents in the study came from 6 industries at risk as seen from the tools and materials used in Palembang city with the total of 164 respondents consisting of 104 male respondents and 60 female respondents from a total population of 211 people. Data collected used a survey method with proportional random sampling technique. Then the method used is the parameter difference test method and the multiple regression analysis method separately for male and female respondents. The model used is as follows:

Different parameter test analysis

This model is used to find out whether or not there are differences in the parameters of the independent variables between men and women. The equation model for the different parameter tests is as follows:

$$U = \alpha_0 + \alpha_1 D_L + \alpha_2 P + \alpha_3 D_L P + \alpha_4 Um + \alpha_5 D_L Um + \alpha_6 JK +$$

$$+\alpha_7 D_L Jk + \alpha_8 PK + \alpha_9 D_L Pk + \alpha_{10} Rs + \alpha_{11} D_L Rs + e \qquad (1)$$

Where: $\alpha_1 - \alpha_{11}$ = Regression coefficient; α_0 = Kontanta; U =Wage; D_L = The dummy variable is 1 for men and 0 for women; P = Education; $D_L P$ = dummy multiplied by education; Um = Age; $D_L Um$ = dummy times age; JK = Working hour; $D_L Jk$ = dummy multiplied by work hours; PK = work experience; $D_L Pk$ = dummy times work experience; Rs = Risk; $D_L Rs$ = dummy multiplied by risk; e = error term.

2. Multiple regression analysis

This model is used to look at factors that influence wages of female workers and wages of male workers. The econometric equation model is as follows:

$$U^L = a_0 + a_1 P + a_2 Um + a_3 JK + a_4 PK + a_5 Rs + e \qquad (2)$$

$$U^P = a_0 + a_1 P + a_2 Um + a_3 JK + a_4 PK + a_5 Rs + e \qquad (3)$$

Where:
U^L = wages for men;
U^P = wages for women;
P = education;
Um = Age;
JK = Working hour;
PK = Work experience;
Rs = risk;
e = confounding variable.

Age is the age of the respondent or worker stated by the date, month and year of birth. Education is the highest and last education completed by the respondent measured in years. Work experience is the difference in age with the age of education completed. Working hours are the number of hours worked by a person excluding rest hours and working hours used for things other than the main job. Risk is a dummy variable where when it is assumed in carrying out the work there is a risk of 1 and when the work is done does not open opportunities for injury not at risk 0.

4. Empirical result

The initial analysis results in this study are about the frequency distribution of each variable studied based on field research in the formal sector according to gender. The distribution is the distribution of respondents according to education, age, working hours, work experience, risk and wage levels as follows:

Table 1. *Distribution of Respondents by Education*

Education (Years)	Total	
	Male	Female
9 years (Graduate of SMP)	10 (9.62%)	18 (30%)
12 years (Graduate of SMA)	62 (59.62%)	36 (55%)
15 years (Graduate of Diploma/ University	32(30.77%)	9(15%)
Total	104 (100%)	60 (100)

Source: Field Research Results.

Table 2. *Distribution of Respondents by Age*

Age Group (Years)	Total	
	Male	Female
15-25	10 (9.61%)	7 (11.67%)
26-35	44 (42.30%)	20 (33.33%)
36-45	30 (28.84%)	27 (45%)
≥ 45	20 (19.23%)	6 (10%)
Total	104	60

Source: Field Research Results.

Table 3. *Distribution of Respondents by Working Hours*

Working Hours/Weeks	Total	
	Male	Female
Less than 40 hours	0 (0%)	0 (0%)
More than 40 hours	104 (100%)	60 (100%)
Total	104 (100)	60 (100)

Source: Field Research Results.

Table 4. *Distribution of Respondents According to Work Experience*

Work Experience (Years)	Total	
	Male	Female
1-10	6 (5.76%)	3 (5%)
11-20	39 (37.5%)	13 (21.67%)
21-30	25 (24.03%)	29 (48.33%)
≥ 30	34 (32.69%)	15 (25%)
Total	104	60

Source: Field Research Results.

Table 5. *Distribution of Respondents by Risk*

Risk	Jumlah	
	Male	Female
At risk	56 (53.85%)	31 (51.67%)
No risk	48 (46.15%)	29 (48.33%)
Total	104 (100%)	60 (100%)

Source: Field Research Results.

Table 5. *Distribution of Respondents by Wage Level*

Wage/monthly rate (Rp)	Total	
	Male	Female
1.500.000,00 – 2.000.000,00	- (0%)	5 (8.33%)
2.100.000,00 – 3.000.000,00	42 (40.38%)	30 (50%)
3.100.000,00 – 4.000.000,00	36 (34.62%)	21 (35%)
4.100.000,00 – 5.000.000,00	18 (17.31%)	4 (6.67%)
5.100.000,00 – 6.000.000,00	8 (7.69%)	- (0%)
Total	104 (100%)	60 (100%)

Source: Field Research Results.

Based on the above table regarding the distribution of respondents based on education, age, working hours, work experience, risk and wage levels it is known that for male and female respondents the highest school education is 59.62% for men and 55% for women. Then the

distribution of respondents by age shows that the age of men is at most 26-35 years which is 44 people (42.30%), while for female respondents, the most are 36-45 years old that is equal to 27 people or 45 percent. Furthermore the respondents' distribution based on working hours said that both male and female respondents worked more than 40 hours per week, so this concluded that respondents in the formal sector worked above normal working hours.

Distribution of respondents based on work experience shows that male respondents have the most work experience ranging between 11-20 years which is equal to 37.5% (39 people), whereas for female respondents the most have work experience ranging from 21-30 years which is equal to 48.33% or 29 people. Furthermore, the distribution of respondents according to risk shows that both male and female respondents work the most at risk compared to those who are not at risk, amounting to 53.84% or as many as 56 people for men and as many as 31 people and by 51.67% for female respondents. Finally, the distribution of wage levels for both men and women has the most wages ranging from Rp. 2,100,000.00 to Rp. 3,000,000.00 per month.

Table 6. *Different Test Results for Male and Female Parameters*

Variable	Coefficient	t-statistic	Significance
Konstanta	-59126,704	-2,944	0,004
DL	-12041,538	-2,822	0,005
Education	127929,532	3,085	0,002
DL Education	25009,869	5,291	0,000
Age	24223,631	2,349	0,020
DL Age	3084,556	3,194	0,002
Working Hours	42190,309	2,890	0,004
DL Working Hours	16956,063	2,311	0,022
Work Experience	13387,941	2,576	0,011
DL Work Experience	22855,522	2,346	0,001
Risk	347621,666	2,578	0,011
DL Risk	6489,272	1.207	0,229

Source: SPSS Processed Results.

Based on the results of different test parameters of men and women show that the parameters between men and women are different or there are differences for all variables except risk variables because seen from the significance value for all variables namely education, age, working hours and work experience are in below 0.05 or 5% (<0.05) while the risk variable is above 0.05. The difference in education variables between men and women is caused by the lack of opportunities for women to pursue higher education and the production level and ability of women who are considered lower than men. Then for the age variable there is a difference due to female workers in their 20-30s married, pregnant, and having children decided to stop working with the reason to take care of the family and when they return workers will receive a salary at the initial point like new workers, while men will continue to work until reaching the age of retirement so that the salary received will continue to grow.

Furthermore, for the variable hours worked, there are differences in parameters due to the decision of workers to choose to add or break down working hours. In general, women usually consider leisure as a normal item because it is prioritized for household needs. Whereas men consider leisure as inferior goods because as the head of the family must

meet the needs of the family. The different parameters of work experience between men and women are caused by different work experiences due to the type of experience. Usually men have experience of practical training and general training while for women only have experience of general training caused by their physical weakness. Meanwhile, the risk variable does not have different parameters because if men and women work in the same place, the risks they face will be the same.

Table 7. *Results of Estimation of Multiple Linear Regressions for Male Respondents*

Variable	Coefficient	t-value	Std Error	Significance
Education	152,939	4,271	35,809	0,000
Age	27,308	1,441	18,955	0,153
Working Hours	59,146	1,945	30,414	0,055
Work Experience	36,243	2,040	17,769	0,044
Risk	354,110	2,176	116,776	0,032
Kontanta = -711,683 R-Square = 0,658 R-Square Adjusted = 0,641		D-W Hitung = 1,827 F-Statistik = 40,377		

Source: Processed Results of SPSS, 2019.

Table 8. *Results of Estimation of Multiple Linear Regressions for Women Respondents*

Variable	Coefficient	t-value	Std Error	Significance
Education	127,929	3,678	34,780	0,001
Age	24,223	2,144	11,296	0,037
Working Hours	42,190	1,282	32,910	0,205
Work Experience	13,387	1,104	12,131	0,275
Risk	347,621	2,399	144,888	0,020
Kontanta = -59,126 R-Square = 0,551 R-Square Adjusted = 0,510		D-W Hitung = 2,050 F-Statistik = 19,997		

Source: Processed Results of SPSS, 2019.

Then based on the results of the regression that has been done, the simultaneous equation model can be formulated as follows:

$$U^L = -711{,}683 + 152{,}939P + 27{,}308Um + 59{,}146JK + 36{,}243PK + 354{,}110Rs + e$$

$$U^P = -59{,}126 + 127{,}929P + 24{,}223Um + 42{,}190JK + 13{,}387PK + 347{,}621Rs + e$$

Based on the calculation results F obtained a value of 40,337 for male respondents and 19,997 for female respondents. So that it can be concluded that the independent variables for both men and women together influenced the dependent variable. Then the results of processing found that the value of the coefficient of determination for male respondents by 66% and for women by 55% which means that the variables of education, age, hours of work, work experience by 55% for women and 66% percent for men and the rest 34% for men and 45% for women are explained by other variables not included in the regression model.

The results of the estimation of the regression equation show that the education variables for female and male workers have a positive and significant effect on the wages of male and female workers. This can be seen from the coefficient values of 152.939 and 127.929, respectively. And for the value of t-count for each respondent of 4.271 and 3.678 is greater than the t-table for men for 1.659 and t-table for women for 1.670 (t-count > t-table). The significance of this educational variable is in accordance with research conducted by

Miswar (2018); Firdaus (2011); Primana (2006) and Oaxaca (1973) which stated that a person's income is a reflection of individual choice of investment in education and training because the wage level is determined by investment in human capital in which if one's education increases, the wages to be received will also increase.

Based on the results of estimation obtained that age for male workers has a positive and not significant effect on the wages of male workers as seen from the coefficient value of 27.308 and the value of t-count smaller than t-table (1.441 <1.659). Whereas for female workers, it shows that age has a positive and significant effect on the wages of female workers as evidenced by a coefficient value of 24,223 and a t-test value greater than t-table (2,144 > 1,670). The significance of the age variable in male respondents is not following the theory, but the significance of the age variable in female respondents is in accordance with the theory that the marginal revenue from efficiency of quality of human capital which initially rises, then decreases as the working age increases. Because young workers usually have limitations in terms of skills and work experience so that the marginal product produced will be much lower than older workers (Borjas, 2016).

The estimation results of the equation show that working hours have a positive and significant effect on the salary of male workers. This can be seen from the t-value greater than t-table (1.945 > 1.659). Whereas for female workers it was shown that working hours had a positive and not significant effect on the wages of female workers because the t-count was smaller than t-table (1,282 < 1,670). The significance of the working hour variable in male respondents is consistent with the theory and research conducted by Firdaus (2011); Blinder (1973) and Sugiharso (1990) which stated that the preferences of individual workers could affect the level of wages earned was highly dependent on the hours worked by the worker.

Regression results for work experience differ between men and women in which for men the work experience variable has a positive and significant effect on the wages of male workers, as evidenced by a coefficient value of 36,243 and a t-test value greater than t-table (2,040 > 1,659). Whereas for women, it showed that the work experience variable had a positive and not significant effect on the wages of female workers, as seen from the t-count value which was smaller than t-table (1,104 < 1,670). The significance of the work experience variable in men is in line with the hedonic theory which states that one of the causes of wage differences is the difference in experience that workers have. Because according to Tarmizi (2012) work experience is reflected by workers who can work elsewhere before so that the more work experience gained by workers will make these workers more trained and skilled in carrying out their work. However, this situation is inversely proportional to women, which shows that work experience does not make women workers more skilled.

The results of the regression equation show that risks for both men and women have a positive and significant effect on the wages of male and female workers with coefficients of 354,110 and 347,621, respectively. Then the t-value of the risk of male and female respondents is greater than t-table, namely (2.176 > 1.659) and (2.333 > 1.670). This result is in accordance with the hedonic theory and Wellschmied (2016) which states that the

source of the difference in the level of wages of workers includes 2 aspects namely diverse aspects of work and diverse aspects of workers.

5. Conclusion

Based on the results of the study showed that male respondents on education, working hours, work experience and risk have a positive effect on the wages of male workers and age have a positive and no significant effect on the wages of male workers. Meanwhile the female respondents showed that education, age and risk had a positive and significant effect on the wages of female workers while working hours and work experience had a positive and no significant effect on the wages of female workers. Then for the different parameter test results showed that education, age, working hours and work experience have different parameters between men and women while for risk there is no difference between men and women. Some suggestions that can be offered are Palembang city government can make strategies to control the distribution of wage that occurs and make a policy. Policies that are made are not only standard policies to increase women's productivity, but also create policies that promote justice between men and women in recruitment and workplaces so that the welfare of male and female workers can be increased.

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Optimal Taylor rule in the new era central banking perspective[1]

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Abstract. *The Taylor rule is a simple monetary policy rule that specifies how central banks should adjust policy interest rate in response to inflation deviation and output gap. However, with the change in the central role of central banks in the economy after the 2008 global crisis, alternative monetary policy implementations have been brought to the agenda. In this study, the optimal interest of the Taylor rule in terms of interest rate approaching zero and macro prudential policy developed to regulate the financial system and prevent imbalances in the real sector after the global crisis is discussed in theoretical terms.*

Introduction

Central banks determine overnight or daily short term nominal interest rate that will affect inflation and indirectly real economic activity. Regarding this issue, although the economic dynamics of countries require comparison of different monetary policy rules, Taylor (1993) rule has received great attention in the literature. Taylor (1993, p. 202) defined a monetary policy rule in which interest rate response to changes in inflation and output gap is decisive. Backward-looking Taylor rule, in which interest rate is determined as a function of the weighted average of past inflation rates, points to a fixed interest rate. On the other hand, forward-looking Taylor rule, in which the interest rate is determined based on the estimation of future inflation rates, is open to more than one interest rate.

At this point, the determination of the monetary transmission mechanism of central bank interest rate decisions affecting inflation and real economic activity comes to the fore. Especially for the policy horizon to be planned by the central banks that adopt the inflation targeting regime, it is important how long the interest rate is fully transferred to inflation. The reason is that because of the ever-changing inflation rates, the monetary policy transmission mechanism will have long and variable delays, which foresees a twelve to twenty-four month basis for the policy horizon. For example, the 2008 global crisis, which began with the collapse of large-scale financial institutions such as Lehman Brothers as a result of the increase in asset and commodity bubbles in the financial markets in the USA, showed that the policy course followed by the central banks, so the monetary transmission mechanism, could go beyond the standard operation.

As a result of the economic recession risk, the central banks of developed countries such as Federal Reserve System (FED), European Central Bank (ECB), Bank of England (BoE) the Bank of Japan (BoJ) brought interest rates closer to zero. Quantitative expansion or asset purchases were made to give additional momentum to the fight against the global crisis. As the main goal of monetary policy, central banks' consensus on price stability continued, financial risks began to come into prominence. Central banks focused on the risks that financial markets could strengthen and took macro prudential measures against serious problems for the real economy.

Therefore, a period has begun in which macro prudential policy implementations have been effective in the development of the forward monetary transmission mechanism. On the other hand, the tendency that focuses on the institutional frameworks of central banks plays a role as public expectations cannot be ignored regarding the role of this policy change, which is seen as a part of the global economic conjuncture. It should be noted that both the independent conduct of monetary policy and the sensitivity to accountability and transparency have a strong impact on the direction of public expectations. Because the perception of not meeting the expectations of the public, Kydland and Prescott (1977), Calvo (1978) and Barro and Gordon (1983) expressed by the time inconsistency[2] problem manifests itself. The failure of the central bank to follow an optimal monetary policy strategy in time makes the promise of low inflation unsatisfactory to the public. In fact, the problem of inconsistency in time, which includes predictions such as the credibility of the central bank and the provision of strong institutional design, will largely reflect on the effectiveness of central bank interest rate decisions.

After the 2008 global crisis, the next part of this study on the analysis of the optimal Taylor rule with the new era central banking approach consists of three section. In the first section, the general framework of the new era central banking, in the second section the transformation process in the monetary policy is given. In the third section, the development of Taylor rule is evaluated and its role in the economy is discussed within the scope of its theoretical content.

1. The new era central banking

In 2008, as a result of the bankruptcy of large-scale financial institutions such as Lehman Brothers, the global recession experienced as the Great Recession. The main factors behind the global crisis, which changed the understanding of the central duty of central banks as price stability, are summarized in Figure 1.

Figure 1. *Key factors behind the 2008 global crisis*
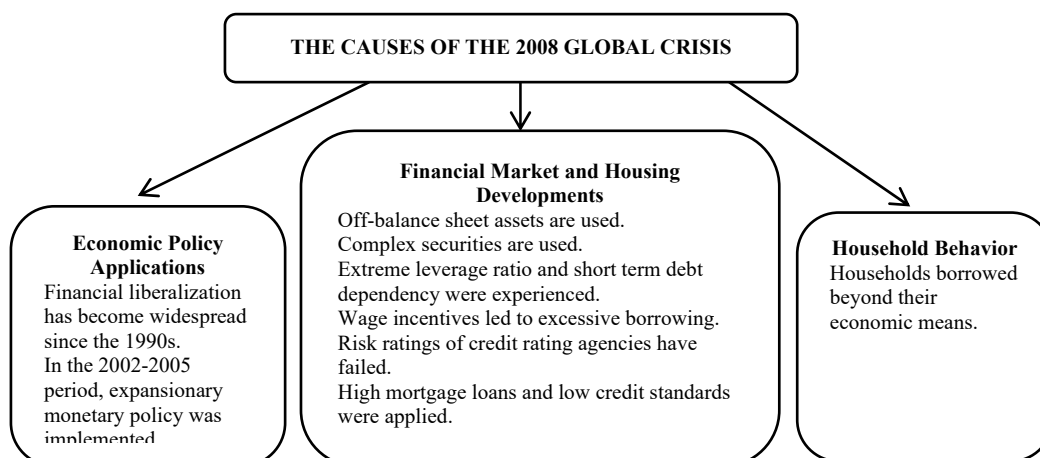
Source: Verick and Islam (2010).

Different interrelated factors were effective in the global crisis. The acceleration of foreign capital movements since the 1990s and the expansionary monetary policy practices adopted during the 2002-2005 period increased access to credit. The households, which act in particular with a high risk perception, have been exposed to excessive debt through loans, resulting in a rapid rise in housing and property prices. As a result, the problems experienced in repayment of these loans since the end of 2006 increased the mortgage debt obligations and foreclosures. With the reversal of risk perception, the financial distress experienced by banks affected the financial markets negatively.

Banks of America, England, Japan and Europe, has adopted a missionary monetary policy aimed at economic growth and employment, which cannot be drawn with the goal of price stability. For example, in 2009, the FED pulled the policy interest rate between 0% and 0.25% and increased its balance sheet by $3.5 trillion through quantitative easing. BoE applies funding mechanism programs for quantitative easing and credit, BoJ has implemented comprehensive monetary loosening, quantitative and qualitative loosening programs.

On the other hand, the ECB pursued a monetary expansion policy due to the fact that Germany was away from monetary expansion, In fact, in 2014, the Bank reduced its deposit interest rate from 0% to -0.10% and purchased 400 billion euro assets through its bond purchase program. While these central banks manage short-term interest rates in this way, with the verbal guidance, the perception of the long-term interest rates for the future period.

As a result of the expansionary monetary policies, liquidity, which was abundant in the market, turned to developing countries with high interest rates. This liquidity, which is generally portfolio and short-term foreign capital investments, led to the expansion of domestic credit volume at low cost. Although this situation, which put pressure on the appreciation of the national currency, resulted in a current account deficit, the developing countries have survived this crisis slightly. Because, these countries compensated the possible effects of monetary expansion with the contractionary fiscal policy they implemented.

Beside the global recession, in this period, when deflation concerns increased, helicopter money[3] was discussed again. The helicopter money first expressed by Friedman (1969, pp. 4-5). In a deflationary environment, the central bank finances public expenditures by coining money. In other words, helicopter money with pure fiscal policy while domestic demand through public expenditures is increasing, the direct transfer of money to the public sector adversely affects the independence and balance sheet of the central bank.

However, unlike central digital currencies and banking systems, the crypto (cryptic) currency offered outside the central authority is becoming widespread. There are different types of crypto money available via the internet, the most known of which is Bitcoin[4], the value of which is determined by the current supply and demand in the market. The evaluation of the central bank and countries regarding crypto money, which is based entirely on the mutual trust of its users, can be exemplified as follows: The FED stated that it is meaningless to give official form because they do not look hot on crypto money. The ECB also stated that the member states did not adopt crypto currency. The Bank of China (BoC), on the other hand, banned crypto money because of the dangers of cyberattack, money laundering and tax evasion. In contrast, the CBRT stated that the crypto currency system can contribute to financial stability provided that it is well designed. The Bank of Denmark (BoD) has planned to use the crypto currency in the form of e crowns, Switzerland's largest bank The Swiss Banks Association is aiming to introduce a new currency to the market in 2018 with the participation of some banks from Germany and America.

In the last decade alone, central banks have focused on the systemic risks of the crisis and developed macro prudential policies. Systemic risk is the disruption of the main financial services that may have serious consequences for the real sector (Osinski et al., 2013). The macro prudential policy, which was initially applied as a micro prudential policy based on the provision of corporate finance and risk management, was introduced especially in the Asian and Latin American crises in the 1990s (Duff, 2014, p. 191). Figure 2 describes the interrelations of micro and macro prudential policies within the scope of crisis management. For example, if the expansion in the volume of consumer loans or commercial loans is considered to have systemic risk potential, the central bank's required reserve ratio and the finance ministry are expected to increase the tax rate on banking

transactions. There is a need for coordinating institutions to coordinate these policies. Indeed, to this end, the United States' Financial Stability Oversight Council, "in the UK" Financial Policy Committee "in the European Union" European Systemic Risk Board "and in Turkey" Financial Stability Committee "various responsible for such macro-prudential policy implemented regulatory and supervisory institutions have been established" (Nier et al., 2011, pp. 11-20).

Figure 2. *Scope of macro prudential policy*

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                    ┌─────────────────────────┐
                    │   CRISIS MANAGEMENT     │
                    └─────────────────────────┘
                       ↙                 ↘
┌────────────────────────────────┐   ┌────────────────────────────────┐
│   Micro Prudential Policy      │   │   Macro Prudential Policy      │
│ Arrangements have been made to │   │ In addition to monetary and    │
│ protect the rights of savings  │   │ fiscal policies, policies have │
│ owners and investors.          │   │ been adopted for financial     │
│ Practices have been started to │   │ markets.                       │
│ eliminate the financial        │   │                                │
│ problems of the companies.     │   │                                │
└────────────────────────────────┘   └────────────────────────────────┘
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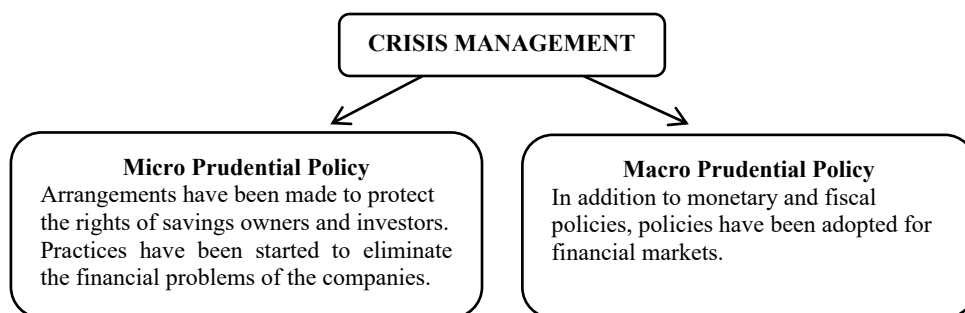
Source: Osinski (2013).

The International Monetary Fund (IMF) and the Bank for International Settlements (BIS) were also instrumental in the preparation and implementation of the macroprudential policy. The IMF (2010) has made efforts to fully understand the analytical and operational basis of macroprudential policy and ensure the effectiveness of its instruments. To this end, the IMF requested the establishment of four business lines: To identify systemic risk indicators, to review country experiences on the use and effectiveness of instruments deprived of macro financial risk, to evaluate the effectiveness of different institutional arrangements for macro prudential policy, to take into account multilateral views on macro prudential policy.

BIS (2010), on the other hand, foresees that the Basel III[5] consensus can impose the global banking system beyond direct reforms. High leverage ratios (borrowing costs), inadequate liquidity and weak capital structure, which are among the major causes of the global crisis, have set standards to prevent them. In particular, the cyclical capital buffer[6] was added to the legislation to provide an environment for limiting credit expansion by increasing the capital requirements of banks. In this way, the inconsistency between the real sector and the financial sector was tried to be solved by banking regulations.

Thus, from the perspective drawn by the IMF and Basel III, Figure 3 explains what macro prudential policy instruments can be and how they can be used. Macroprudential policy instruments, which are determined by considering the economic and financial development levels of the countries, their sensitivity to shocks and exchange rate systems, fall into two groups (Orsmond and Price, 2016, pp. 75-81). The first of these is the identification tools that work like an early warning system, giving information about the time and cross-sectional dimensions of systemic risk and showing appropriate measures (Lim et al., 2011, pp. 6-18). The other is operational risk prevention.

An imbalance that may arise in any of the recognition and monitoring tools is perceived as systemic risk and operational tools are used as a precaution (Lim et al., 2011: 6-18). For example, to limit the excessive expansion of the loan/GDP ratio and liquidity level, a ceiling is applied to the loan/collateral ratio or debt/income ratio. Or reserve requirements are used against the mobility of foreign funds with high exchange rate risk. In developing countries such as Turkey, Brazil, Hong Kong, especially loan/deposit ratio and debt/income ratio is used, developed countries such as America, Germany and France use capital buffers to regulate the activities of large-scale banks.

Figure 3. *Macro prudential policy tools and usage*
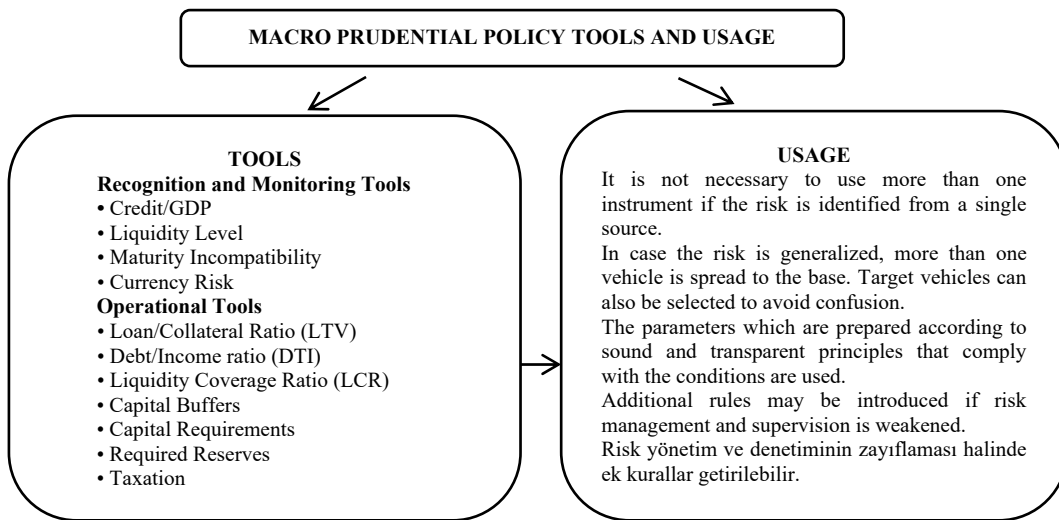
Source: Lim et al. (2011).

When an overall assessment is made, the control gap caused by excessive confidence in the ability of the financial system to adjust itself, which is the main cause of the crisis, has paved the way for macro prudential policy (Galati and Moessner, 2010). Thus, before the crisis, Filardo (2000), Borio and White (2004), Schinasi (2004) stated that the central bank can take measures to achieve the goal of financial stability, as stated in the studies, the general belief that its main purpose is to achieve price stability has started to be broken. Cukierman (2011), Goodhart (2011) and Smets (2014) emphasized the direction in which central banks will evolve, that is, how to balance the price stability and financial stability. Consequently, monetary policy regimes that will follow the global financial system should be developed without moving away from price stability, which is the central task of the central bank in the new period.

2. Monetary policy within the framework of financial stability

There are two dimensions of central bank policy before and after the global crisis. These include the determination of the central bank objective and the implementation of its policy; According to Clocker and Towbin (2012, p. 79), the aim of the central bank is to minimize an externally given cost function.

Before 2008, as stated in Equation 2, the central bank loss function (LPS) includes only the traditional targets of price stability and production (Glocker and Towbin, 2012, pp. 79-80).

$$L^{PS} = E[\pi_t^2 + \lambda_Y(\tilde{Y}_t)^2] \qquad (1)$$

Here, π_t; realized inflation rate, $\tilde{Y}_t$; production value deviation and λ_Y; it represents the subjective weight of the central bank's production stability according to price stability.

After 2008, the central bank also attaches importance to financial stability (LFS) and as a result, the variability of loans is included in the loss function in Equation 2 (Glocker and Towbin, 2012, pp. 79-80).

$$L^{FS} = E\left[\pi_t^2 + \lambda_Y(\tilde{Y}_t)^2 + \lambda_L(\acute{L}_t)^2\right] \qquad (2)$$

Here, $\acute{L}_t$; the deviation of the credit value in the steady state, λ_Y and λ_L represent the subjective weight of the central bank's production and credit stability relative to financial stability.

Before 2008, it is easier to identify the tools that central banks should use when both equations are compared. After 2008, as stated by Tinbergen (1952), at least as many targets as monetary policy instruments were determined. Central banks have begun to use unconventional monetary policy instruments such as low policy interest, monetary expansion, credit expansion and verbal guidance to ensure financial stability and slow down the economic recession.

3. Taylor's rule

The Taylor (1993) rule is a simple monetary policy rule that acts as a reaction function used by the central bank as a guide in determining short-term interest rates. According to the Taylor rule developed under rational expectations and wage-price stickiness assumptions, there is a linear relationship between central bank interest rate and inflation deviation and output gap (Boehm and House, 2014, pp. 2). Against the deviations of the realized inflation from the target or the potential level of the actual output, the interest rate targeted by the central bank is obtained as follows:

$$i_t^* = i^* + \alpha_\pi(\pi_t - \pi^*) + \alpha_y(y_t - y^*) \qquad (3)$$

In Equation 3, i_t^*; the targeted short-term interest rate, π_t; realized inflation rate, π^*; the targeted inflation rate, y_t; the actual GDP, y^*; potential GDP, i^*; the desired interest rate, α_π; inflation response coefficient, α_y; the output gap represents the response coefficient. $\alpha\pi$; the deviation of the realized inflation rate from the targeted rate is related to the short-term interest rate. As $\alpha\pi$ increases or decreases, sensitivity to inflation increases or decreases. αy, on the other hand, correlates the deviation of the realized GDP from the potential with the short term interest rate. As the αy increases or decreases, sensitivity to growth increases or decreases. Inflation with $\alpha_\pi = 0$; If $\alpha_y = 0$, growth is not effective in determining the short-term interest rate.

However, the Taylor rule, which is based on past or current data, may be misleading in revealing the course of central bank interest rate decisions, and a forward-looking Taylor rule has been developed (Clarida et al., 2000).

3.1. Forward-looking Taylor rule

Kerr and King (1996), Bernanke and Woodford (1997), Clarida et al. (2000) stated that the future deviation of inflation and output gap will help the central bank avoid inconsistencies and achieve its targets. Accordingly, the forward-looking Taylor rule is as follows (Clarida et al., 2000, p. 150):

$$i_t^* = i^* + \beta(E\{\pi_{t,k}|\Omega_t\} - \pi^*) + \gamma\big(E\{x_{t,k}|\Omega_t\}\big) \tag{4}$$

In Equation 4, i_t^*; the expected short-term interest rate, $\pi_{t,k}$; the percentage change between t and $t + k$, π^*; the targeted inflation rate, $x_{t,k}$; the average output gap between period t and $t + k$, i^*; the desired interest rate, β; expectation-added inflation deviation response coefficient, γ; expectation-added output gap response coefficient, E; inflation and output gap. Ω_t; it is defined as a set of information that will ensure that the central bank is $i_t^* = i^*$. In case the expected inflation rate is more or less than the targeted rate, the central bank increases or decreases the targeted short-term interest rates with expectancy additions. The Central Bank follows the same strategy in case the expected output gap is more or less.

As the economic conjuncture alone does not take into account that the signs and values of β and γ may change, implicit real interest rule is proposed (Clarida et al., 2000).

3.2. Implied real interest rule

The implicit real interest rate rule aims to maintain economic stability against external shocks. The fixed real interest rate, which is assumed to be influenced by fixed and non-monetary factors in the long run, is defined as follows (Clarida et al., 2000, p. 151):

$$r_t^* = i_t^* - E(\pi_{t,k}\,\Omega_t) \tag{5}$$

$$r^* = i^* - \pi^* \tag{6}$$

In Equation 5, r_t^*; short-term implicit real interest rate; the long-run equilibrium, fixed and independent of monetary policy, represents the real interest rate. When both equations are included in Equation 4, the implicit real interest rate rule is as follows:

$$r_t^* = r^* + (\beta - 1(E\{\pi_{t,k}|\Omega_t\} - \pi^*)) + \gamma\big(E\{x_{t,k}|\Omega_t\}\big) \tag{7}$$

In Equation 7, r_t^* is adjusted according to the expected inflation deviation and changes in output gap, whether β is greater than or less than 1, and the value of γ. For example, in case of an increase in inflation or output gap with a sudden drop in nominal interest rates as a result of an external shock, if $\beta > 1$ or $\gamma > 0$, the short-term implicit real interest rate increases until the nominal interest rate reaches its original course. In this way, economic stability can be achieved. When $\beta = 0$ and $\gamma = 0$, economic stability cannot be achieved, as this rule is not effective against the increase in inflation and output gap.

However, it is explained by the following three assumptions that the forward-looking Taylor rule and the implicit real interest rule are simple and restrictive in explaining central bank interest rate decisions (Clarida et al., 2000, p. 151): First, there is no need for interest rate smoothing as the interest rate in the current period can be adjusted to the targeted rate without delay. Secondly, the central bank reacts systemically to changes in economic conditions. Finally, the central bank has excellent control over short-term interest rates.

3.3. Interest rate smoothing rule and external shocks

The interest rate smoothing rule is considered to be successful in achieving the real course of short-term interest rates or in reaching the estimated future rates (Clarida et al.; 2000, Rudebusch; 2001, Woodford; 2001, Orphanides; 2004). The interest rate smoothing rule, which includes the targeted and one-time lagged interest rates and the actual interest rate (i_t) is defined as follows (Clarida et al., 2000, p. 153):

$$i_t = \rho(L)i_{t-1} + (1 - \rho)i_t^* + v_t \tag{8}$$

Equation 8, $\rho(L) = \rho_1 + \rho_2 L + \cdots + \rho_n L^{n-1}$ and $\rho = \rho$ (1) with ρ; the degree of interest smoothing, L; the delay operator, vt; the zero-mean external interest shock represents the error term.

If equation 8 is expressed according to the prospective Taylor rule, it is possible to obtain the effect-response function[7] of the central bank interest rate decisions as follows:

$$i_t^* = i^* + \beta(E\{\pi_{t,k}|\Omega_t\} - \pi^*\}) + \gamma(E\{x_{t,k}|\Omega_t\}) \tag{9}$$

$$i_t^* = i^* - \beta\pi^* + \beta\pi_{t,k} + \gamma x_{t,k} \tag{10}$$

$$i_t^* = r^* + \pi^* - \beta\pi^* + \beta\pi_{t,k} + \gamma x_{t,k} \tag{11}$$

$$i_t^* = r^* - (\beta - 1)\pi^* + \beta\pi^* + \beta\pi_{t,k} + \gamma x_{t,k} \tag{12}$$

$$i_t^* = r^* - (\beta - 1)\pi^* + \beta\pi^* + \beta\pi_{t,k} + \gamma x_{t,k} \tag{13}$$

$$i_t = \rho(L)i_{t-1} + (1 - \rho)[r^* - (\beta - 1)\pi^* + \beta\pi^* + \beta\pi_{t,k} + \gamma x_{t,k}] + \varepsilon_t \tag{14}$$

In Equation 14, the error term (ε_t) that assumes the validity of the rule is assumed to be a linear combination of estimated errors and deficiencies in the data set (Clarida et al., 2000, pp. 153-154):

$$\varepsilon_t = -(1 - \rho)[\beta(\pi_{t,k} - E\{\pi_{t,k}|\Omega_t\} + \gamma(x_{t,k} - E\{x_{t,k}|\Omega_t\})] \tag{15}$$

When i_t is set, $z_t^{(8)}$ is written as the vector of known but unobservable variables (for example, $z_t \varepsilon \Omega_t$), including the orthogonal matrix[9] conditions in Equation 14 (Clarida et al., 2000, pp. 153-154):

$$E = [\, i_t - (1 - \rho)(r^* - (\beta - 1)\pi^* + \beta\pi^* + \beta\pi_{t,k} + \gamma x_{t,k}) + \rho(L)i_{t-1}] + z_t = 0 \tag{16}$$

In equation 16, an optimal weight matrix that computes the series correlation (ρ, β and γ), which is the basis for the estimation of the parameter vector, is calculated using the Generalized moments method (GMM) (ε_t) (Hansen, 1982, pp. 1032-1038). To the extent that the vector zt dimension is more than four (the number of predicted parameters), it refers to some preferred limiting constraints in order to evaluate the validity of the rule and the policy tools used.

In equation 16, if the default value of r^* - (β-1) π^*, π^* exists as a single term, it is stated that r^* value can also be obtained (Clarida et al., 2000). Therefore, the fixed term real interest rate is included in the estimation process as an external variable (Clarida et al., 2000; Rudebusch, 2001).

The rule of Taylor (1993) is rearranged according to Equation 16 and if the real interest rate is included in the equation as a fixed term, the final version of the interest smoothing rule is written as follows (Clarida et al., 2000, pp. 153-154):

$$i_t = \rho(L)i_{t-1} + (1-\rho)[i^* - \beta\pi^* + \beta\pi_{t,k} + \gamma x_{t,k}] + \varepsilon_t \tag{17}$$

$$i_t = \rho(L)i_{t-1} + (1-\rho)[\beta\pi_{t,k} + \gamma x_{t,k}] + \varepsilon_t \tag{18}$$

Equation 18 represents the interest smoothing rule. The value of ρ represents the effect of inflation deviation and output gap on actual interest rate. When $\rho = 1$, it is assumed that inflation and output gap have no effect on actual interest rate, whereas when $0 < \rho < 1$, inflation and output gap affect the actual interest rate.

As a result, interest smoothing coefficient representing a period lagged value of interest rate, furthermore, it is the weighted average of the current and previous period values of the interest rate which makes it close to the real interest rate in interest rate targets (Peker and Sümer, 2018, p. 80). This shows that the monetary policy authorities have taken decisions within the framework of the gradual interest rate policy and thus differentiates it from the original Taylor rule (Peker and Sümer, 2018, p. 80).

Conclusion

It has tried to ease its financial markets by lowering short-term interest rates, particularly in the US, Japan, the UK and the Euro Area. The economic recession led the central bank to provide liquidity to the markets through monetary expansion and credit expansion. In order to alleviate the uncertainties about these policies and to ensure the rapid results of the policies, verbal guidance has been made by communicating with the public. However, despite the abundance of liquidity in these countries due to the low policy interest rate, economic agents avoided spending and the liquidity trap stated by Keynes (1936) was experienced. While such a problem is experienced in developed countries in general, foreign capital mobility towards developing countries has increased. This has led to a sharp appreciation of the national currency and an increase in domestic credit utilization, as well as a reduction in financing costs in developing countries. Therefore, the negative effects of foreign trade and current transactions have led the central banks of these countries to similar alternative monetary policy instruments. For example, while the weight of monetary expansion in China, Turkey, the interest rate corridor, began to use the reserve and the reserve option mechanism active.

As a result, central banks responded with a response function based on interest rate volatility, in order to create an extended response and communication function that would affect financial markets.

Notes

[1] This study is based on the Ph.D. thesis on "The Impact of Central Bank Interest Decisions on Macroeconomic Variables" adopted on 09.04.2019. I would like to thank my supevisor dr. Osman Peker for his contribution to this study.

[2] Chang (1998, pp. 1-3) constructs the theory put forward by Kydland and Prescott using the father-son relationship: Father Federico wants to teach his teenage son Pablo the difficulties and value of work. To this end, Federico agrees to have Pablo cut his neighbors to Pablo for money. However, Federico's main problem is to persuade Pablo to work. For this, Federico promised Pablo that he could get a tattoo with the money he would earn in exchange for cutting the grass. But Pablo realized that he would want his father to buy a good book, for example, by refusing to keep his promise to him and refusing to work. Therefore, there was distrust between father and son.

[3] Friedman explained that helicopter money was imagined as a helicopter began to scatter $ 1000 banknotes. In 2003, the President of the FED stated that helicopter money could be created by making tax cuts instead of coinning money.

[4] Other types of crypto currencies are: Dash, Ethereum, Litecoin, Monero, Nem, Neo and Ripple.

[5] Basel is a capital consensus carried out by the BIS in 1930, which encourages central banks for international co-operation to ensure financial and financial stability. Basel I was published in 1988 and Basel II in 2004.

[6] Circular capital buffer is the provision of additional core capital as a precaution against the inadequacy of shareholders' equity in the elimination of financial risk arising from credit expansion.

[7] The effect-response function was obtained by using $r^* = i^* - \pi^*$.

[8] Clarida et al. (1998) by the forward-looking Taylor rule, $i_t = \vartheta + \emptyset E\{\pi_{t,k}|\Omega_t\} + \gamma E\{x_t|\Omega_t\} + \xi E\{z_t|\Omega_t\}$ defined as and unobservable variables in equality may be variables such as real exchange rate, foreign interest rate and money supply.

[9] A transpose (matrix displacement of rows and columns) and vice versa is the matrix that is equal to each other.

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The analysis of the quarterly evolution of the gross domestic product in 2019

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Abstract. *Gross Domestic Product is the most complex indicator of the results of a country. According to the methodology of the national accounts system, it is calculated quarterly and annually. The quarterly calculation of the Gross Domestic Product plays an important role both in establishing the situation at one time of the national economy's outcome, but also in obtaining accurate information about how the national economy has evolved and how it will evolve in the future.*

The analysis of the Quarterly Gross Domestic Product in 2019 showed an increase compared to the same quarter of the previous year 2018, as compared to the previous quarter. It has been found that overall in the third quarter the activity is a bit slower, i.e. the results are weaker, this probably taking into account the seasonal character of some activities marked during the summer holidays and many others. The analysis of the evolution of the Quarterly Gross Domestic Product was made on the basis of raw data series, but also on the basis of seasonally adjusted data series according to the number of days worked. The results are somewhat close and show an increase of the Gross Domestic Product in the last three years, reaching the end of 2019 to register a provisional increase of the Gross Domestic Product by 4.1%, compared to December or 2018. The analysis also expanded on how resources and uses contributed to the formation and growth of the Gross Domestic Product in each quarter and then annually. Some components of the resources and uses that had a negative effect were highlighted during the analysis, by increasing the price index on the results obtained within the national economy.

The analysis reveals a particular model of interpretation and quarterly study, which needs to be carried out in order to identify the stage in which the evolution of the economic activity is and the effect that the measures taken by the authorities in the national development programs have.

Keywords: Quarterly GDP, resources, uses, price index, volume index, estimator.

JEL Classification: E01, E20.

Introduction

In this article of quarterly analysis of the evolution of the Gross Domestic Product of Romania, the authors started from simple to complex, trying to identify the results that were obtained quarter by quarter, in order to identify some influences that determine the growth, reduction or at least maintaining, stagnating at a certain level the results obtained.

The analysis was made on the basis of the raw data series and the seasonally adjusted data series according to the number of days worked, but also according to the evolution of the price index and the volumes realized, which alone give the value indicator of the participation of each aggregate in the formation and growth of the Internal Product. Gross, but in the end I also give the effect that each sector of activity (each resource or use) has in achieving the growth of the Gross Domestic Product quarterly.

The analysis also came down to some interpretations over longer periods of time, precisely to highlight how the quarterly evolution of the Gross Domestic Product played an important or more modest role in the results obtained by the national economy of Romania.

The article presents a series of complex data provided by the National Institute of Statistics, using and interpreting the respective data in correlation and in close interdependence with the objective that must always be kept in mind, namely that of maintaining macroeconomic macrostability.

There are graphical representations, as well as possibilities of analysis based on the increase in volumes or price indices, in certain fields of activity and in total. The analysis also compares the results obtained according to the evolution of the main indicators that characterize the structural evolution and on the whole of the national economy quarterly and then annually. In fact, the study ends with an analysis of how the Gross Domestic Product evolved according to resources and uses according to the volume and price indices, as well as the resources and uses they had, revealing a series of issues to consider in the respective analysis. Of course, the analysis can also be extended by using statistical-econometric models, but this implies the extension of the respective study much extended in this variant compared to the objective that the authors had.

Literature review

Anghel, Burea and Dumbravă (2018) addressed a number of issues regarding the use of GDP for comparative analysis. A similar theme is studied by Anghelache, Soare and Popovici (2015). Anghelache (2018) has carried out an extensive study regarding the evolution of GDP in the European Union as a whole, as well as at the level of the Member States. Bachman (2011), as well as Censolo and Colombo (2008) analyzed a number of elements regarding the structure and effect of public consumption on the evolution of the economy. Barro and Redlick (2011) were concerned with identifying the macroeconomic impact of public spending. Issues related to Nominal Gross Domestic Product are highlighted by Bhandari and Frankel (2015) and Garin, Lester, and Sims (2016). Chamberlin (2011) studied the correlation between GDP, real income and

economic welfare at a country level. Some aspects of the economic welfare are also studied by Fleurbaey (2009). Foerster and Choi (2016), as well as Kaplan and Violante (2014) analyzed the effect of applying measures to stimulate consumption growth in order to recover from the financial crisis. Guner, Ventura and Yi (2008) and Macchiarelli (2013) studied the effect of policies applied at the macroeconomic level. Jorgenson and Slesnick (2008) studied the relationship between consumption and labor, while Pistoresi and Rinaldi (2012) analyzed the correlation between exports, imports and economic growth. Woodford (2010) analyzed the effect of financial intermediation on the market evolution.

Some methodological details

The Gross Domestic Product is the most complex and representative indicator that is calculated at the macroeconomic level, most accurately reflecting the results obtained over a period of one year. It is used for static, dynamic analysis but also for international comparisons. By analyzing the resources and uses, we obtain conclusive data on the national economy, the possibilities of growth and development. This indicator, in its evolution, compared to the demographic indicator, the population of the country, offers the possibility of appreciation of incomes per inhabitant, an aspect that leads to the assessment of the standard of living, to the quality of life.

The Gross Domestic Product can be calculated monthly, quarterly and finally annually, according to the methodology of the national accounts system. These calculations of GDP are performed for the purpose of intermediate and annual analysis, in order to obtain useful data in undertaking economic strategy measures. GDP can be calculated at factor prices or at market prices.

The quarterly Gross Domestic Product at market price (PIBT) represents the final result of the activity of the resident economic agents, during a period, respectively a quarter. The quarterly Gross Domestic Product at market price is usually estimated by two methods: the production method and the expense method.

The production method takes into account gross added value, inventions and subsidies on the product.

The expenditure method is based on the cumulation of the actual final consumption, the gross formation of capital, the export of goods and services and the import of goods and services.

Also, the GDP can also be calculated by the method of income, respectively the remuneration of the employees, the gross operating surplus, taxes on production and imports and subsidies on production and imports.

The main data sources used for the estimation of the Gross Domestic Product are the statistical ones (infra-annual surveys regarding industrial production, construction, services, trade; the agricultural production account calculated on the basis of the data provided by the Ministry of Agriculture; infra-annual surveys regarding the earnings and the number of employees) financial-accounting (accounting balances of financial

institutions) and administrative (execution of the state budget and local budgets, as well as of the state social insurance budget; balance of external payments).

The estimation of production at current prices is performed for non-financial companies (enterprises), population households and non-profit institutions serving population households are estimated, by activity branches, by extrapolation in volume and price, or in value.

Intermediate consumption is estimated for non-financial societies (enterprises), population households and non-profit institutions serving population households are estimated, by activity branches, by applying the weight of intermediate consumption in calculated production.

For financial companies and public administrations, intermediate consumption is determined directly on the basis of data sources (accounting balances and budgetary executions).

The gross value added is estimated as a balance between production and intermediate consumption, and the taxes and subsidies on the product are determined based on the data from the budget execution.

The gross domestic product is estimated in current prices, in the prices of the previous year and in average prices of the year 2000. The estimates in the average prices of the year 2000 are calculated by linking the volume indices. In addition to the gross estimates of the Gross Domestic Product, seasonally adjusted estimates are calculated using the regressive method recommended by the European regulations.

The seasonal adjustment aims to eliminate the seasonal influences within the data series in order to highlight the real economic evolution from consecutive periods.

The national accounts in Romania present, in general, a strong seasonality, being adjusted also according to the number of working days and calendar, even if their effect is insignificant.

The seasonally adjusted series was obtained by eliminating from the gross series the seasonal effect, with the help of correction coefficients, established according to the regression model used. The additive or multiplicative model used for regression is automatically identified by the JDemetra program depending on the nature of the series subject to adjustment.

Seasonally adjusted GDP is obtained by the direct method, which can lead to a statistical discrepancy between GDP and the sum of its seasonally adjusted components.

Starting with 2012, the policy of estimating and disseminating the Quarterly Gross Domestic Product was modified by introducing a third estimate, called provisional data (2).

Data, results and discussions

The analysis of the evolution of the Gross Domestic Product can be made on the basis of annual or quarterly data series. To clear the trend of evolution in the next period we will conduct a study on a quarterly basis.

In this sense, the Gross Domestic Product in the fourth quarter of 2019 compared with the third quarter of 2019 was, in real terms, higher by 1.5%. Compared to the third quarter of 2019, the Gross Domestic Product registered an increase of 4.3% on the gross series and 4.2% on the seasonally adjusted series.

Next we will resort to the seasonal evolution of the quarterly GDP in the period 2017-2019, calculated as gross series and seasonally adjusted series. The data series is presented in Table 1.

Table 1. *The evolution of the quarterly GDP, for the period 2017-2019*

		Quarter I	Quarter II	Quarter III	Quarter IV	Year
- in % compared to the corresponding period of the previous year -						
Gross series	**2017**	105.9	106.4	108.9	106.8	107.1
	2018	104.4	104.5	104.5	104.4	104.4
	2019	105.0	104.4	103.0	104.3	104.1
Seasonally adjusted series	**2017**	106.2	106.4	108.3	106.8	-
	2018	104.8	104.7	104.3	104.3	-
	2019	105.0	104.4	103.2	104.2	-
- in% compared to the previous quarter -						
Seasonally adjusted series	**2017**	102.4	101.6	102.0	100.6	-
	2018	100.5	101.5	101.7	100.6	-
	2019	101.1	100.9	100.6	101.5	-

Source: National Institute of Statistics, press release no. 61/10.03.2020.

From the data presented in the table it is observed that in all quarters of 2019, the GDP has increased in quarterly terms. In the third quarter of 2019, the growth was the smallest. The results regarding the analysis based on the data as gross or seasonally adjusted series are similar. In the five years under review, it is found that the calculated annual GDP decreased, respectively 107.1% in 2017, 104.4% in 2018 and 104.1% in 2019.

The Gross Domestic Product estimated based on the seasonal adjustment estimated for the fourth quarter of 2019 was 274.0049 billion lei, current prices rising, in real terms, by 1.5% compared to the third quarter 2019 and 4.2% compared to the quarter IV 2018. The data are summarized in Table 2.

Table 2. *Quarterly GDP evolution, in 2019 based on seasonally adjusted series*

	Quarter I	Quarter II	Quarter III	Quarter IV
Billions lei, current prices	252.7499	258.1521	264.5216	274.0049
In % compared to the previous quarter	101.1	100.9	100.6	101.5
In % compared to the corresponding period of the previous year	105.0	104.4	103.2	104.2

Source: National Institute of Statistics, press release no. 61/10.03.2020.

Analyzing over a longer period of time, we find out how the quarterly Gross Domestic Product evolved in the main branches of the national economy. The data are compared with the quarterly average calculated for the year 2000. In the Graph 1 these data are presented.

Graph 1. *GDP evolution – seasonally adjusted series*
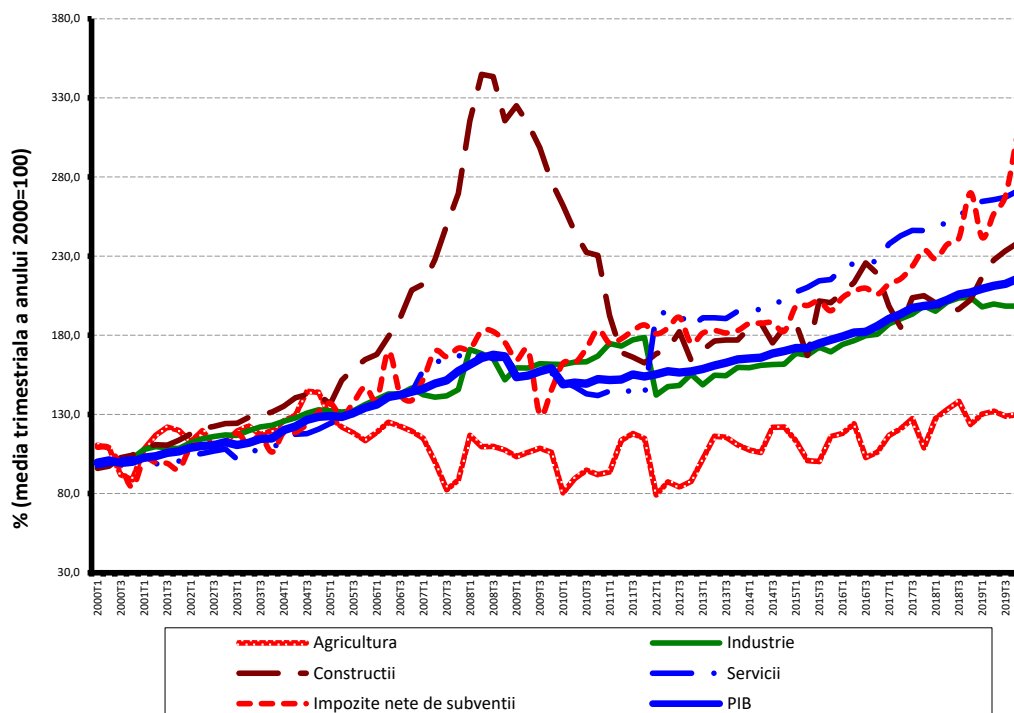
Source: INS release no. 61/10.03.2020.

From the analysis carried out on the basis of the gross series we find that the Gross Domestic Product estimated for the fourth quarter of 2019 was 320.3731 billion lei current prices, in real terms, with 4.3% increase compared to the fourth quarter of 2018. The data are summarized in Table 3.

Table 3. *Quarterly GDP, in 2019, gross series*

	Quarter I	Quarter II	Quarter III	Quarter IV	2019
Billions lei, current prices	201.9831	241.8627	289.6659	320.3731	1053.8848
In % compared to the corresponding period of the previous year	105.0	104.4	103.0	104.3	104.1

Source: National Institute of Statistics, press release no. 61/10.03.2020.

The estimated GDP for the whole of 2019 was 1,053.8848 billion lei at current prices, being 4.1% higher than in 2018.

The analysis of the contribution of the categories of resources and uses to the realization of the Gross Domestic Product

From the data presented in Table 4, it turns out that in 2019 the GDP growth compared to 2018, contributed the majority of the branches of the economy, positive contributions more important having the following branches: constructions (+ 0.9%), with a share of 6.4% in GDP formation and whose activity volume increased by 16.8%; wholesale and

retail trade; repair of motor vehicles and motorcycles; transportation and storage; hotels and restaurants (+ 0.9%), with a share of 18.2% in GDP formation and whose volume of activity increased by 4.8%; net taxes on the product (+ 0.9%), with a weight of 9.3% at GDP formation and whose activity volume increased by 9.5%.

In 2019, the industry made a negative contribution to GDP growth (-0.3%) as a result of reducing its volume of activity by 1.5%. This is a new situation and it seems that, due to the lack of technology, this branch will have a downward trend in terms of contribution, in absolute and relative figures to the formation of the Gross Domestic Product.

The estimations expressed are based on the data series in Table 4. It is found that the gross added value for the entire economy was 90.70% of the Gross Domestic Product.

Table 4. *The contribution of the resource categories to the formation and growth of the Gross Domestic Product, in the fourth quarter and the year 2019*

	Contribution to GDP formation %		Contribution to GDP growth %	
	Quarter IV	Year 2019	Quarter IV	Year 2019
Agriculture, forestry and fishing	2.0	4.1	0.1	0.0
Industry	22.0	21.9	-0.6	-0.3
Construction	11.2	6.4	1.6	0.9
Wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storage; hotels and restaurants	18.0	18.2	0.8	0.9
Information and communication	5.2	5.6	0.3	0.4
Financial intermediation and insurance	2.6	2.4	0.0	0.0
Real estate transactions	6.9	7.3	0.6	0.4
Professional, scientific and technical activities; administrative service activities and activities of support services	8.0	7.9	0.2	0.4
Public administration and defense; social insurance from the public system; education; health and social assistance	11.7	13.5	0.3	0.3
Performing, cultural and recreational activities; repair of household products and other services	3.1	3.4	0.1	0.2
Gross value added – total	**90.7**	**90.7**	**3.4**	**3.2**
Net taxes on the product	**9.3**	**9.3**	**0.9**	**0.9**
Gross domestic product	**100.0**	**100.0**	**4.3**	**4.1**

Source: National Institute of Statistics, press release no. 61/10.03.2020.

From the point of view of the weights of the uses of the GDP, the increase was due, especially the final consumption expenditures of the households, whose volume increased by 5.9% contributing by 3.7% to the GDP growth and the gross formation of fixed capital, whose volume increased by 17.8%, contributing 3.7% to GDP growth. A negative contribution to GDP growth and in the fourth quarter, as in the whole of 2019, had a net export (-1.7%), a consequence of the 3.5% increase in the volume of exports of goods and services correlated with a higher increase in the volume of imports of goods and services, by 7.2%.

The data on the contribution of the categories of uses to the formation and growth of the quarterly and annual GDP are summarized in Table 5.

Table 5. *Contribution of the categories of uses to the formation and growth of the Gross Domestic Product, in the fourth quarter and the year 2019*

	Contribution to GDP formation %		Contribution to GDP growth %	
	Quarter IV	Year 2019	Quarter IV	Year 2019
Total actual final consumption	**80.6**	**81.3**	**6.5**	**4.9**
Effective individual final consumption of households	71.1	71.2	4.8	3.7
Expenditure for final consumption of households	61.8	63.1	4.4	3.7
Expenditure for final consumption of non-profit institutions in the service of households	1.5	0.8	0.0	0.0
Expenditure for individual final consumption of public administrations	7.8	7.3	0.4	0.0
The actual final collective consumption of public administrations	9.5	10.1	1.7	1.2
Gross fixed capital formation	**23.3**	**23.7**	**3.2**	**3.7**
Stock changes	**0.8**	**-1.0**	**-4.1**	**-2.8**
Net export of goods and services	**-4.7**	**-4.0**	**-1.3**	**-1.7**
Export of goods and services	33.4	40.1	1.1	1.5
Import of goods and services	38.1	44.1	2.4	3.2
The gross domestic product	**100.0**	**100.0**	**4.3**	**4.1**

Source: National Institute of Statistics, press release no. 61/10.03.2020.

Table 6 summarizes the contribution to the formation and growth of GDP in the fourth quarter of 2019 by resources and uses, taking into account the contribution made by the increase in volume compared to the fourth quarter of 2018 and the change in prices over the same period of comparison. Price indexes were found to have a negative influence, especially in agriculture, forestry and fisheries (118.8%), construction (112.5%), financial and insurance intermediation (108.7%) and industry (108, 4%). In terms of volume, significant contributions had gross product taxes (109.8%), construction (117.2%) and financial intermediation (108.0%).

From the point of view of the uses, as a realized volume, we notice the final collective consumption (118.8%), the gross formation of capital (115.2%), the individual final collective consumption and of the households (107.0%, respectively 7.2%). From the point of view of the price, the expenditure for the individual final consumption and of the public administration (112.8%), had a big negative contribution.

The data on the evolution of the quarterly GDP in 2019 based on the gross data series are summarized in Table 6.

Table 6. *Gross Domestic Product by categories of resources and uses, in the fourth quarter of 2019*

	Achievements billions RON current prices	Volume indices % compared to the quarter IV 2019	Price indices % compared to the quarter IV 2019
Agriculture, forestry and fishing	6.5463	103.1	118.8
Industry	70.4287	97.6	108.4
construction	35.7655	117.2	112.5
Wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storage; hotels and restaurants	57.6794	104.5	106.4
Information and communication	16.5467	106.1	106.1
Financial intermediation and insurance	8.2181	98.5	108.7
Real estate transactions	22.1008	108.0	103.4
Professional, scientific and technical activities; administrative service activities and support service activities	25.5420	101.9	106.1
Public administration and defense; social insurance from the public system; education; health and social assistance	37.5717	102.3	107.1

	Achievements billions RON current prices	Volume indices % compared to the quarter IV 2019	Price indices % compared to the quarter IV 2019
Performing, cultural and recreational activities; repair of household products and other services	10.0588	104.3	106.1
Gross value added – total	290.4580	103.7	107.7
Net taxes on the product	29.9151	109.8	100.2
Gross Domestic Product	**320.3731**	**104.3**	**107.0**
Actual final consumption	25.8004	108.3	105.8
Effective individual final consumption of households	227.6414	107.0	106.5
Expenditure for final consumption of households	198.0350	107.2	105.9
Expenditure for final consumption of non-profit institutions in the service of households	4.7553	103.0	103.1
Expenditure for individual final consumption of public administrations	24.8511	105.9	112.8
Actual collective final consumption of public administrations	30.3629	118.8	100.5
Gross capital formation	77.1847	96.4	107.8
from which:			
Gross fixed capital formation	74.5805	115.2	106.2
Net export of goods and services	-14.8159	-	-
Export of goods and services	107.0142	103.1	102.0
Import of goods and services	121.8301	106.1	100.8

Source: National Institute of Statistics, press release no. 61/10.03.2020.

The analysis of the realization and growth of the Gross Domestic Product, based on the seasonally adjusted series according to the number of working days, after resources and uses will be made based on the data in Table 7. And in this case, the contribution of the volume and price changes will be considered. The volume increased in taxes and duties (114.2%) and in real estate transactions (102.5%). The prices did not increase too much, except for public administration and defense, social insurance, education, health and social assistance (104.3%) and cultural activities (103.5%).

From the point of view of the uses we see volume increases at the gross capital formation (148.4%), and the final collective consumption of the public administration (125.8%). Prices changed moderately, with significant decreases in gross capital formation (66.8%) and the final collective consumption of public administrations (83.1%).

The data regarding the evolution of GDP in the fourth quarter of 2019 compared to the third quarter of the same year, are summarized in Table 7.

Table 7. *Gross Domestic Product by categories of resources and uses, in the fourth quarter of 2019*

	Achievements billions RON current prices	Volume indices % compared to the quarter III 2019	Price indices % compared to the quarter III 2019
Agriculture, forestry and fishing	10.2546	100.8	92.4
Industry	58.9854	100.0	102.4
construction	17.6397	102.0	102.7
Wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storage; hotels and restaurants	49.9771	101.8	102.4
Information and communication	15.2306	102.4	99.7
Financial intermediation and insurance	6.6180	100.6	101.6
Real estate transactions	20.2699	102.5	102.5
Professional, scientific and technical activities; administrative service activities and support service activities	20.8632	97.9	99.8

	Achievements billions RON current prices	Volume indices % compared to the quarter III 2019	Price indices % compared to the quarter III 2019
Public administration and defense; social insurance from the public system; education; health and social assistance	37.3720	100.1	104.3
Performing, cultural and recreational activities; repair of household products and other services	9.2934	100.4	103.5
Gross value added – total	246.5039	101.1	101.5
Net taxes on the product	26.4756	114.2	93.0
Statistical discrepancy	1.0254	-	-
Gross Domestic Product	**274.0049**	**101.5**	**102.0**
Actual final consumption	227.0997	105.2	100.5
Effective individual final consumption of households	199.0479	104.0	101.8
Expenditure for final consumption of households	175.2732	104.0	101.4
Expenditure for final consumption of non-profit institutions in the service of households	2.2429	104.0	98.2
Expenditure for individual final consumption of public administrations	21.5318	105.9	104.2
Actual collective final consumption of public administrations	28.0518	125.8	83.1
Gross capital formation	58.5318	148.4	66.8
from which:			
Gross fixed capital formation	64.3148	96.2	103.2
Net export of goods and services	-11.5113	-	-
Export of goods and services	107.4589	100.5	100.5
Import of goods and services	118.9702	100.7	100.3
Statistical discrepancy	-0.1153	-	-

Source: National Institute of Statistics, press release no. 61/10.03.2020.

By extending the analysis throughout the year 2019, by resources and uses, as well as by fields of activity, depending on the volume and price indices, we will identify some important aspects. The data are presented in Table 8.

Table 8. *Gross Domestic Product by category of resources and uses, in 2019*

	Achievements billions RON current prices	Volume indices % compared to the year 2018	Price indices % compared to the year 2018
Agriculture, forestry and fishing	43.4554	96.8	108.2
Industry	230.9857	98.5	108.0
construction	67.2990	116.8	110.2
Wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storage; hotels and restaurants	191.6088	104.8	106.3
Information and communication	58.4979	108.1	105.7
Financial intermediation and insurance	25.7029	99.3	109.4
Real estate transactions	76.7885	105.7	102.0
Professional, scientific and technical activities; administrative service activities and support service activities	83.0685	105.7	107.3
Public administration and defense; social insurance from the public system; education; health and social assistance	142.4923	102.5	108.9
Performing, cultural and recreational activities; repair of household products and other services	35.5977	107.3	107.1
Gross value added – total	955.4967	103.5	107.2
Net taxes on the product	98.3881	109.5	98.1
Gross Domestic Product	**1053.8848**	**104.1**	**106.3**
Actual final consumption	857.1308	106.2	105.6
Effective individual final consumption of households	750.4099	105.3	105.6
Expenditure for final consumption of households	664.9652	105.9	105.3
Expenditure for final consumption of non-profit institutions in the service of households	8.7994	102.4	103.3

	Achievements billions RON current prices	Volume indices % compared to the year 2018	Price indices % compared to the year 2018
Expenditure for individual final consumption of public administrations	76.6453	100.3	109.1
Actual collective final consumption of public administrations	106.7209	112.8	105.6
Gross capital formation	238.5002	103.9	105.9
from which:			
Gross fixed capital formation	249.2985	117.8	106.0
Net export of goods and services	-41.7462	-	-
Export of goods and services	423.1073	103.5	103.3
Import of goods and services	464.8535	107.2	102.1

Source: National Institute of Statistics, press release no. 61/10.03.2020.

In terms of resources, the volume increased in constructions (116.8%), information and communications (108.1%). Price indices increased, with a negative contribution, in financial and insurance intermediation (109.4%), public administration and defense (108.9%), agriculture (108.2%), construction (110.2%) and industry (108.0%). The study, after use, indicates volume increases at gross capital formation (117.8%), actual collective final consumption of public administration (112.8%), import of goods and services (107.2%). Price indices increased at the individual final consumption of public administration (109.1%), gross capital formation (106.0%), actual final consumption (105.6%).

Conclusions

The data contained in the article based on the study by the authors ensure that some theoretical conclusions are reached. First of all, it is noted that the quarterly evolution of the Gross Domestic Product offers indicators on aggregates and on the total, which allow the possibility of inter-temporal analyzes of the way the Gross Domestic Product evolves and especially compared with the respective forecasts, to identify those measures that would be worth doing to ensure a more pronounced growth of the Gross Domestic Product.

Attention was paid to volume indices and price indices, establishing that price indices play a negative role on the contribution of components, aggregated to the formation of the Gross Domestic Product and especially to its growth.

A simplified study would lead to the conclusion that this 4.1% increase in 2019 is somewhat mitigated by the concomitant increase in the consumer price index or the harmonized price increase index. Therefore, another conclusion is that the harmonization of macroeconomic proportions and correlations must take into account measures that will reduce the inflation rate, but at the same time cause a more substantial increase in volume.

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*** Institutul Național de Statistică, Comunicat nr. 61/10.03.2020.

The analysis of the international trade of Romania

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Abstract. *The international commercial activity is important for any national economy, in the sense that the surplus of goods and services that can be realized is the object of the exports, and the harmonization of the correlations within the national economy can often be ensured by complementary imports. No country in the world under the current conditions can operate under autarchy, so it can no longer procure absolutely everything it needs to carry out its activity.*
In 2019, Romania continued to grow on consumption, first and foremost, on investment. This aspect will be maintained further because, especially in the current conditions of the pandemic that invaded mankind, the conditions of macrostability can be ensured. Going beyond this, we are interested in 2019 how, within the economy of our country, imports and exports have been made. Imports and exports should be analyzed from the point of view of the contribution made by the economic agents to the exports and especially the efficiency of the imports in the context where the net export, that is the difference between export and import is negative and affects the annual results of Romania.
The analysis of the foreign trade activity is carried out both within the intra-community, but also in the extra-community one, meaning that the studies lead to the conclusion that Romania's main import-export activity is carried out within the intra-community framework of the 27 states, who are currently members after the Brexit that led to the United Kingdom leaving the European Union concert. The analysis of import and export inside and outside the EU shows that, especially within the European Union, the balance of foreign trade balance or foreign payments is negative. Also, the study shows that both imports and exports have increased year by year, but at the same time, the more alert pace has been the imports that have determined the widening of the value difference between the two activities of international economic exchanges, causing the surplus of the balance to increase. Foreign or commercial payments. The article addresses these issues as a whole and finally some analyzes are made using statistical and econometric methods and models, which highlight the correlation between imports and total trade, total imports and imports on the two structures, to detect exports on those two structures. The article makes complex references to the complete situation registered by Romania in 2019, with relevant analysis and on January 2020, in order to highlight and highlight the trend in the coming period.

Keywords: import, export, trade balance, European Union, trade, economic growth.

JEL Classification: C10, C20, E01.

Introduction

In this article, the focus is on the presentation of the way in which the imports and exports are carried out within the international trade, in this respect aiming to highlight the effect that the international commercial activity has on the results obtained by Romania in each period of time. Specifically, exports are necessary, imports are also needed especially when they are complementary and strictly necessary for the national economy, but the study shows that the structure of imports by part satisfies this perspective. From this point of view, it is studied and it is concluded that this evolution will cause a depreciation in a certain sense of the concrete results, both monthly, quarterly and annually.

There is also a longer-term analysis, in order to show on the basis of figures, charts and data series presented in the tables, that the evolution of the Romanian trade does not fully respect the need to support the economic growth, of the growth of the Gross Domestic Product as the national indicator of results.

The study is conducted both on the basis of data and on the basis of some interpretations of these data, correlated and adjusted, in the sense of intuiting what will be the evolutionary trend of the international trade activity of Romania. There is a study of the international commercial evolution of Romania in the intra-community case, as well as in the extra-community framework. The data are correlated and using the simple linear regression method, the influence of the export on the one hand and the import on the other hand in increasing the volume of international trade is emphasized. Also, the calculated regression parameters ensure the estimation and extension of the evolution prospects of the Romanian economy from the point of view of the net export (exports minus imports).

The article is accompanied by charts and tables, series of data that really and positively highlight the perspective that we should expect in the next period.

Literature review

Algieri (2006) analyzed the development of the international tourism in some small states. Amiti, Itskhoki and Konings (2014) studied the correlation between the participants in the international trade activity and the evolution of the exchange rate. Anghel, Anghelache and Niță (2017) conducted a study on the impact of international trade on economic growth in the EU. Anghelache, Marinescu and Samson (2019) highlighted a number of elements of Eurostat's methodology used in the international trade statistics. Anghelache, Anghelache and Dumbravă (2009), as well as Bernard, Jensen, Redding, and Schott (2012) addressed a number of issues regarding the analysis of foreign trade activity as a whole, while Borio, James and Shin (2014) have were concerned about the international monetary system. Büthe and Milner (2008) addressed some issues regarding the FDI policy in the developing countries. Caron, Fally and Markusen (2014) highlighted the importance of knowing the correlation between production and consumer preferences in order to make international trade more efficient. Hummels (2007) analyzed the influence of transport costs on international trade.

Fajgelbaum, Grossman and Helpman (2011) studied some aspects of product quality and income distribution in international trade. A similar theme is also addressed by Waugh (2010). Guerrieri and Vergara Caffarell (2012) studied the implications of free market and international trade on production in the EU. Kehoea, Pujolàsd and Ruhle (2016) analyzed aspects regarding the identification of opportunity costs by entrepreneurs in the activities carried out in international trade. Konya (2006) investigated the correlation between export levels and economic growth. Soderbery (2015) analyzed methods of estimating the import demand and supply. Staiger and Sykes (2011) presented a number of elements regarding the internal regulations of international trade.

Some methodological considerations

The statistics of international trade in goods and services are established by cumulating data from the INTRASTAT and EXTRASTAT statistical databases.

The databases of the INTRASTAT system include the exchanges of goods between Romania and the other Member States of the European Union, and the databases on the EXTRASTAT system contain the data regarding the exchanges of goods between Romania and the states that are not members of the European Union.

Regarding the intra-EU trade, we specify that it includes shipments of goods from Romania to another EU member state and the introduction of goods to Romania having another EU member state as the country of dispatch. In another vision, intra-EU trade is also called intra-Community sales.

Romania sells (exports) to the Member States of the European Union goods with free movement that leave the territory of Romania destined for another EU member state, as well as goods that have been placed under the customs procedure of active processing (in our country) or processing under customs control and which are intended to be delivered to other Member States.

As regards imports (entries) into Romania, these include goods with free movement in an EU member state, which enters the territory of Romania, as well as goods that have been placed under the active procedure of processing or processing under customs control in another. EU member state, but entering Romania.

It is clear from the existing statistical data that, at present, intra-Community trade holds the share in the international trade of Romania.

EXTRA-COMMUNITY TRADE includes exchanges of goods between Romania and non-EU countries, which have as their object the direct import of consumer goods, imported goods removed from customs warehouses or free zones for consumption, export of goods produced in Romania, as well as and the export of imported goods, declared for domestic consumption.

Also, in this structure of EXTRA-EU exchanges we also consider the temporary imports of foreign goods for active processing within the country, the exports of compensating products resulting after the active processing, the temporary exports of goods for passive

processing in other countries, the imports of compensating products resulting after processing abroad and the goods imported or exported in the financial leasing system, at the full value of the goods, as well as the quasi-exports, for which, at the national border, customs declarations of export, related to the international transactions of the non-resident economic operators in Romania.

Please note that goods in transit, temporary goods admitted or removed to and from the country (except for processing), goods purchased by international organizations for their own use in our country, goods for and after repairs and spare parts are not included in international trade related to machines operating in the Romanian economy.

Values, goods are expressed in FOB prices for exports and in CIF prices for imports. The FOB price represents the price at the border of the exporting country and includes the value of the good, all the transport costs to the point of embarkation, as well as all the related taxes so that the goods can be exported.

The CIF price is the price at the border of the importing country and includes both the component elements of the FOB price, as well as the cost of international insurance and transport.

In the statistical data system the value data are expressed in euros and lei. The conversion into euro of the value data expressed in lei is made using the average monthly exchange rate lei/euro communicated by the National Bank of Romania, for INTRASTAT trade and the exchange rate lei/euro communicated by the National Bank of Romania for the penultimate day of Wednesday of the month, for EXTRASTAT trade.

In reporting the data on the international trade of Romania, the expression in foreign currency (Euro, Dollar etc.) is done to ensure comparability, but depending on the exchange rate, the value is diminished due to the weaker position on the currency market of the currency national.

The data sources in the case of INTRA-EU trade are the INTRASTAT statistical statements collected by the National Institute of Statistics directly from the economic operators who have made a value volume of intra-Community shipments of goods and/or a value volume of intra-Community goods deliveries. Also, the data are obtained from the customs declarations collected and processed by the National Agency for Tax Administration, for intra-Community trade regarding goods for internal processing or processing under customs control, goods that move from and to parts of the EU statistical territory but which do not belong to the fiscal territory of the EU.

We note that in the case of EXTRA-EU trade, the data are obtained from the National Agency for Tax Administration, which collects and processes the customs declarations of export and import. In the case of the authorized economic operators for simplified customs procedures, they send to the NIS export and import data using a form with a predetermined structure.

In connection with the international trade in goods, electricity and natural gas, data are collected through statistical forms from importing or exporting companies and from network operators.

Data, results and discussions

During 2019, the export and import of goods from Romania was carried out on two fronts, namely intra-community and extra-community. The study shows that, over time, exports increased in value, but the deficit of the international trade balance increased, as a result of the share, in absolute data, of imports.

Thus, for example, only in January 2020, exports increased, reaching 5.6921 billion euros, 3.3% more than in January 2019. In the same comparable period, imports reached 7.0151 billion euro, i.e. 3.4% more than in January 2019. In these conditions, the deficit of the trade balance was of -1.323 billion euros, 50 million more than in January 2019.

By analyzing the monthly evolution of exports, imports and trade balance, between January 2015 and January 2020, we find that all three mentioned indicators have grown permanently. Imports are growing faster, which has led to an increase in the trade balance deficit. The evolution of the three indicators is presented suggestively in Graph 1.

Graph 1. *Exports, imports and trade balance between January 2015 – January 2020*
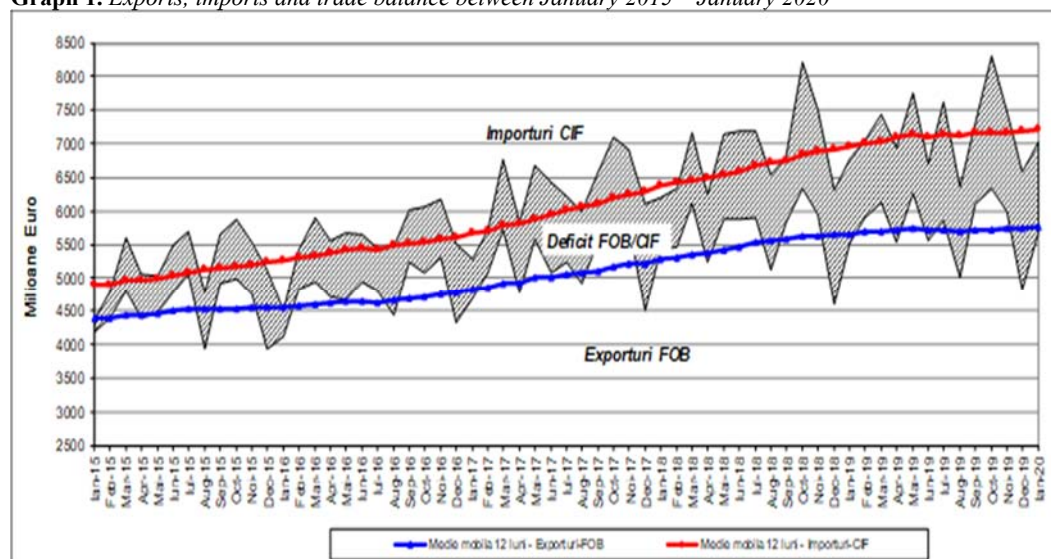
Source: INS press release 64/11 March 2020.

During the analyzed period, it is clear that in the structure of imports, the share held by the transport machinery and equipment and other manufactured products. At export, the machines and equipment held the highest weight. Comparing the trade in January 2020, with the same month of 2019, it is precisely the trend that we mentioned earlier. Table 1 presents, briefly, the structure of trade in January 2020.

Table 1. *International trade by product group according to CSCI Rev. 4, in January 2020*

	Exports FOB			Imports CIF		
	January 2020			January 2020		
	Millions euro	Total import weight (%)	% compared to January 2019	Millions euro	Total import weight (%)	% compared to January 2019
TOTAL	5692,1	100,0	+3,3	7015,1	100,0	+3,4
of which, in relation to UE	4446,4	78,1	+2,5	5108,1	72,8	+1,6
Live food and animals	394,7	6,9	+18,9	588,1	8,4	+13,1
of which, in relation to UE	178,8	3,1	-8,0	504,9	7,2	+11,1
Drinks and tobacco	106,8	1,9	+30,8	55,5	0,8	+10,8
of which, in relation to UE	93,4	1,6	+35,1	42,5	0,6	+21,0
Raw materials, non-edible, excluding fuel	206,9	3,6	+24,0	180,0	2,6	-9,4
of which, in relation to UE	128,3	2,3	+24,1	117,5	1,7	-5,0
Mineral fuels, lubricants and derivatives	243,4	4,3	+8,8	610,3	8,7	+8,8
of which, in relation to UE	115,1	2,0	+46,6	113,4	1,6	-16,9
Oils, fats and waxes of animal and vegetable origin	15,5	0,3	-21,5	14,8	0,2	+16,2
of which, in relation to UE	10,4	0,2	-37,5	13,5	0,2	+23,9
Chemicals and derivatives not specified in another section	223,3	3,9	-11,7	966,7	13,8	+5,2
of which, in relation to UE	160,8	2,8	-9,6	782,2	11,2	+0,8
Manufactured goods classified mainly by raw material	911,4	16,0	-1,1	1259,6	18,0	-0,8
of which, in relation to UE	692,3	12,2	-2,3	934,3	13,3	-4,1
Transport machinery and equipment	2738,6	48,1	+3,5	2539,2	36,2	+1,6
of which, in relation to UE	2315,0	40,7	+4,4	2009,6	28,6	+3,9
Different manufactured articles	840,8	14,8	-1,6	799,0	11,4	+6,6
of which, in relation to UE	750,0	13,2	-2,4	588,5	8,4	+1,7
Goods not included in another section of the CSCI	10,7	0,2	+5,1	1,9	*)	+2,4
of which, in relation to UE	2,3	*)	+59,7	1,6	*)	+6,9

Source: National Institute of Statistics, press release no. 64/11 March 2020.

Analyzing the evolution of exchanges (import and export) on the two data groups, intra-EU and extra-EU, we find that the value of intra-EU28 exchanges of goods in January 2020 was 4446.4 million euros for export (shipments) and of 5108.1 million euros on imports (introductions), representing 78.1% of total exports and 72.8% of total imports.

In the case of trade with non-EU countries, the value of trade in goods in January 2020 was 1245.7 million euros for exports and 1907.0 million euros for imports, representing 21.9% of total exports and 27.2% of total exports total imports.

Table 1 contains these data from a product group, Rev4, according to the International Trade Standard Classification.

In Graph 2 we presented the evolution of exports, imports and trade balance, by intra-state and extra-state during the last two years (January 2018 - January 2020).

Graph 2. *Exports, imports and balances of intra-EU28 and extra-EU28 trade balances between January 2018 - January 2020*
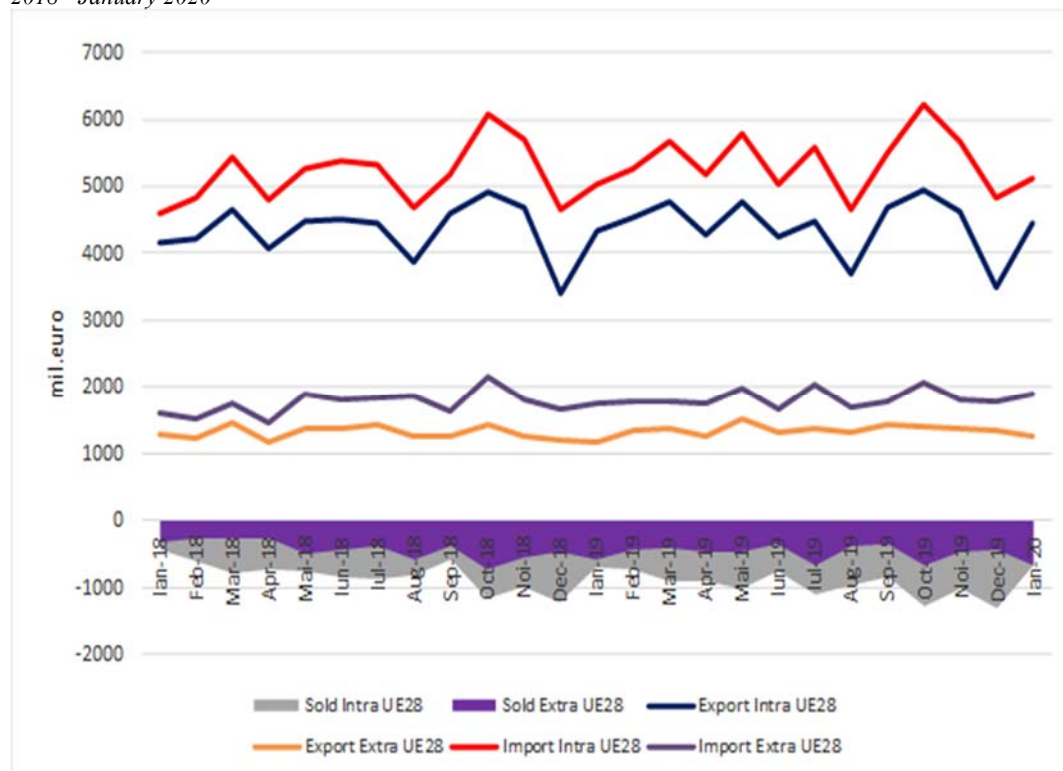
Source: National Institute of Statistics, press release no. 64/11 March 2020.

The graph shows that the evolution of the three indicators showed the same trend.

Next we performed a larger analysis of exports, imports and balance of foreign trade balance for a longer period of time, respectively January 2016 - December 2019. The data are presented quarterly and the analysis is performed on a total, intra-Community and extra- Community. Also, the value expression of the mentioned indicators is in EURO. We only used calculated data, these being more expressive.

The European Union is considered with 28 states, aiming that in the future, after the break, data will be recalculated and brought to the level of 27 Member States, or more, depending on the accession of other Balkan states to the European Union. The data are presented in Table 2.

Table 2. *Exports (FOB), imports (CIF) and FOB/CIF balance of international trade in goods*

Period		Total foreign trade			Trade intra-UE			Trade extra-UE		
		Export FOB mil. euro	Import CIF mil. euro	Sold FOB/CIF	Export FOB mil. euro	Import CIF mil. euro	Sold FOB/CIF	Export FOB mil. euro	Import CIF mil. euro	Sold FOB/CIF
2016	Trim I	4620.4	5272.8	-652,4	3515.1	4117.6	-602,5	1105.4	1155.2	-49,8
	Trim II	4773.8	5616.4	-842,6	3583.3	4352.3	-769	1190.6	1264.1	-73,5
	Trim III	4832.7	5648.2	-815,5	3606.5	4302.8	-696,3	1226.2	1345.4	-119,2
	Trim IV	4903.8	5917.4	-1013,6	3655.2	4544.1	-888,9	1248.5	1373.3	-124,8
2017	Trim I	5159.3	5925.7	-766,4	3921.2	4503.7	-582,5	1238.0	1422.0	-184
	Trim II	5139.4	6312.7	-1173,3	3906.0	4778.2	-872,2	1233.4	1534.6	-301,2
	Trim III	5234.7	6261.4	-1026,7	3962.2	4756.3	-794,1	1272.5	1505.2	-232,7
	Trim IV	5348.0	6701.5	-1353,5	4038.0	5055.4	-1017,4	1309.9	1646.0	-336,1
2018	Trim I	5662.7	6568.8	-906,1	4337.0	4950.1	-613,1	1324.7	1618.7	-294,0
	Trim II	5662.8	6859.8	-1197,0	4354.5	5146.8	-792,3	1308.3	1713.0	-404,7
	Trim III	5623.2	6838.6	-1215,4	4301.9	5061.4	-759,5	1321.2	1777.2	-456,0
	Trim IV	5625.8	7346.0	-1720,2	4333.2	5467.3	-1134,1	1292.6	1878.7	-586,1
2019	Trim I	5844.3	7085.2	-1240,9	4548.1	5317.9	-769,8	1296.2	1767.3	-471,1
	Trim II	5787.5	7123.1	-1335,6	4425.1	5331.1	-906,0	1362.4	1792.1	-429,7
	Trim III	5650.8	7093.4	-1442,6	4280.2	5248.6	-968,4	1370.5	1844.9	-474,4
	Trim IV	5718.6	7459.9	-1741,3	4358.4	5569.5	1211,1	1360.2	1890.4	-530,2

Source: National Institute of Statistics, press release no. 64/11 March 2020 (data processed by authors).

The analysis was also extended by using the statistical-econometric method of simple linear regression. The data series expressed in euro, used in Table 2, were used, because the obtained results can be used in intra-Community comparisons.

Therefore, for the statistical-econometric analysis of the correlation that exists between the evolution of exports in total foreign trade (scored with TE) and the intra-EU trade (scored with EI), we will first proceed to the independent analysis of the two indicators. Thus, the evolution of exports in total foreign trade is presented in Graph 3.

Graph 3. *Export evolution in total foreign trade (TE)*


```
Series: TE
Sample 2016:1 2019:4
Observations 16

Mean          5349.238
Median        5485.600
Maximum       5844.300
Minimum       4620.400
Std. Dev.     402.7769
Skewness      -0.458188
Kurtosis      1.784486

Jarque-Bera   1.544812
Probability   0.461900
```
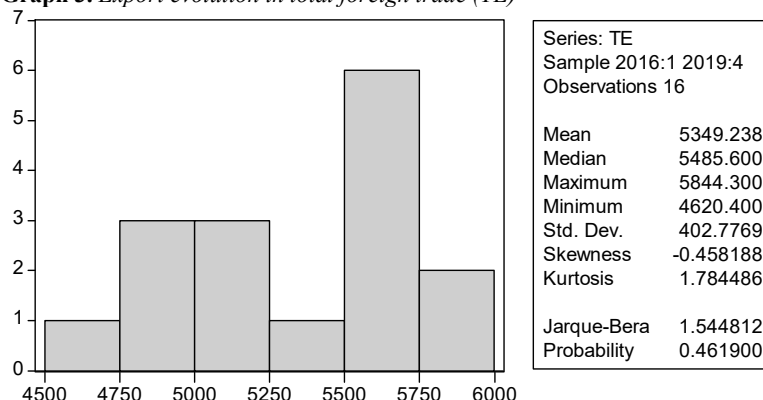
Analyzing Graph 3, we find that during the period subjected to the analysis the indicator the export in total foreign trade registered an average of 5349.238 million euros, and regarding the distribution of Kurtosis we find that the evolution is slow considering the test value of 1.78 which is less than 3. Also, according to the significantly different value of zero of the Skewness test we can say that the evolution of this indicator is not perfectly symmetrical.

Regarding the evolution of exports in intra-EU trade, it is presented in Graph 4.

Graph 4. *Export evolution in intra-EU trade (EI)*
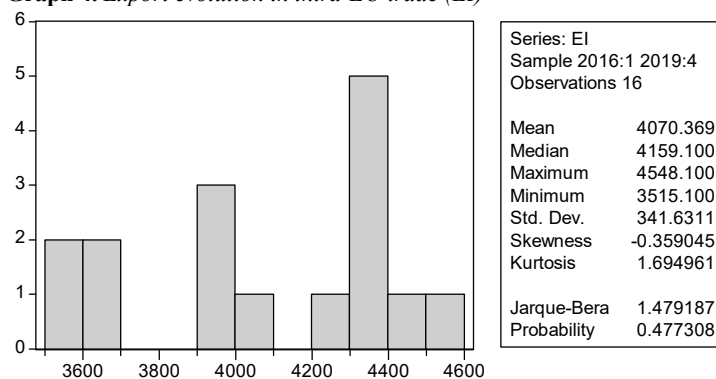
Analyzing Graph 4, we find that during the analysis period, the export indicator in intra-EU trade registered an average of 4070.369 million euros, and regarding the distribution of Kurtosis we find that the evolution is slow considering the test value of 1, 69 which is smaller than 3. Also, according to the significantly different value of zero of the Skewness test we can say that the evolution of this indicator is not perfectly symmetrical.

Regarding the correlation between export in total foreign trade and intra-EU trade, it is presented in Graph 5.

Graph 5. *Correlation between total foreign trade (TE) and intra-EU (EI) exports*
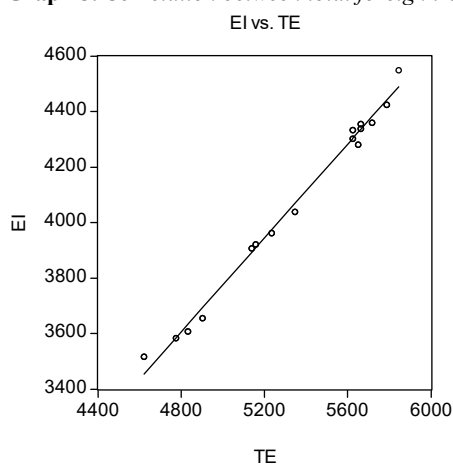
We observe from Graph 5 that the point cloud described by the recorded values has a linear evolution, which allows us to analyze the evolution of the two indicators using a simple linear regression model, of the form:

$$TE = a + b \cdot EI + \varepsilon \tag{1}$$

where:
TE represents the dependent variable;
EI represents the independent variable;
a and b represent the regression parameters;
ε represents the residual variable.

The estimation of the parameters and the test of the significance of the model are done using the EViews statistical-econometric analysis program, the results being presented in Figure 1.

Figure 1. *The results of the simple linear regression model analysis between TE and EI*

Dependent Variable: TE
Method: Least Squares
Sample: 2016:1 2019:4
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	570.8515	118.8259	4.804102	0.0003
EI	1.173944	0.029097	40.34592	0.0000
R-squared	0.991473	Mean dependent var		5349.238
Adjusted R-squared	0.990864	S.D. dependent var		402.7769
S.E. of regression	38.49913	Akaike info criterion		10.25562
Sum squared resid	20750.56	Schwarz criterion		10.35219
Log likelihood	-80.04494	F-statistic		1627.793
Durbin-Watson stat	1.212105	Prob(F-statistic)		0.000000

Interpreting the data in Figure 1 we find that the coefficients recorded in the second column (the Coefficient column) are significantly different from zero, which validates the model, meaning that it is a correct one and can be used to forecast the evolution of these indicators for the next period.

Also, the R-squared correlation coefficient has the value of 0.99, very close to the unitary one, which indicates the probability of 99.14% that this model is correct.
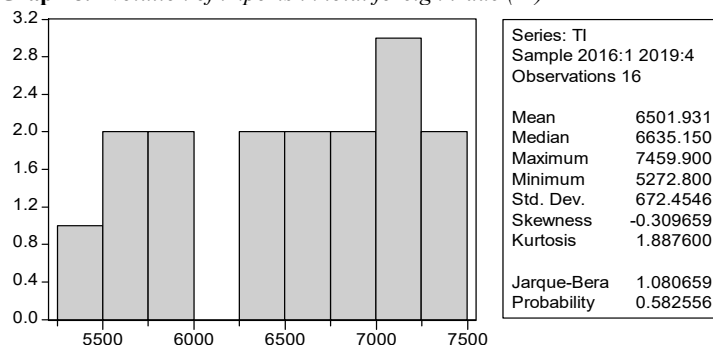
In other ideas, according to the data contained in Figure 1, we can estimate the theoretical values of the endogenous variable, according to the relation:

$$TE = 570.85 + 1.17 \cdot EI + \varepsilon \tag{2}$$

The relation (2) can be used in forecasts on the evolution of this indicator.

Regarding the evolution of the export in the extra-EU trade is presented in the Graph 6.

Graph 6. *Export evolution in non-EU trade (EE)*

Series: EE	
Sample 2016:1 2019:4	
Observations 16	
Mean	1278.787
Median	1294.400
Maximum	1370.500
Minimum	1105.400
Std. Dev.	70.02675
Skewness	-0.822258
Kurtosis	3.409181
Jarque-Bera	1.914574
Probability	0.383933
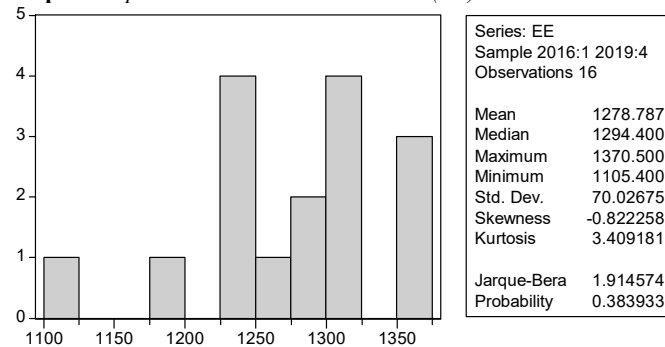
Analyzing Graph 6, we find that during the period subjected to the analysis, the export indicator in the extra-EU trade registered an average of 1278.787 million euros, a value much lower than that registered in the case of intra-EU trade, and regarding the distribution of Kurtosis we find that the evolution is a normal one considering the test value of 3.4 which is greater than 3. Also, according to the significantly different value of zero of the Skewness test we can say that the evolution of this indicator is not perfectly symmetrical.

Regarding the correlation between exports in total foreign and non-EU trade, it is presented in Graph 7.

Graph 7. *Correlation between total foreign trade (TE) and non-EU (EE) exports*
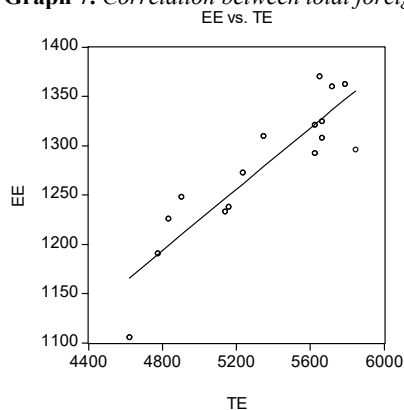
We observe from Graph 7 that the point cloud described by the recorded values has a linear evolution, which allows us to analyze the evolution of the two indicators using a simple linear regression model, of the form:

$$TE = a + b \cdot EE + \varepsilon \tag{3}$$

where:
TE represents the dependent variable;
EE represents the independent variable;
a and b represent the regression parameters;
ε represents the residual variable.

The estimation of the parameters and the test of the significance of the model are done using the EViews statistical-econometric analysis program, the results being presented in Figure 2.

Figure 2. *Results of simple linear regression model analysis between TE and EE*

Dependent Variable: TE
Method: Least Squares
Sample: 2016:1 2019:4
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1218.930	886.0052	-1.375759	0.1905
EE	5.136246	0.691876	7.423650	0.0000
R-squared	0.797426	Mean dependent var		5349.238
Adjusted R-squared	0.782957	S.D. dependent var		402.7769
S.E. of regression	187.6454	Akaike info criterion		13.42345
Sum squared resid	492951.1	Schwarz criterion		13.52003
Log likelihood	-105.3876	F-statistic		55.11059
Durbin-Watson stat	1.121002	Prob(F-statistic)		0.000003

Interpreting the data in Figure 2 we find that the coefficients recorded in the second column (the Coefficient column) are significantly different from zero, which validates the model, meaning that it is a correct one and can be used to forecast the evolution of these indicators for the next period. Also, the correlation coefficient R-squared has the value of 0.79, close to the unit, which indicates the probability of 79.74% that this model is a correct one.

In other ideas, according to the data contained in Figure 2, we can estimate the theoretical values of the endogenous variable, according to the relation:

$$TE = -1218.93 + 5.13 \cdot EE + \varepsilon \tag{4}$$

The relation (4) can be used in forecasts on the evolution of this indicator.

Another analysis was made of the correlation that exists between the evolution of imports in total foreign trade (scored by IT) and the intra-EU trade (scored by II), starting with the independent analysis of the two indicators. Thus, the evolution of imports in total foreign trade is presented in Graph 8.

Graph 8. *Evolution of imports in total foreign trade (IT)*

Series: TI Sample 2016:1 2019:4 Observations 16	
Mean	6501.931
Median	6635.150
Maximum	7459.900
Minimum	5272.800
Std. Dev.	672.4546
Skewness	-0.309659
Kurtosis	1.887600
Jarque-Bera	1.080659
Probability	0.582556

Analyzing Graph 8, we find that during the period subjected to the analysis the indicator the import in the total foreign trade registered an average of 6501.931 million euros, and regarding the distribution of Kurtosis we find that the evolution is slow considering the test value of 1.88 which is less than 3. Also, according to the significantly different value of zero of the Skewness test we can say that the evolution of this indicator is not perfectly symmetrical.

Regarding the evolution of imports in intra-EU trade, it is presented in Graph 9.

Graph 9. *Evolution of imports in intra-EU trade (II)*
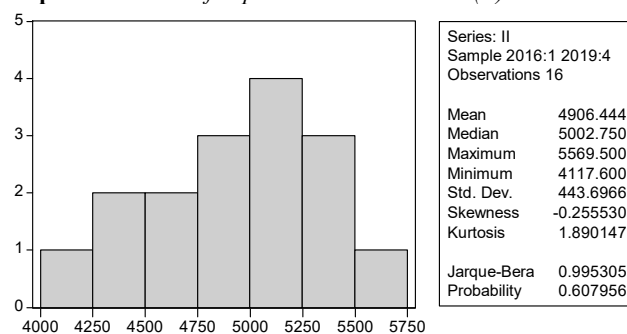
Analyzing Graph 9, we find that during the period under analysis the indicator import in intra-EU trade registered an average of 4906.444 million euros, and regarding the distribution of Kurtosis we find that the evolution is slow considering the test value of 1, 89 which is smaller than 3. Also, according to the near zero value of the Skewness test we can say that the evolution of this indicator is quite symmetrical.

Regarding the correlation between imports in total foreign trade and intra-EU trade, it is presented in Graph 10.

Graph 10. *Correlation between total foreign trade (IT) and intra-EU (II) imports*
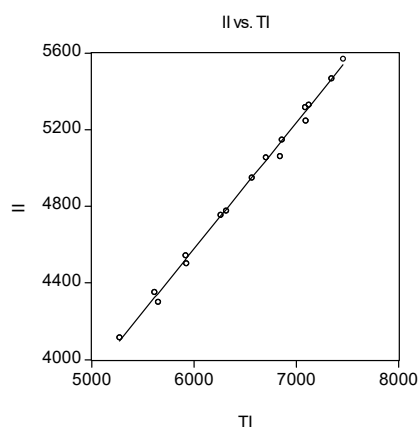
We observe from Graph 10 that the point cloud described by the recorded values has a linear evolution, which allows us to analyze the evolution of the two indicators using a simple linear regression model, of the form:

$$TI = a + b \cdot II + \varepsilon \tag{5}$$

where:

TI represents the dependent variable;

II represents the independent variable;

a and b represent the regression parameters;

ε represents the residual variable.

The estimation of the parameters and the testing of the significance of the model are done using the EViews statistical-econometric analysis program, the results being presented in Figure 3.

Figure 3. *Results of simple linear regression model analysis between TI and II*

Dependent Variable: TI
Method: Least Squares
Sample: 2016:1 2019:4
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-917.5102	133.3570	-6.880106	0.0000
II	1.512183	0.027076	55.84881	0.0000
R-squared	0.995532	Mean dependent var		6501.931
Adjusted R-squared	0.995212	S.D. dependent var		672.4546
S.E. of regression	46.52884	Akaike info criterion		10.63449
Sum squared resid	30309.06	Schwarz criterion		10.73106
Log likelihood	-83.07592	F-statistic		3119.089
Durbin-Watson stat	2.479045	Prob(F-statistic)		0.000000

Interpreting the data in Figure 3 we find that the coefficients recorded in the second column (the Coefficient column) are significantly different from zero, which validates the model, meaning that it is a correct one and can be used to forecast the evolution of these indicators for the next period.

Also, the correlation coefficient R-squared has the value of 0.99, close to the unit, which indicates the probability of 99.55% that this model is correct.

In other ideas, according to the data contained in Figure 3, we can estimate the theoretical values of the endogenous variable, according to the relation:

$$TI = -917.51 + 1.51 \cdot II + \varepsilon \tag{6}$$

The relation (6) can be used in forecasts on the evolution of this indicator.

Regarding the evolution of imports in extra-EU trade, it is presented in Graph 11.

Graph 11. *Evolution of imports in extra-EU trade (IE)*

	Series: IE
	Sample 2016:1 2019:4
	Observations 16
	Mean 1595.506
	Median 1632.350
	Maximum 1890.400
	Minimum 1155.200
	Std. Dev. 231.6640
	Skewness -0.389122
	Kurtosis 1.938091
	Jarque-Bera 1.155543
	Probability 0.561147
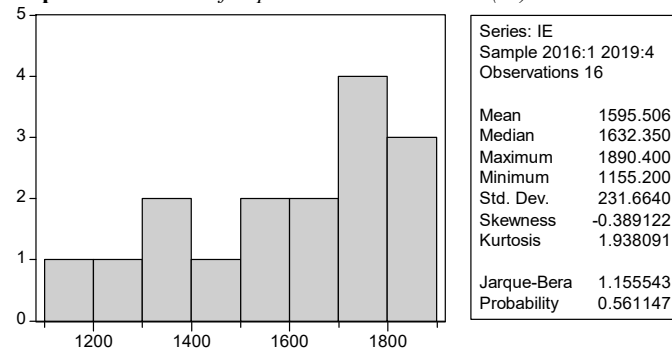
Analyzing Graph 11, we find that during the period subjected to the analysis the indicator the import in the extra-EU trade registered an average of 1595.506 million euros, significantly lower than the average recorded in the case of intra-EU trade, and regarding the distribution of Kurtosis we find that the evolution is a slow one considering the test value of 1.93 which is less than 3. Also, according to the significantly different value of zero of the Skewness test we can say that the evolution of this indicator is not perfectly symmetrical.

Regarding the correlation between the import in the total foreign trade and the extra-EU trade, it is presented in the Graph 12.

Graph 12. *Correlation between total foreign trade (IT) and non-EU (IE) imports*
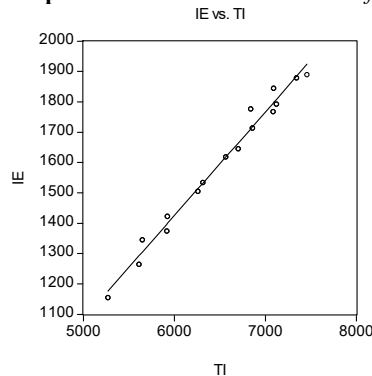
We observe from Graph 12 that the point cloud described by the recorded values has a linear evolution, which allows us to analyze the evolution of the two indicators using a simple linear regression model, of the form:

$$TI = a + b \cdot IE + \varepsilon \tag{7}$$

where:
TI represents the dependent variable;
IE represents the independent variable;
a and b represent the regression parameters;
ε represents the residual variable.

The estimation of the parameters and the test of the significance of the model are done using the EViews statistical-econometric analysis program, the results being presented in Figure 4.

Figure 4. *Results of simple linear regression model analysis between TI and IE*

Dependent Variable: TI
Method: Least Squares
Sample: 2016:1 2019:4
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1908.770	160.0816	11.92373	0.0000
IE	2.878811	0.099356	28.97479	0.0000
R-squared	0.983598	Mean dependent var		6501.931
Adjusted R-squared	0.982426	S.D. dependent var		672.4546
S.E. of regression	89.14503	Akaike info criterion		11.93487
Sum squared resid	111255.7	Schwarz criterion		12.03145
Log likelihood	-93.47900	F-statistic		839.5383
Durbin-Watson stat	2.574332	Prob(F-statistic)		0.000000

Interpreting the data in Figure 4 we find that the coefficients recorded in the second column (the Coefficient column) are significantly different from zero, which validates the model, meaning that it is a correct one and can be used to forecast the evolution of these indicators for the next period. Also, the correlation coefficient R-squared has the value of 0.98, close to the unit, which indicates the probability of 98.35% that this model is correct.

In other ideas, according to the data contained in Figure 4, we can estimate the theoretical values of the endogenous variable, according to the relation:

$$TI = 1908.77 + 2.87 \cdot IE + \varepsilon \tag{8}$$

The relation (8) can be used in forecasts on the evolution of this indicator.

Conclusions

The article published in the study by the authors on the evolution of the international trade of Romania, highlights a series of theoretical and practical conclusions, useful for the activity of macroeconomic, but also microeconomic management.

In this sense, a first conclusion is that at present the weight of Romania's international trade relations within the European Union has become predominant, but at the same time it must be emphasized that exports are well below the level of imports, which leads to the depreciation of the quarterly results and annuals that Romania obtains on the national level.

Another conclusion is that the trade balance deficit has increased from time to time (the analysis being performed over a longer period of time), which is expected to occur in the next period as well. From here we can immediately draw the conclusion that it is necessary to support the exports of our country and to reduce as much as possible some imports that are not strictly necessary in order to achieve macrostability. Thus, for

example, many products from the agri-food field or from fields that have no relevance for the economic-financial situation of Romania, have the share of imports. Of course, we are a member of the European Union which has the directive according to which the free movement of goods and services is ensured, but at the same time we must see that they must also be achieved in order to balance the Romanian economy at a macroeconomic level.

Another conclusion that emerges from the study carried out by the authors is that the data provided by the National Institute of Statistics offer a wide possibility to use statistical-econometric methods, based on which to make estimates on the perspective of the future evolution of the Romanian economy. In this context, conclusions can be drawn that ensure the undertaking of measures at the level of macroeconomic management that will ensure macrostability, ensure the proportions and macroeconomic correlations required by a balanced development of the economy and in this way can obtain some results growing during the next period.

One conclusion at the moment is that this virus crisis can produce huge destabilizations at the level of the economy, at the level of social activity and at the level of the whole activity. Therefore, analyzes on this side of a component in the development and growth of the Gross Domestic Product must be a priority.

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*** Institutul Național de Statistică, Comunicat nr. 64/11 martie 2020

The Romanian population's perceptions regarding income inequalities and discrimination

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Abstract. *The issue of income inequalities is a priority for the European Union, the more so as, for the last few years, the effects of the economic recession have caused the reversal of the living standards' convergence tendency and have put more pressure on social security systems. Across European states, the level of income inequality has risen, causing concerns from the standpoint of sustainable economic growth, as well as from the standpoint of social cohesion, the communal sense of belonging, and discrimination. Among the priorities of the Europe 2020 agenda is reducing poverty, but this objective cannot be attained without addressing income inequalities and, implicitly, its effects, such as social discrimination. The analysis we have performed in this article starts from the results of a social survey with 850 respondents. The social survey had the goal of investigating the population's perceptions and attitudes regarding inequalities, discrimination and vulnerabilities. The results showed that the majority of the respondents believe that their current incomes are not enough to cover even basic needs or only enough to cover basic needs. Monthly income is influenced by gender and place of residence. The highest-earning areas of economic activity are Information and communications and Real estate transactions, while the lowest-earning are registered in Performance, cultural and leisure activities and other service activities. The respondents also generally agree with the granting of social aids and with the fact that these may help reduce income inequalities, however they do not have a favourable opinion of individuals who may be eligible to receive social aid. Regarding discrimination, the results indicated that this phenomenon is most widespread in the areas of work and employment, education and medical assistance, with common individuals, private employers and state institutions being the main actors who discriminate. The respondents believe that discrimination is most often tied to ethnicity, income level, and sexual orientation, the main reason behind discrimination in Romania being a lack of education.*
Evidently, the European Union's concerns in carrying out the process of economic and social convergence are also related to policy areas closely tied to fighting the rise of income inequalities and securing equality of opportunity to a greater degree. For these reasons, studying such phenomena at the level of Romanian society is important.

Keywords: income inequalities, discrimination, sociological inquiry.

JEL Classification: J71, J31.

1. Introduction and literature review

Income inequality analyses the differences in income or consumption registered among the population. Generally, inequality is conceptualized as the degree of dispersion of a distribution, be it income, consumption or any other indicator that measures the well-being of an individual.

At the European level, the degree of inequality has increased in most Member States, affecting the sustainability of economic growth, and consequently the economic and social cohesion. There are also concerns about the inclusive nature of economic growth. When the income produced in a country grows faster than the incomes of the population in that country, it means that the economic growth is not favourable to inclusion and that its benefits are not felt by all households. According to the study carried out by Saez (2016), it has been proven, based on concrete elements, that the increase of the GDP registered in the last years in the United States of America has brought benefits almost exclusively to the households with the highest incomes.

In any society, whether it is highly developed or less developed, there is a certain degree of income inequality, which is not only unavoidable but also necessary for the healthy functioning of an economy (Welch, 1999). However, even if the level of inequalities is not a problem in itself, the causes and consequences of income inequalities and their growth must be considered. And here we refer to a variety of phenomena, from poverty to health and life expectancy, crime, community disruption, intergenerational immobility and the spread of poverty from generation to generation, all of these phenomena being of utmost importance to any society (Salverda et al., 2009). If income inequality influences or is influenced by this kind of phenomena, understanding the income inequalities is a major research topic (Neckerman and Torche, 2007; Burtless and Jencks, 2003).

The framework for analysing income inequality starts from the analysis of the distribution of income of households, which represents the central point of economic inequalities and how they are generated. We must say that there is still no unified theory of income distribution, so even to a less degree is there one about income inequality (Atkinson and Bourguignon, 2000). The distribution of household incomes is influenced primarily by the earnings of the members of the households. Therefore, in order to understand the distribution of household incomes we need to focus on how individuals earn their incomes on the labour market, but also on the composition of households in relation to the labour market. From this perspective, the labour market institutions (trade unions, employers, minimum wage regulation) have an extremely strong influence on the distribution of work earnings, with significant differences in the level of earnings between groups of workers according to sex, ethnicity, education, etc.

Moene and Wallerstein (2003) showed that a pronounced wage inequality leads to an increase in the demand for redistribution and that the level of social spending is higher in countries with a more even distribution of income. And the effects on poverty reduction depend to a large extent on the magnitude of spending on social protection – there is a theory to this effect, developed by Smeeding (1997) and called "size redistribution theory", but it is strongly influenced by the way in which the social benefits system is built

(Esping-Andersen, 1999; Palme, 2006). In conclusion, we can say that, in accordance with the Rawlsian principle of social justice, any redistribution of income must be in favour of the poor, but the extent to which the poor benefit from this is also given by the socio-demographic characteristics of the population we refer to (Esping-Andersen and Myles, 2009).

In another study, Fournier and Koske (2012) analysed the determinants of earnings inequality for a group of 32 countries by using micro-data from household surveys and taking into account the following variables: number of hours worked, gender, age and the highest degree of education obtained. The study found that women have lower chances of employment than men, and those women who work earn less than men. Moreover, work experience plays a bigger role in poorly paid jobs, if the individual work experience is captured by the age variable, and the working hours lead to a greater inequality of employment income among the employed population. The empirical study also indicated that policies aimed at increasing the graduation rate for upper secondary education should reduce wage inequalities.

Many European and non-European countries face different forms of discrimination on the labour market, namely gender discrimination, discrimination on the grounds of religion, ethnicity, nationality, disabilities, age, political options, economic status, sexual orientation, health condition.

Gender disparities in terms of pay can have many negative effects. Lower wages of women can increase the economic dependence on the partner, which can increase the risk of domestic violence. Secondly, many women are single mothers and the only supporters of the family, so lower wages will increase the likelihood of their families living in poverty. Thirdly, gender differences in the workplace are transformed into inequality even after retirement. As women, on average, live longer than men, they are more likely to live in poverty in old age (Witkowska, 2013).

Hersch (2007) analysed the sources of the gender pay gap between men and women using the regression method and confirmed that gender discrimination plays an important role in the persistent gender pay gap in the United States of America.

Christofides et al. (2010) analysed the gender pay differences for a set of 24 EU Member States, applying different methods of analysis, such as regression based on quantiles and probit models. They used characteristics such as education, company size, marital status, field of activity, age or experience, number of children, income from real estate rents, financial assets, mortgage expenses and occupation. The authors divided the total wage difference into a part explained by the difference between the male and female characteristics of the jobs and an unexplained part, which corresponds to the male advantage versus the disadvantage of women. The unexplained part of the gender pay gap is identified as gender discrimination.

Regarding the minority discrimination, the United States has a long tradition in this area of study. The research has clearly established the persistence of vulnerabilities and inequalities in terms of obtaining jobs, mobility, wages and redundancies for workers belonging to minorities, despite the 50 year existence of civil rights protection (Roscigno et al., 2012;

Huffman, 2004; Pager et al., 2009; Tomaskovic-Devey, 1993). The regression-based decomposition analyses have suggested that certain observable characteristics, such as experience and education, play a role in racial inequalities, although the extent of their contribution is still debated (Neal and Johnson, 1996; Wilson and Rodgers 2016). Some of these differences are explained by occupational segregation, which in turn is also influenced by discrimination (Hamilton et al., 2011).

In Europe, the Roma are the largest ethnic minority and have been an integral part of the European society for centuries. But despite the efforts made at national, European and international level to improve the protection of their fundamental rights and to promote their social inclusion, many Roma continue to face severe poverty, profound social exclusion, discrimination and barriers to the exercise of their fundamental rights (European Union Agency for Fundamental Rights, 2014). A triple vicious circle is at stake: unsatisfactory socio-economic outcomes are mutually reinforcing; they fuel negative attitudes and perceptions, leading to inappropriate policies; and segmentation is perpetuated by discrimination. A severe lack of data hinders progress, making it difficult to research and develop precise policies (Kahanec, 2014).

Theories of inequality on the labour market of people with disabilities concern aspects related to both supply and demand for work. The characteristics of the supply, such as human capital and workers' preferences, as well as the typical demand factors, which include the role of policies, labour market conditions and employer discrimination, explain a substantial part of the disadvantages related to employment and earnings of people with disabilities (Yelin and Trupin, 2000). In terms of human capital, studies have shown that people with disabilities often differ from the rest of the population in terms of skills, education and job choice (Blanck et al., 2007). At the same time, the health status influences the preferences of workers with disabilities, as they often opt for part-time employment contracts, with serious effects on wages (Hotchkiss, 2004).

Age inequality is mainly manifested at the level of two vulnerable groups: young people and people close to the retirement age. Discrimination against young people may be perceived as less severe than discrimination against elder people, because youth is a temporary status. However, the consequences of age-based discrimination on young people can be just as serious for their material and psychological well-being or even their physical health, as is the case among elder adults (Iversen et al., 2009). Sociologists suggest that age segregation that occurs in modern societies is a source of prejudice among age groups, resulting in conflicting attitudes in both directions.

2. Research methodology

Our study is based on the results of a sociological survey that aimed to investigate the perceptions and attitudes of the population regarding inequality, discrimination and vulnerability. Through the representative survey among the Romanian population, information on social attitudes and perceptions regarding inequalities and discrimination, the importance of equality, or the perception of the unequal treatment to which certain groups are subjected, was collected. Also, the opinions of the respondents were examined

regarding the causes and consequences of inequalities and discrimination, respectively the role and personal responsibility, of the community, of the state institutions, of the non-governmental organizations in this issue.

The sample of respondents was constructed to represent the population structure at national level and comprised 800 adults (at least 18 years of age) and a supplement of 50 questionnaires in rural areas. The theoretical margin of error for the entire sample was ±3.46% at a confidence level of 95%. The national sample is probabilistic, random, tristadial, with stratification in the first stage based on the development regions, including all counties. Subsequently, the random selection of the survey areas (areas circumscribed to the polling stations within the localities included in the sample) was made. The sampling points - the areas of the polling stations – were selected with a statistical step. The headquarters of the polling stations represented the starting points in the application of *the random route method* or the routes for the selection of households with a fixed, predetermined statistical step.

The validation of the sample was based on data from the National Institute of Statistics. The research instrument consisted of a structured questionnaire, and the interviews were conducted *face-to-face* at the respondents' home between October 31 and November 12, 2019. On average, the interviews lasted 37 minutes.

3. Analysis of population's perceptions regarding income inequalities and discrimination

The analysis of the distribution of income per household indicated at the sample level that 42% of the respondents had average monthly incomes lower than 2000 lei. A percentage of 27% obtain an income between 2000 and 4000 lei, and 17% have an average monthly income per household between 4000 and 6000 lei. An income of over 8000 lei per month was declared by only 4% of the respondents (Figure 1).

Figure 1. *Distribution of incomes per household (lei/month)*
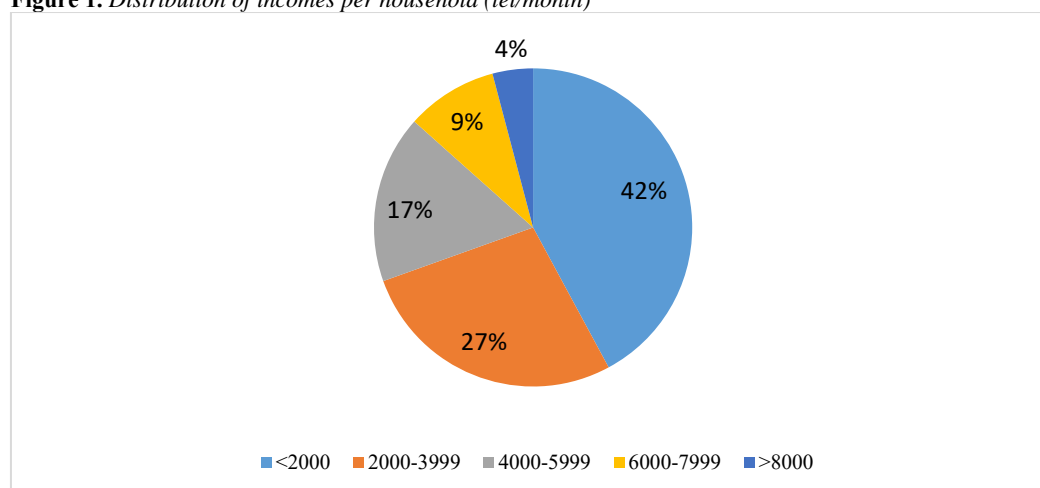
Source: authors' calculations based on data collected in the survey.

The maximum household income reported per sample was 10100 lei, the minimum being 200 lei, and at the individual level the maximum was 8100 lei and the minimum 0 lei. These data indicate the existence of income inequalities and the fact that almost half of the respondents have very low average monthly incomes, far from the European averages.
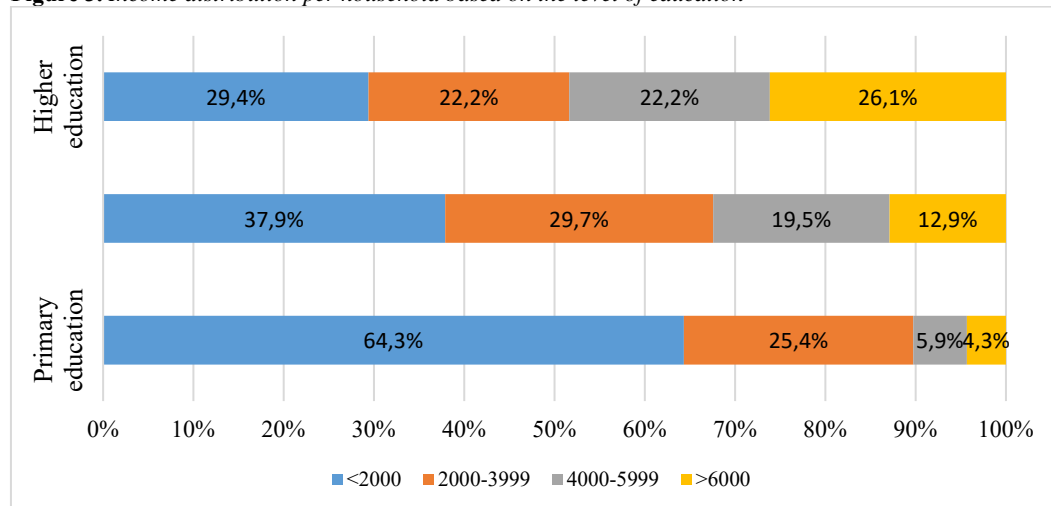
The median value of the monthly income at the sample level is 3100 lei/household and 1600 lei/individual. As expected this value is lower in the rural area than the urban area. In the rural area, the median income is 1500 lei at the individual level and 2800 lei at the household level, while in the urban area we have an income of 1700 lei at the individual level, respectively 3500 lei at the household level. There are inequalities between women and men as well, with women reporting lower incomes compared to men. Among women we have an individual income of 1450 lei while the income per household is 3000 lei. In the case of men the income per individual is 1900 lei, respectively 3500 lei at household level. Men in the urban area have the highest incomes – 4000 lei is the median value of the monthly income per household and 2000 lei the individual income, while women in the rural area have the lowest incomes, 2600 lei at the household level and 1333 lei at the level individual (Figure 2).

Figure 2. *Median value of monthly income by residence and gender (lei/month)*
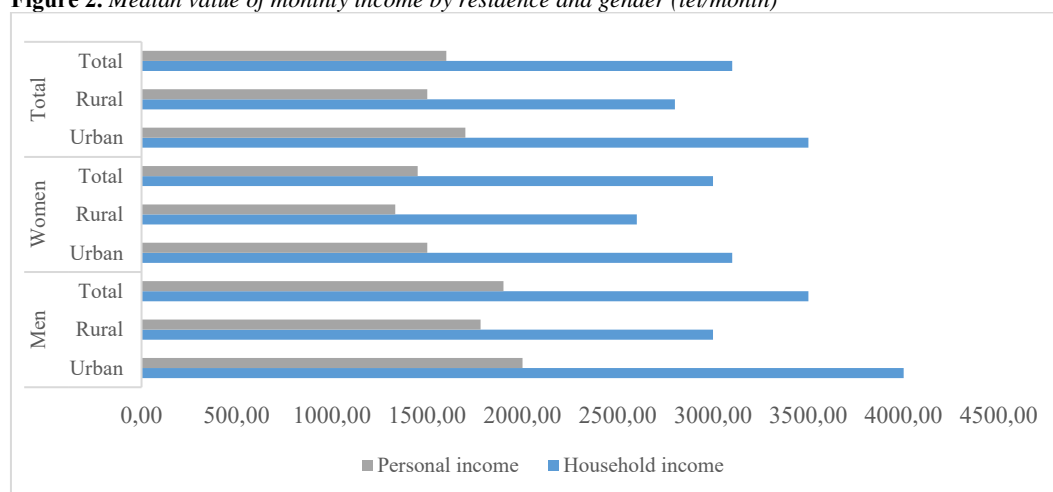
Source: authors' calculations based on data collected in the survey.

In terms of education we observe that there are significant inequalities depending on the studies completed. It can be seen that income increases with the level of education. Of those with primary education, 64.3% have monthly incomes below 2000 lei, while 25.4% earn between 2000 and 4000 lei and only 4.3% have incomes over 6000 lei. For high school and post-secondary school graduates, the incomes are slightly higher, 37.9% of the respondents having an income below 2000 lei and 12.9% over 6000 lei. In those with higher education, the situation is balanced on the four income ranges, meaning that 29.4% have incomes below 2000 lei/month and 26.1% have incomes over 6000 lei/month (Figure 3).

Figure 3. *Income distribution per household based on the level of education*

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

Depending on the field of activity, we note that the highest paid people are those who work in the financial and IT fields. Thus, the highest median value of the monthly income, both at the individual level and at the household level, is reported by individuals in the area of *Financial intermediation and insurance* (4550 lei at the individual level and 10050 lei per household). Other areas where individuals report higher incomes are *Information and communication* (3300 lei per individual and 6000 lei per household) and *Real estate transactions* (3650 lei at individual level, respectively 6300 lei per household). The lowest incomes are reported by individuals who work in *Performances, cultural and recreational activities and other service activities*, 3500 lei at household level and 1900 lei at individual level (Figure 4).

Figure 4. *Median value of the monthly income based on the field of activity, lei*
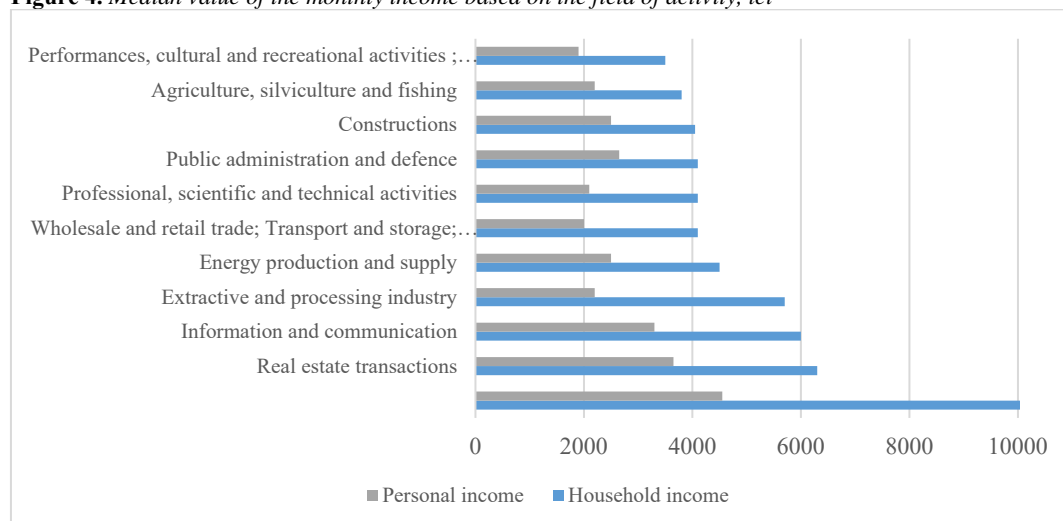
Source: authors' calculations based on data collected in the survey.

The respondents' opinions regarding the current incomes show that the majority (60%) of them declare that the current incomes "are not enough for the bare necessities" or "are only enough for the bare necessities". The latter category of respondents is the largest, representing over one third of the sample. The individuals who answered that they had everything they needed, without being restricted from something, were only 5% and most were between 18 and 24 years old. 23% of the respondents said their income was enough for the strictly necessary with some money to spare, while 11% could buy some more expensive things, but they had to restrict themselves in other areas.

Figure 5. *Distribution of subjective estimates of current incomes*
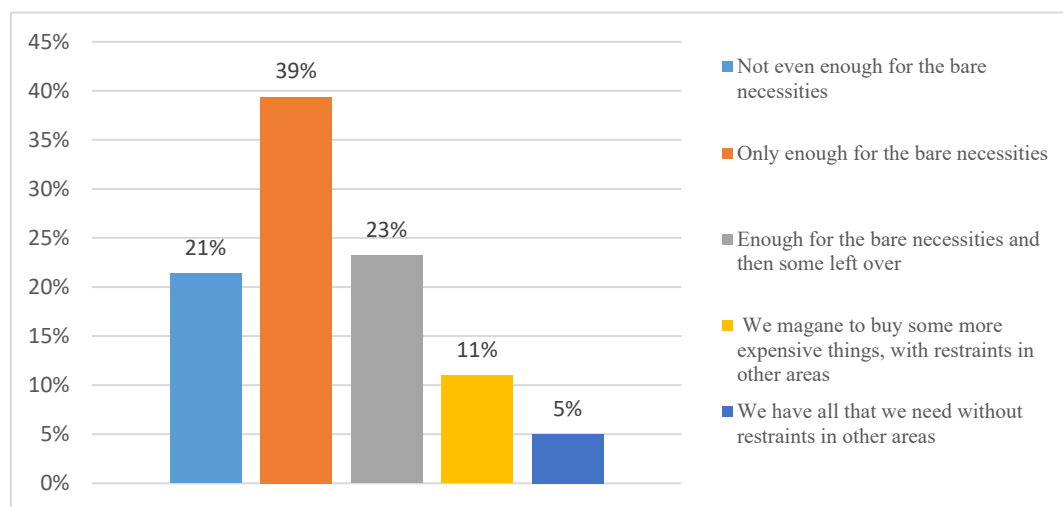
Source: authors' calculations based on data collected in the survey.

Gender distribution is relatively equal for all categories of responses except the first. Of the respondents who answered that the current incomes were not enough for the bare necessities, almost three quarters are female. It is difficult to say whether this is due to the fact that men are more reluctant to recognize financial difficulties or if it is the consequence of an unequal distribution of income and a risk of poverty that disproportionately affects women (Figure 5).

Respondents' attitudes regarding social aids and their impact on income inequalities indicate that most consider this support provided by the state to discourage work, but also play a vital role in the survival of the poor.

Except for the statement "*Most of the poor are people who do not work and are guilty for their current situation*", the majority (over 50%) of the respondents agree or totally agree with the statements presented in Figure 6. The smallest percentage of the option of neutral answer seems to apply for the statement "*The state is responsible for ensuring the well-being of the citizens*", the only statement that does not mention poverty or poor people. Higher rates of neutral responses in the case of the other statements may indicate that this is an uncomfortable topic for respondents, who then prefer not to make a decision, or that they are unfamiliar with the subject and thus do not have a clear opinion.

Figure 6. *Distribution of attitudes regarding social aids and income inequalities*
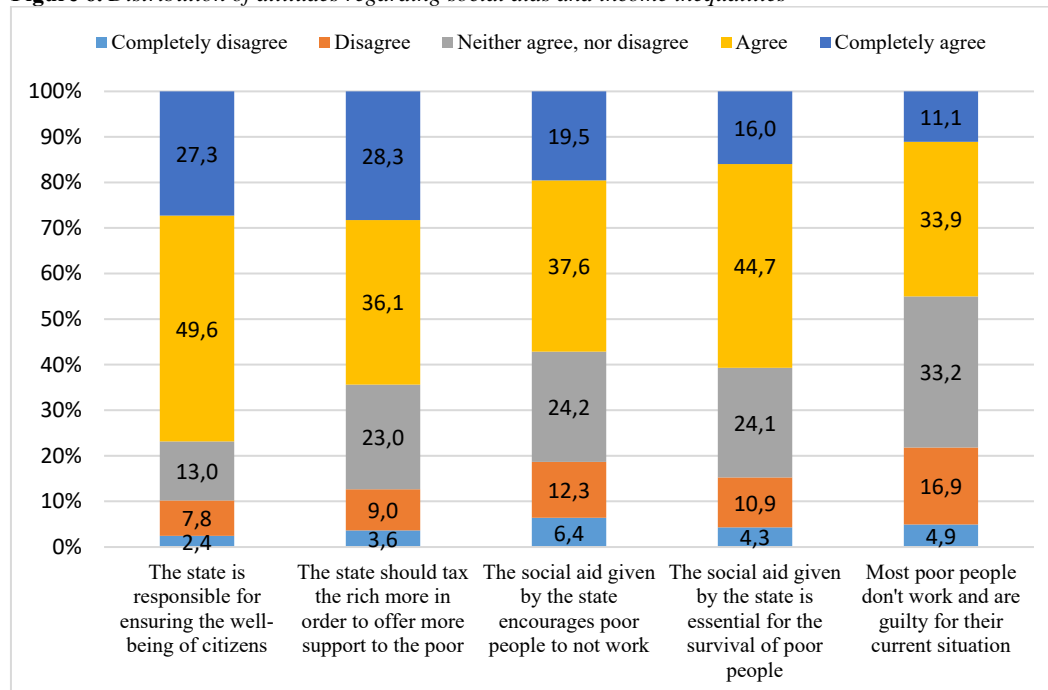
Source: authors' calculations based on data collected in the survey.

The last two statements show that the majority of the respondents agree that state social aids are important for reducing income inequalities and for the welfare of the population in general. Thus, it is all the more unexpected that the respondents also mostly agree with the statement "*The social aid offered by the state encourages poor people not to work*". Together with the high rate of agreement (45%) with the statement "*Most of the poor are people who do not work and are guilty for their current situation*", this indicates that although the respondents agree with the granting of social aids and are aware of their importance, they do not have a favourable opinion about the people who could benefit from these aids.

Respondents' perceptions of some government measures outline the way in which these measures affect income inequalities. Thus, 79% of the respondents are of the opinion that the increase of special pensions would increase the level of income inequalities, this being the only measure where the respondents' opinion is approaching a consensus. In the case of the increase of the minimum wage, of the increase of the pensions in the social insurance system and of the introduction of a progressive taxation, there is no majority opinion regarding the effects, although the highest percentages are found in the response category "they reduce social inequalities".

Figure 7. *Distribution of the impact perceived regarding some measures on income inequalities*
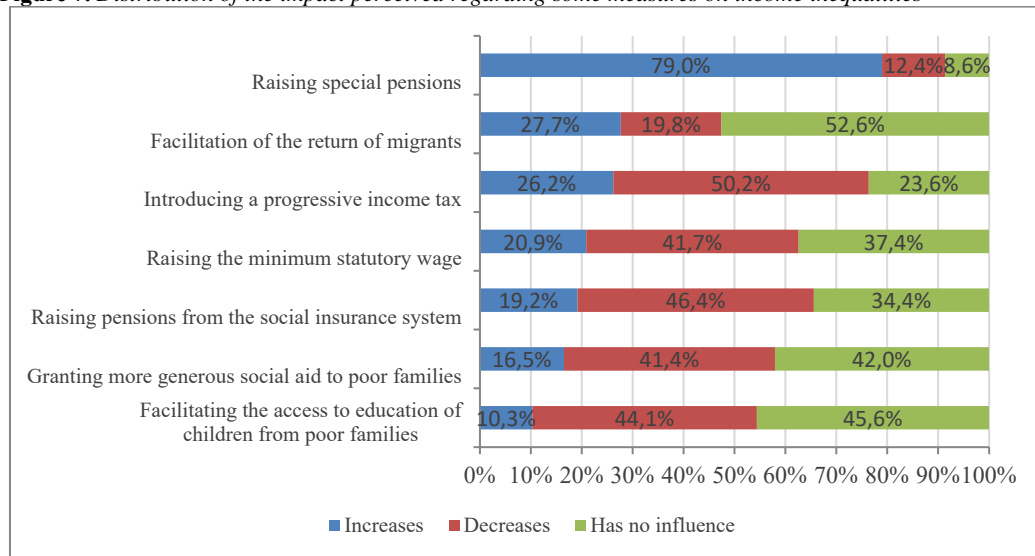
Source: authors' calculations based on data collected in the survey.

"*Giving more generous social aid to poor families*" is perceived equally as reducing inequalities or having no influence on them. A similar situation is also found for the measure "*Facilitating access to education for children from disadvantaged families?*" where 44.1% believe that it would lead to the reduction of inequalities, and 45.6% believe that it would have no influence on the inequalities. 53% consider that "*Facilitating the return of migrants*" would not have an effect on income inequalities, and 27.7% believe that the level of inequalities would increase (Figure 6).

Concerning perceived discrimination, among the characteristics on which this is based, political opinion and sexual orientation particularly stand out. For these two categories there are the most respondents who chose not to give an answer, with 122 refusals for the former and 164 for the latter. This can be explained either by a lack of formed opinion for those two categories, either by respondents considering these topics to be more controversial or uncomfortable.

Figure 8. *Distribution of characteristics perceived as being the most often encountered in cases of discrimination in Romania*
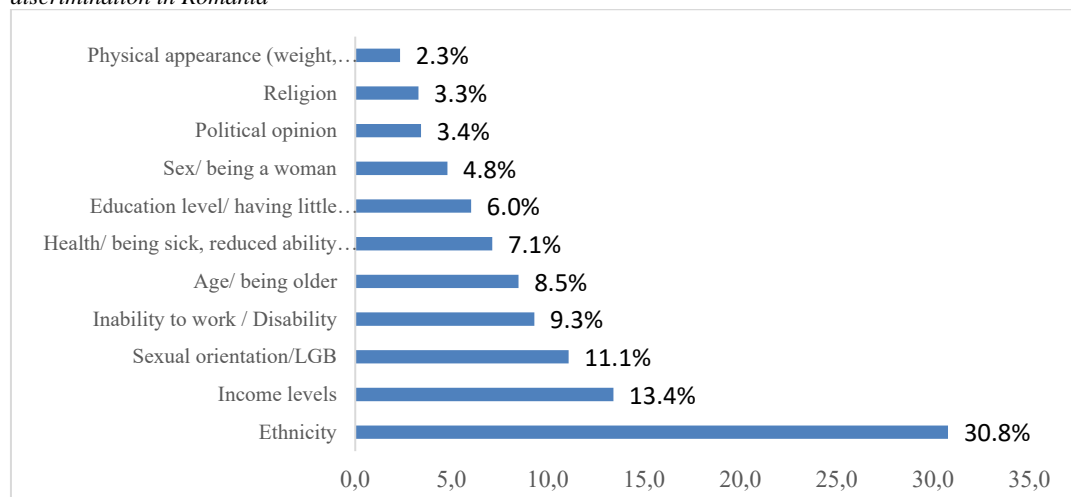
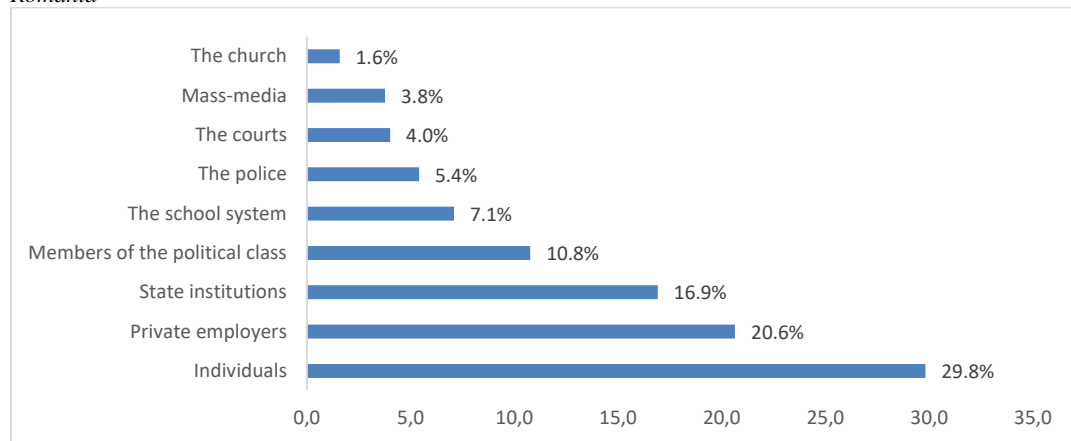**Source:** authors' calculations based on data collected in the survey.

Over half of the respondents consider that the following characteristics which are targeted for discrimination often or very often are ethnicity (61.2%), sexual orientation (52.3%), and disability (51%). When asked which characteristic discrimination cases in Romania are most often based on, ethnicity was most often selected (30.8%), followed by income levels (13.4%) and sexual orientation (11.1%) (Figure 8). Lack of education is considered as mostly responsible for discrimination cases in Romania. Other reasons brought up were social and income inequalities, and corruption.

Figure 9. *Distribution of areas in which respondents believe discrimination to occur most frequently in Romania*
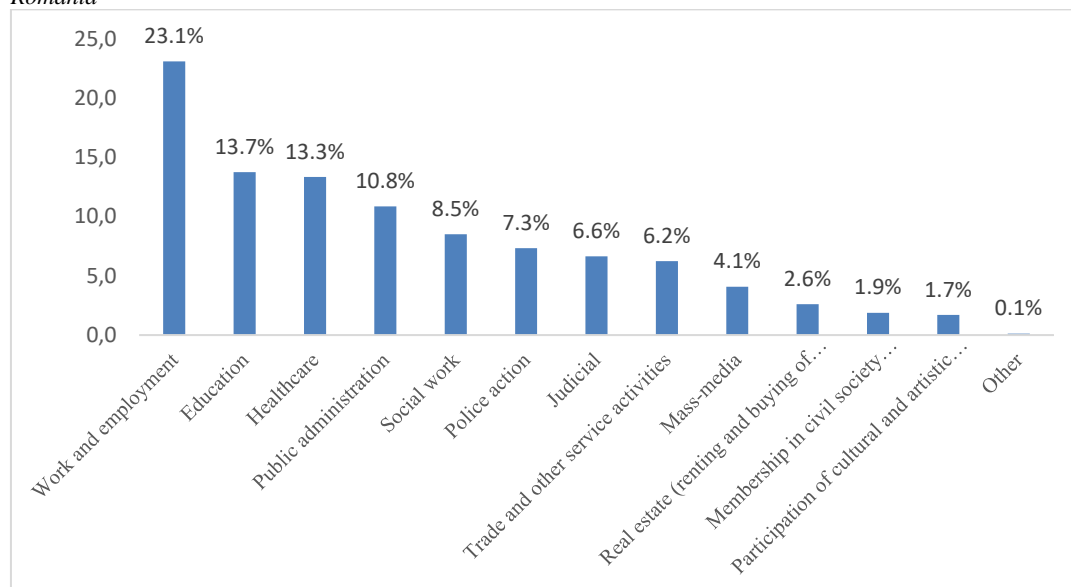
Source: authors' calculations based on data collected in the survey.

Almost one quarter of the respondents (23.1%) said that work and employment is the area in which discrimination occurs most frequently in Romania. Work and employment, education, and healthcare sum up half of the respondents' answers (Figure 9).

Figure 10. *Distribution of individuals/organisations which respondents believe discriminate most often in Romania*
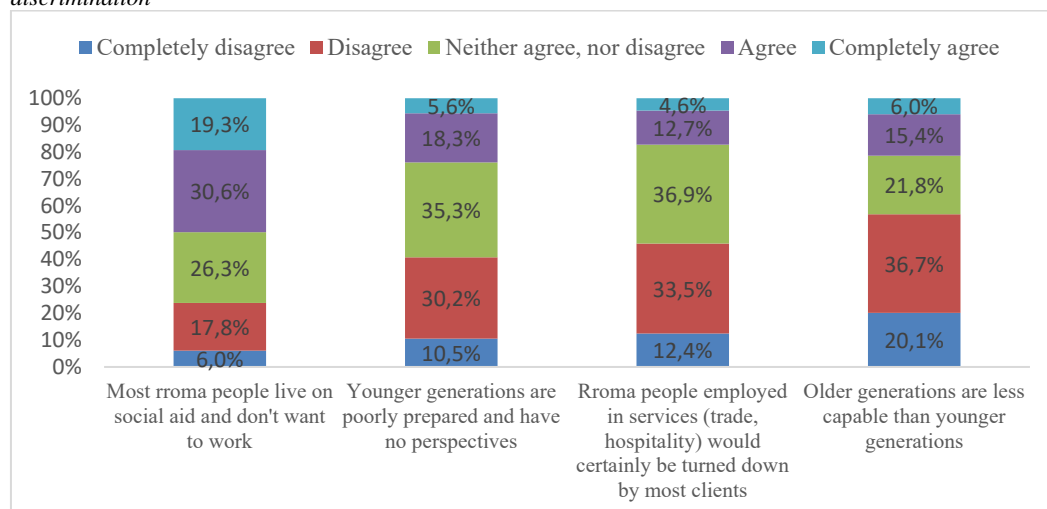

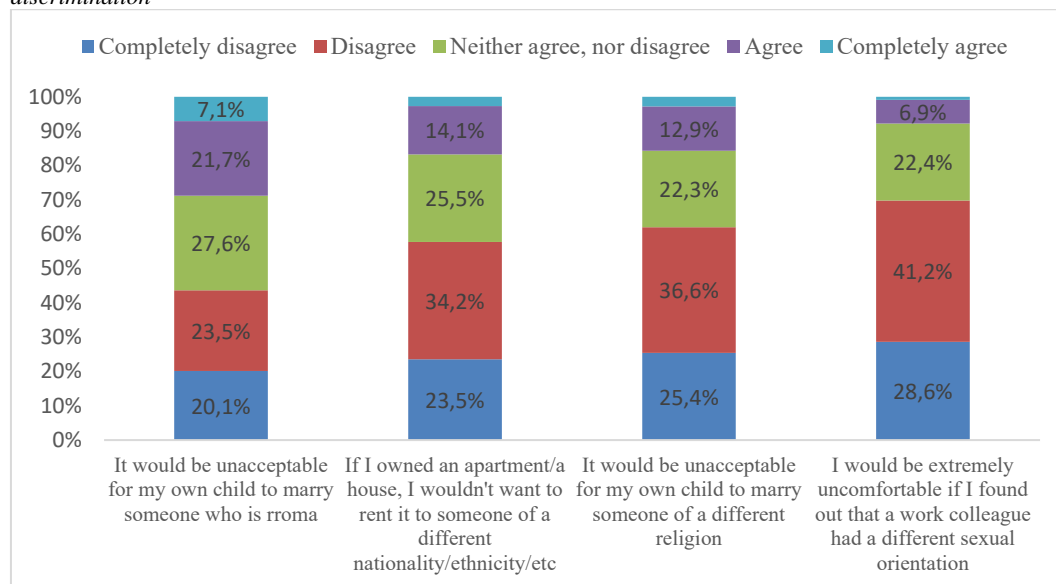**Source:** authors' calculations based on data collected in the survey.

Regarding who discriminates in Romania, nearly one third of the respondents (29.8%) believe the answer to be individuals, followed by private employers (20.6%), and state institutions (16.9%) (Figure 10).

The following three figures present the levels of agreement or disagreement to a series of statements related to discrimination. Most of the statements refer to ethnicity related discrimination, as it has been the most encountered reason for discrimination according to the survey results.

Figure 11a. *Distribution of levels of agreement/disagreement with a series of statements related to discrimination*

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

Figure 11b. *Distribution of levels of agreement/disagreement with a series of statements related to discrimination*

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

Figure 11c. *Distribution of levels of agreement/disagreement with a series of statements related to discrimination*
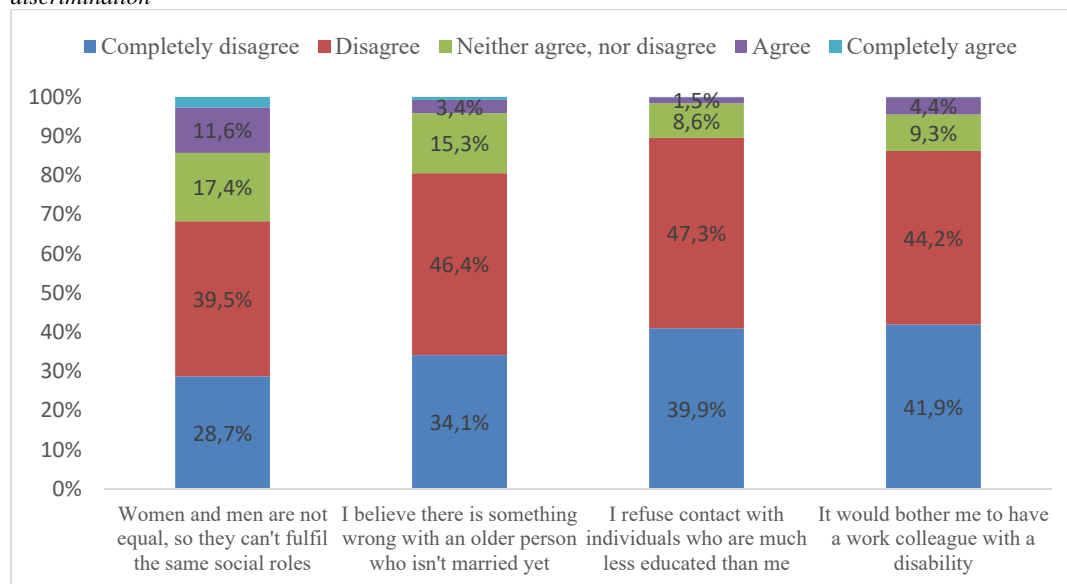
Source: authors' calculations based on data collected in the survey.

Over three quarters of respondents (>75%) disagree or completely disagree with the statements *"It would bother me to have a work colleague with a disability"*, *"I refuse contact with individuals who are much less educated than me"*, and *"I believe there is something wrong with an older person who isn't married yet"*. Over two thirds (>66.6%)

disagree or completely disagree with the statements *"Women and men are not equal, so they can't fulfil the same social roles"* and *"I would be extremely uncomfortable if I found out that a work colleague had a different sexual orientation"*. Over half (>50%) disagree or completely disagree with the statements *"It would be unacceptable for my own child to marry someone of a different religion"*, *"If I owned an apartment/a house, I wouldn't want to rent it to someone of a different nationality/ethnicity/etc."* and *"Older generations are less capable than younger generations"* (Figure 11a, b, c).

The statements where less than half of the respondents (<50%) disagree or completely disagree are *"It would be unacceptable for my own child to marry someone who is roma"*, *"Roma people employed in services (trade, hospitality) would certainly be turned down by most clients"*, *"Younger generations are poorly prepared and have no perspectives"* and *"Most roma people live on social aid and don't want to work"*. The last statement also has the highest rate of respondents agreeing or completely agreeing with the expressed opinion, that being half of the respondents (49.9%).

4. Conclusions

In general, it is considered that a certain degree of inequality can be an incentive for investing in human capital, promoting mobility and encouraging innovation. The economic incentives, important for economic growth, are based on the possibility that a person can achieve better results through his/her own efforts. However, when the level of inequality becomes too high, it can jeopardize economic growth. This is especially true when inequality is determined by the increase in poverty at the bottom of the income distribution ladder. In this situation, a vicious circle is created when the people at the bottom of the income distribution do not have the resources to invest in their skills and education and they may not be able to reach their maximum potential, which harms global economic growth. In addition, income redistribution can also help stimulate demand in the economy, as low-income households tend to spend more.

The answers provided in the survey showed that the monthly income obtained by the respondents is influenced by gender and residence environment, the lowest incomes being reported by women from rural environment and the highest incomes being reported by men from urban areas. The most successful areas of economic activity from the point of view of the obtained income are Information and communication and Real estate transactions. At the opposite end, the lowest incomes are obtained in the field of Performances, cultural and recreational activities and other service activities. Compared to the previous year, 2019 registered a decrease in the levels of savings and revenues, but an increase in the level of expenses.

Most respondents assess that their current incomes are not enough for the bare necessities or only for the bare necessities. Respondents generally agree with the provision of social benefits and the fact that they can reduce income inequalities, but they do not have a favourable opinion about the people potentially eligible to receive social benefits. As for income inequality policies, in most cases there is no consensus on their impact.

Inequalities in a society have many determinants, but discrimination is a fundamental cause of inequality. The effects of discrimination are particularly serious, frequently leading to marginalization, exclusion and poverty, as vulnerable groups are not able to enjoy the economic, social or cultural rights they should benefit from under the law. The link between discrimination and inequality has been studied mainly in relation to the labour market and to the health and education services sector, the main areas in which the two phenomena manifest.

Discrimination on the labour market, for whatever reason or form, within the potential reduction of the labour supply, can adversely affect the economic performance of the state, so it is necessary to take measures to reduce inequalities and increase the number of employees from these vulnerable social groups. Reducing the inequality rate will increase the quality of life, intensify the activity of enterprises and reduce the unemployment rate and social differentiation.

Respondents find that discrimination is most often related to ethnicity (31%), income level (13%) and sexual orientation (11%). Also, respondents consider that people with disabilities are discriminated against often or very often (51%). The main reason cited by the respondents as being responsible for the discrimination in Romania is the lack of education. The areas in which respondents believe that discrimination is the most widespread are *Work and Employment*, *Education and Healthcare*. The main actors that discriminate are individuals, private employers and state institutions. The media and the church seldom discriminate, according to the respondents' opinions.

More than one quarter (29%) of the respondents consider that *It would be unacceptable for their own child to marry a Roma person*. Also, half consider that the *Majority of the Roma live on social assistance and do not want to work*. Of the respondents who say they have faced discrimination, most argue that these were related to ethnicity or the income level.

Acknowledgements

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