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## **International banking, crises and strategic interests**

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**Abstract.** *The article reflect the analysis of the most relevant European, American and Chinese financial banking groups, mainly driven by the context of changes generated by the financial and pandemic crises. The first two parts of the paper highlight the broader context of the design of strategic interests and the competitive development of banking businesses after the financial crisis, together with relevant research findings. The third part of the research includes the analysis and interpretation of the evolution of indicators that have an impact from a competition perspective, for the exponents of the three banking systems analysed, over the period 2009-2020. The fourth part highlights the results obtained, along with qualitative correlations that add value to the research. The paper ends with a section including the authors' conclusions.*

**Keywords:** financial crisis, competition, international banking, strategic interests, pandemic crisis.

**JEL Classification:** E63, G01, G15, F450.

## Introduction

Top concerns, within crisis and post crisis contexts (financial, pandemic), are linked with the level of competition and cooperation, between the international banking groups, invited to provide solutions and to contribute to the recovery process. The impact has a strategic approach, due to the effects of a crisis, over the long run, for an economy, for a monetary area, for the financial and banking sector.

The paper focuses on competitive developments from the perspective of the impact of the global financial crisis. This has led to changes in the global financial and banking governance framework, the emergence of new bodies and institutions, development of new tools for prudential supervision and resolution of credit institutions. The structural changes resulting from the global financial crisis have significantly influenced the responsiveness, the degree of coordination at the level of authorities, the mechanisms and tools used in the context of the pandemic crisis.

Since the 1970, starting with OPEC energy crisis, every two years a crisis<sup>(1)</sup> has occurred in one country in the world, affecting at least that region. Selectively, may be reflected the debt crisis in Latin America (1982), the crisis in the USA (1987, Black Monday), geopolitical crises in Eastern Europe (1989), the Asian financial crisis (1997), the Dotcom crisis (1999/2000). After 2000, other crisis contexts reflect the terrorist attacks in the USA (2001), the global financial crisis (2007/2008), sovereign debt crisis (2010), Greek debt crisis (2009-2019), Crimean geopolitical crisis (2014), China real estate crisis (2015), Turkish currency and financial debt crisis (2018), pandemic crisis (2020) and Ukraine geopolitical crisis (2022).

The structure and composition of banking systems differ. They are following the structure of the economies to which they belong, the strategic interests of governments, the commercial interests of companies in the countries of provenience. The contribution of banking systems and capital markets to the financing of economies, the financing of economic expansion, the presence of banking players in financial markets, also influence the design of strategic interests.

The focus of this research captures the evolution of competitiveness in the period between the global financial crisis and the pandemic crisis, 2007-2020. During this period, strong regulatory dynamics, lack of economic growth, "zero" interest rates, low deposit take-up and financial market development for Europe stand out. In the US banking market, the strong links between banks and capital markets support developments and growth in investment banking. In the Chinese banking system, considering the same period, strong economic growth has been oriented towards the financing of international trade, strategic infrastructure programmes and exports.

We have selected two relevant tables to begin the analysis of key indicators, reflecting the competition at the level of European, US and Chinese banking groups.

**Table 1.** *Top 10 banks/banking groups globally, 1970*

Rank	Bank	Country	Total Assets \$m
1	BankAmerica	US	25,573
2	First National City	US	23,092
3	Chase Manhattan	US	22,168
4	Barclays Bank	UK	15,137
5	Manufacturers Hanover	US	11,965
6	JPMorgan	US	11,448
7	National Westminster Bank	UK	10,642
8	Western Bancorp	US	10,617
9	Banca Nazionale del Lavoro	Italy	10,233
10	Chemical New York	US	9,739

Source: The Banker.

And 50 years later, the top 10 banks/banking groups are shown in Table 2.

**Table 2.** *Top 10 banks/banking groups globally, 2020*

Rank	Previous	Bank	Country	Tier 1 capital (\$bn)
1	1	ICBC	China	380
2	2	China Construction Bank	China	316
3	3	Agricultural Bank of China	China	278
4	4	Bank of China	China	258
5	5	JPMorgan Chase	US	214
6	6	Bank of America	US	188
7	7	Wells Fargo	US	159
8	8	Citigroup	US	156
9	9	HSBC	UK	148
10	10	Mitsubishi UFJ	Japan	144

Source: The Banker.

From the two tables, we can see the presence of Chinese banks in the top four positions of the global bank ranking in 2020. These results are considered the consequence of the economic reforms carried out since 1979 for agriculture, the stimulation of exports and imports of high technologies, the granting of incentives for business development, tax and trade facilities to attract investors and trade liberalization. The economic reforms created and developed over the last 50 years have contributed to increasing economic efficiency, stimulating production and increasing the volume of resources for further investment in the economy.

China's trade and investment reforms and incentives have led to a significant increase in foreign direct investment since the early 1990s. These flows represented a major source of China's banking system development, productivity and trade growth. Economic reforms and the liberalisation of trade and investment have transformed China's banking system into a major global trading and banking power. Manufactured goods have represented a significant part of China's trade.

At the start of the global economic slowdown, many Chinese governmental entities borrowed money to stimulate local economies, particularly by supporting infrastructure projects. The Belt and Road Initiative (BRI) was drafted as China's plan to finance and build infrastructure projects across Eurasia. Infrastructure development is one of the five components of the BRI, which include enhanced regional political cooperation, unfettered trade, financial integration and people-to-people exchanges.

The main sources of financing for most of these BRI-participating projects are Chinese development banks, the \$40 billion Silk Road Fund, which targets investments in energy infrastructure projects, and two major state-owned commercial banks<sup>(2)</sup>.

Compared to the diversified sources of funding of the Chinese financial and banking system, capital markets in Europe play a relatively modest role in the financing structure of the European companies. Raising funds from the capital markets, and in particular the corporate bond market, is the predominant financing method in the US.

US banks are focusing on investment banking products, with the major US bulge-bracket investment banks (Goldman Sachs, Morgan Stanley, JP Morgan, Citigroup and Bank of America Merrill Lynch) becoming leaders in global investment banking.

The slower development of capital markets and securitisation in Europe has created a barrier to reducing the stock of non-performing assets accumulated during the crisis (especially in countries such as Greece, Portugal, Spain, Cyprus), which penalises the profitability of European banks. In contrast to the European banking market, US investment banks are using the capital markets more aggressively to extract certain assets through securitization, selling assets to US federal agencies or Government Sponsored Entities (GSEs): the Federal Home Loan Mortgage Corporation (Freddie Mac), the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Banks (FHLB). The role played by banks in the US in terms of providing funds to the private sector is rather underestimated, due to the fact that, the significant amount of debt securitised by banks is not considered.

In the US banking model, securitization plays an important role because it allows banks to "pack" assets, structure and sell them on the capital market in order to free up balance sheet and capital, to increase profitability. US banks use securitisation as a source of funding, as a balance sheet rotation and capital release tool. The volumes securitized by US banks are much higher than the volumes securitized by European banks, leading to higher profitability for US banks compared to their European counterparts.

The research pays particular attention to the elements that contributed to the different path for European and US banking groups, in the period between the global financial crisis and the pandemic crisis. Other research interest is represented by the rapid and strong economic rise of the Chinese banking groups, during 2007-2020. Due to a quick recovery from the global financial crisis, relevant indicators reflect that China outpaced other major economies of the world.

The paper adds value to existing literature by analysing the evolution of the competitiveness of relevant banking actors from the three selected banking systems.

In the second part, studies and articles representative for the problematique are included.

The third and fourth parts of the research include the presentation of the methodology, the analysis of the evolution of the most relevant global banking groups, from a competitiveness perspective and the interpretation of the results. The last part contains the authors' conclusions.



### Literature review

According to (Bijlsma and Gijsbert, 2013) bank assets in the EU (excluding Eastern Europe) have increased substantially as a percentage of GDP, in contrast to the US and Japan, where this ratio has remained relatively stable. Regarding bank credit to the private sector as a percentage of GDP, Pozsar et al. (2010) state that in Europe and Japan this volume has been much higher than in the US. In addition, there has been a massive increase in bank credit in the EU, with the exception of the early period of the financial crisis in 2008, while in the US it has remained more stable over the last decade and Japan has not been much affected by the crisis.

Ruzickova and Teply (2015) highlight the theoretical and practical aspects of fee and commission income in the European Union. The authors suggest that the magnitude of fee and commission income depends largely on the bank's business strategy as well as market conditions. Banks facing stronger competition tend to expand more aggressively into potentially riskier non-traditional activities. As a result, they may have higher shares of fee and commission income but may need additional capital.

The authors find that a high deposit-to-asset ratio, an indicator of traditionally oriented banking activity, tends to be associated with higher shares of fee income, while the close relationship between bank and depositors allows European banks to sell more additional fee-based services, given inelastic demand, at higher prices.

Khan et al. (2016) show that the effect of monetary policy on bank lending is reduced as the level of competition is reduced. However, their results suggest that a decrease in the level of competition strengthens the transmission of monetary policy through the bank lending channel. The weakening/strengthening effect is stronger for banks with a high level of capitalization, and high liquidity.

Bremus (2015) studies the impact of foreign direct investment and cross-border banking on market concentration and competition. Both foreign lending and foreign ownership of banks coincide with lower concentration in the banking sector. In contrast, the implications of these two different modes of cross-border banking differ in terms of banks' market power. According to the granularity literature, higher concentration in banking may lead to a stronger variation in aggregate variables such as credit, investment or GDP, and if there is a reduction in cross-border banking, this will lead to higher bank concentration, with the link between bank-level volatility and macroeconomic volatility thus becoming stronger.

Andrievskaya and Semenova (2016) examine bank transparency and concentration with bank disclosure in terms of credit risk. Banking markets are less concentrated in countries with more tightly controlled information transparency. This effect increases as bank credit risks increase, but when these risks are considered too high, information transparency regulation becomes less effective and can lead to the opposite results.

According to the authors (Andrès and Truchet, 2022) European banks need to be more efficient, more profitable, more capitalized. Banking Union and a functioning European Deposit Insurance Scheme (EDIS) are essential elements for the European financial governance. Compared to European banking systems, US banks can subsidise servicing in

Europe, but they do not have to fund resolution, having the ability to transfer an important amount of risk to securitisation markets or to government-sponsored enterprises (GSEs) for their mortgage business.

At the level of European banking markets, the completion of the Capital Markets Union must be based on a mix of merging stock exchanges, harmonising regulatory and supervisory activities around capital markets. A single supervisor at the level of the 27 countries may support the development of Europe's technology sector, transition to renewable energy, and strengthen the resilience and competitiveness of financial institutions.

As in the case of US banks, lending Chinese banks are exposed on trade and present on the capital markets. As highlighted by the authors (Casanova et al., 2021) and (Cerutti et al., 2020), the positive effects which have contributed to the overall economic growth of the Chinese banking system, persist on the long run.

In terms of competitiveness, the authors (Berndt et al., 2016) highlight that the EU has failed to benefit from new technologies to the same extent as the US, mainly due to insufficient investment in skills and organisational change. The financial crisis has had a strong negative effect on productivity growth, more in the EU than in the US.

US banks operate predominantly on an "originate to distribute" model as presented by the authors (Andrès and Truchet, 2022), and this has led to a stronger secondary capital market. It also allows for a stronger primary market and funding market for businesses and banks. The competitiveness gap between the major European banks and their US and Asian competitors also exists due to factors such as interest rates, market fragmentation, especially after Brexit, excess capacity and the fact that the structure of the financial sector in Europe is different from that in the US. The existence of deep liquidity buffers to reduce funding costs and allow for global cross-border flows into the European market is an issue that the European Union needs to continue to focus on.

European banks were hit hard by the global financial crisis of 2007-2009 and by the subsequent European (sovereign) debt crisis. The problem of non-performing loans, over a longer period of time, prolonged the zombie ("ever-greening") loans. In contrast, US banks have been addressing this problem since early 2008-2010, building up large loan loss provisions and making significant write-downs on their loan portfolios, respectively (de Haan and Kakes, 2020, pp. 197-211) and (Schildbach, 2017).

Regarding China, according to the authors Li et al. (2012) it has been hit hard by the global recession generated by the financial crisis, suffering a significant drop in exports, stock market and real estate market. These effects on the economy have been only partially offset by the huge stimulus program for the Chinese economy. Although growth remained well above the international average, the downturn was as strong as in the US.

Regarding the pandemic crisis, according to (ECB, 2021), European banks have absorbed well the economic shock, as a result of both the regulatory reforms put in place in the wake of the global financial crisis and the achievements on single supervision within the banking union. At the US level, the improved outlook resulting from the large fiscal stimulus

prompted banks to release provisions in the fourth quarter of 2020. This differs from banks under European banking supervision, which continued to build provisions in the fourth quarter, albeit at a slower pace than in the first two quarters of 2020. Loan impairments for US banks were significantly higher for the full year 2020.

China's overall economic response to the pandemic crisis, according to (Borst, 2020), has been relatively muted compared to major fiscal and monetary responses in the US and Europe. While the Federal Reserve has taken unprecedented actions to support banks, financial markets, small borrowers, the measures taken by China's central bank have been more gradual. The Chinese authorities appear to be balancing the need to support the economy against the risks of exacerbating China's high debt levels and economic imbalances.

### Research methodology

The study aims to contribute to the formulation of support for addressing strategic issues, reflected in two questions: what are the influential factors for the European and US financial-banking groups, respectively the European and US banking systems, that have weathered the global financial crisis and the pandemic crisis differently? What are the elements that contributed to the rapid and consistent rise of Chinese financial-banking groups, between 2007-2020?

The comparative analysis was carried out at the level of the most relevant financial-banking groups in Europe, US and China. The source of the data is The Banker and the World Bank's databases, with records extracted for a 14-years period, from 2007 to 2020. From an economic perspective, the selected banks/banking groups play a prominent role in the global economy, which was an important argument for the selection. Top global 500 and 1000 banks were analysed within the research process.

The methodology consisted in a comparative analysis of a number of indicators relevant to financial and banking activity. The study included the five largest banks in Europe, the four largest banks in China and the five largest banks in North America – USA. The relevant indicators selected are: Tier 1 capital, profitability, measured by return on assets (ROA) and volume of assets. The analysed banks are included in Table 3.

**Table 3.** *List of banks on which the study was based*

Rank	European Banks	Chines Banks	US Banks
1	BNP Paribas	Industrial and Commercial Bank of China	JPMorgan Chase
2	HSBC Holdings	China Construction Bank	Bank of America
3	Crédit Agricole Group	Bank of China	Wells Fargo & Co
4	Banco Santander	Agricultural Bank of China	Citigroup
5	Barclays	Bank of Communications	Morgan Stanley
6	Société Générale	China Development Bank	Charles Schwab
7	Groupe BPCE	Postal Savings Bank of China	Goldman Sachs
8	Deutsche Bank	Industrial Bank Co Ltd	US Bancorp
9	Intesa Sanpaolo	China CITIC Bank Corp	PNC Financial Services Group Inc.
10	Lloyds Banking Group	China Merchant Bank	Capital One Financial Corp

**Source:** authors' processing.

## Results and discussions

The global financial crisis of 2008 changed the global economic and financial landscape. The US government stepped in with a \$700 billion bailout package to prevent the failure of banking institutions, considered "too big to fail". While some of these institutions, such as Lehman Brothers and Bear Stearns have been allowed to fail, the government prevented the collapse of other large banks.

Strategic decision support a strategic vision. America's largest investment bank, JP Morgan Chase, received a \$30 billion loan from the Federal Reserve in 2008 to buy Bear Stearns, paying \$10 per share for the ailing investment bank. In 2020 JP Morgan Chase was the largest bank, with \$3 trillion in terms of assets.

Investment banks Morgan Stanley and Goldman Sachs, after the financial crisis context, change the strategy to diversify the sources of funding but also risks. In 2020 Morgan Stanley offered a variety of banking services, in addition to investment banking and recorded relevant revenues, of \$48.2 billion.

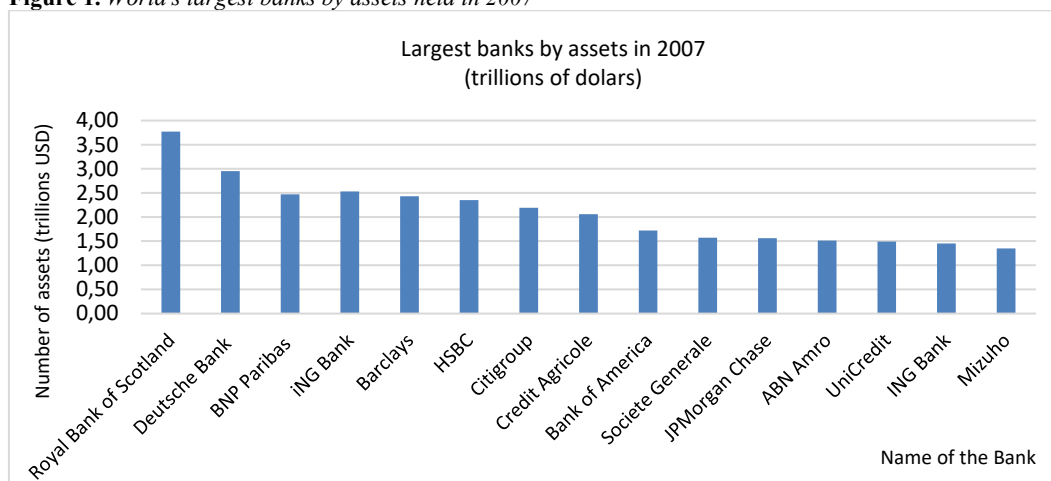
Bank of America also received the government bailout package, including more than \$100 billion in guarantees, in order to buy failed financial companies Countrywide Financial and Merrill Lynch. It had to take losses related to those companies, including bearing the legal fees associated with Countrywide's questionable mortgage lending practices. (Too Big to Fail Banks: Where Are They Now?, 2021)

## US, Chinese and European banks – comparative analysis

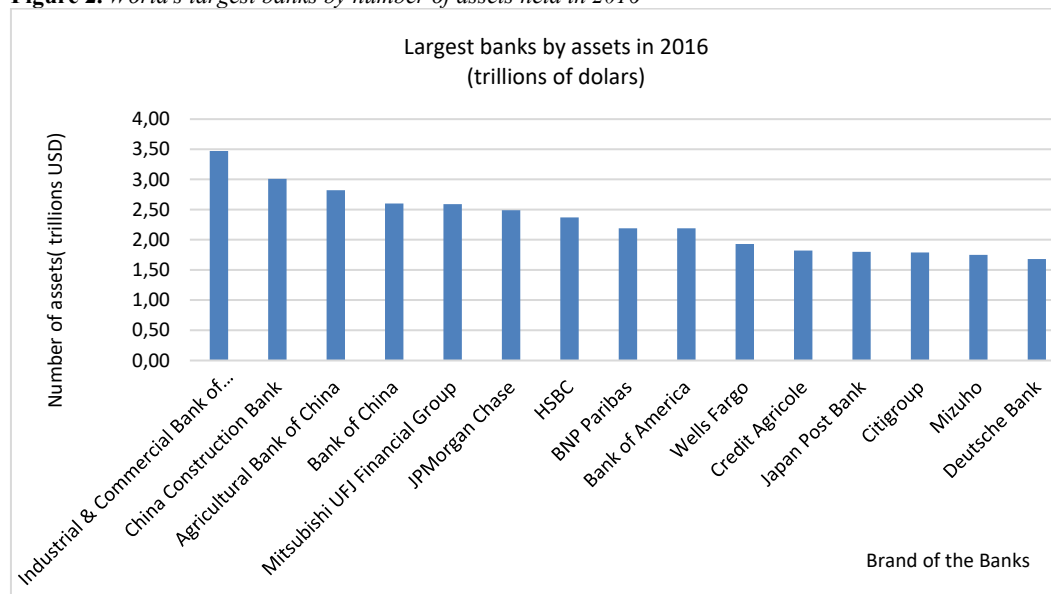
Before the financial crisis, the ranking for the world's biggest banks in terms of assets included banking organisations from UK, Europe, US and Japan.

In 2016 and 2020, before the pandemic, the global ranking changed significantly.

**Figure 1.** World's largest banks by assets held in 2007



**Source:** authors' own calculations based on the Banker data.

**Figure 2.** World's largest banks by number of assets held in 2016

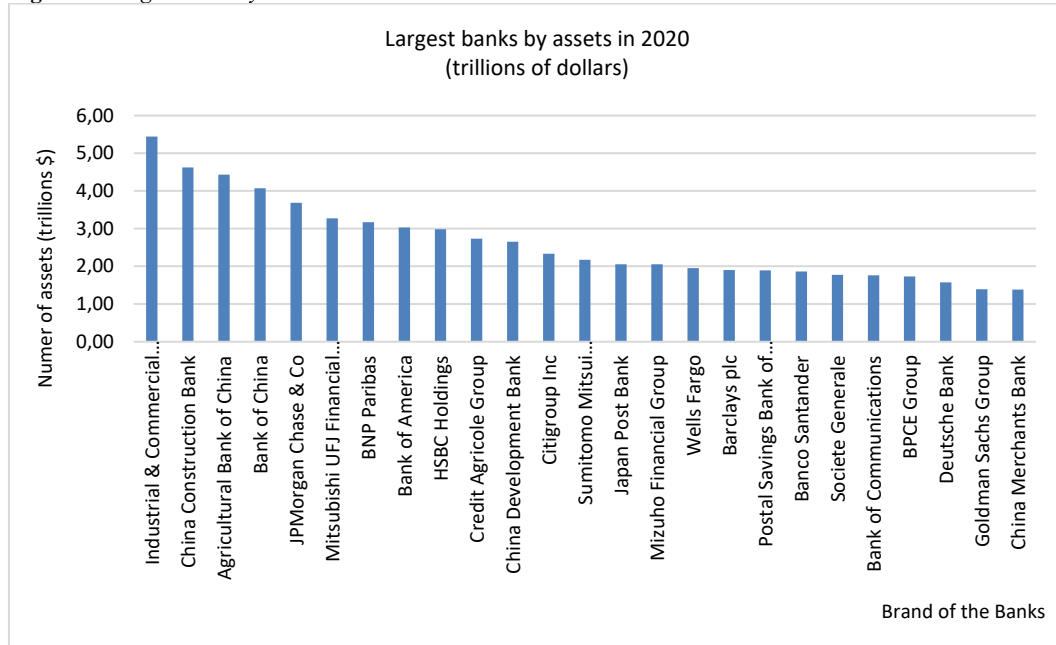
**Source:** authors' own calculations, based on the Banker data.

Since 2015, Chinese investment banks have overtaken US and European investment banks in the Asia-Pacific market, and the Chinese banking system has become the largest in the world, with 2020 assets of USD 53tr. By comparison, the US banking system stood at USD 19tr in the same period. The Chinese banking is mainly a domestic system, while the US banking system has a considerable share of cross-border activities. Cross-border claims of US banks were 4.35 billion USD in 2020 or 22.8% of total assets, while cross-border claims of Chinese banks amounted to 2.66 bn. USD or 4.7% of total assets.

As can be seen from Figure 1 and Figure 2, Chinese banks overtook European banks at the end of 2016 becoming the world's largest banking organisations, by assets, a sign of both the country's growing influence in global finance and its reliance on debt to drive economic growth, within the post financial crisis context. This development has been fuelled by a strategic increase in bank lending since 2008, when the government launched aggressive monetary and fiscal stimulus, constantly intervened in the capital markets to maintain financial stability, investment flows and direct lending, as the authors (Subacchi, 2021) point out, to mitigate the impact of the global crisis.

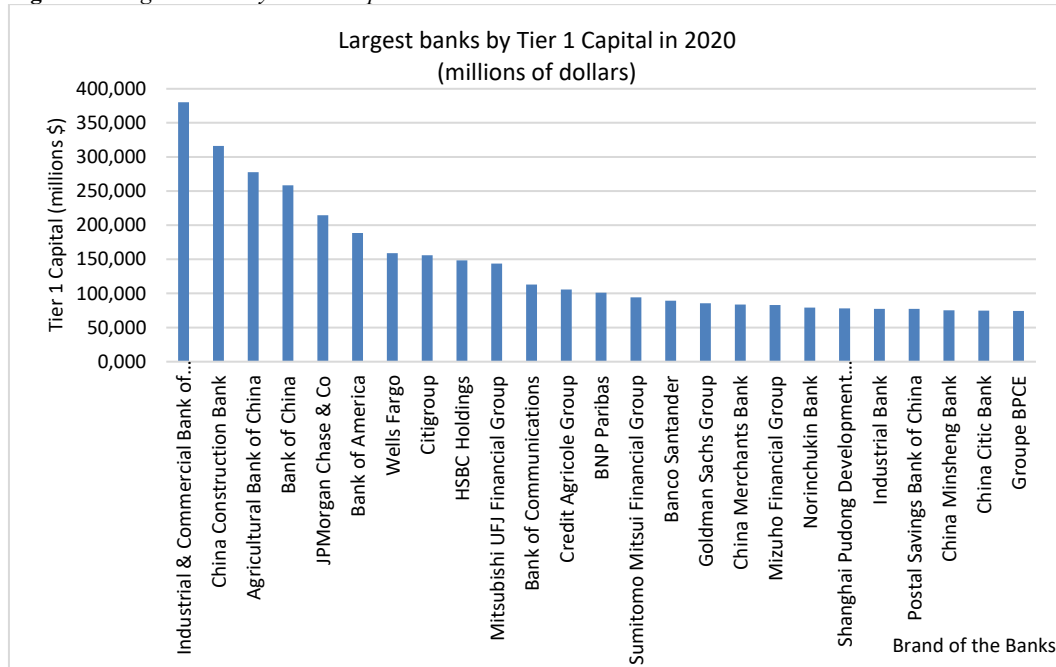
The stimulus package for Chinese banks included a two-year fiscal program that involved spending about \$586 billion, a figure equivalent to nearly 7% of China's 2008 GDP. In terms of bank asset size, Chinese bank assets reached \$33 billion at the end of 2016, compared to \$31 billion for Euro area banks and \$16 billion for US banks.

Figure 3. Largest bank by assets in 2020



Source: Authors' own calculations, based on The Banker data.

Figure 4. Largest banks by Tier 1 Capital in 2020



Source: Author's calculations, based on The Banker.

Figure 3 and Figure 4, reflect that related to the assets and Tier 1 capital size, ICBC, China Construction Bank, Agricultural Bank of China and Bank of China occupied the top four positions, for fourth years in a row. ICBC managed to maintain the first position as the world's largest bank for 8 consecutive years, recording a combined asset value of \$14.821 billion in 2020, up by 7.52% compared to the ranking in 2019. The banks included in the top of global rankings had substantial increases in Tier 1 capital, between 10% and 14%, as well as moderate increases in pre-tax profit.

Chinese banks were seven of the twenty ranked global banking groups in 2020. A total of 143 Chinese and 184 US banks were part of the top 1000 world's largest banks, in 2020.

Chinese banks had a high degree of exposure on corporates, with 55.67% of gross outstanding loans to the corporate segment, totalling \$17,905.6 billion, spread across the 143 banks in this ranking. US banks had a lower exposure of \$8,052.9 billion of gross loan value on corporate, spread across the 184 banks included in the ranking, representing 47.51% of the total exposure.

The analysis reveals that US banks are more cost and capital efficient, compared to the Chinese counterparts. Chinese banks were holding 24.64% of total global assets and 28.46% of global pre-tax profits, compared to US banking organisations, holding 13.55% of total global assets and 21.86% of pre-tax profits. At the aggregate level, return on assets (ROA) was 1.11% for US banks while for Chinese banks was 0.87%. Comparatively, JP Morgan earned pre-tax profits of \$44.5 billion in 2020, representing a 9.19% increase from 2019, outperforming Chinese counterparts, such as Bank of China and Agricultural Bank of China. Both Chinese banks were ahead of JP Morgan in terms of Tier 1 capital. JPMorgan managed to perform the best, out of the 20 banks, in terms of return on equity (ROE), registering 13.93% in 2020, and in terms of return on assets (ROA), registering 1.36% in 2020.

At the European level, for Europe's largest bank HSBC, 2020 was a particularly difficult year, with its pre-tax profits falling by a third year-on-year, to \$7.3 billion, representing goodwill impairment as the cause of the losses.

French banks made the largest share of European banks' profits for the fifth consecutive year, but their pre-tax profits fell slightly by 1.96%. BNP Paribas, Groupe BPCE and Credit Mutuel recorded small increases in pre-tax profits of 9.11%, 2.2% and 2% respectively. The country's largest bank, Credit Agricole, recorded a year-on-year fall in profits of 8.65% and Societe Generale also recorded a year-on-year fall in profits of 16.74%.

The German banking industry remains fragmented, with the top four banks (Deutsche Bank AG, Commerzbank AG, KfW Group, DZ Bank Group) accounting for 31% of total market assets, compared to the European average of 50%. Between 2010 and 2019, German banks' revenues fell by around 8%, from €129 billion to €119 billion, registering also a decline in market share and revenue levels, in favour of foreign banks. The revenue level of German banks decreased from around 70% in 2010 to 60% in 2019. They still dominate retail banking (including private banking) with a market share of 80%, keeping only a minority share in the investment banking, wealth and asset management market, with shares between around 20% and 45%.

In case of Spanish banks, profits declined in the wake of the pandemic crisis, falling for BBVA by 7% year-on-year to USD 1.14 billion in 2020, for Sabadell profits fell by 77% in 2020 to USD 57 million and for Caixabank the decline in profits represented 19%. In terms of the consolidated net profit of Spanish deposit-taking institutions, the aggregate result was negative, approximately -8 billion euros. This translated into a return on assets (ROA) of -0.21% and a return on equity (ROE) of -3.1%.

Japanese banks increased their profits by 4%, taking the country from 6th to 5th place, according to The Banker's world's 1000 best banks. This was due to a 443% increase in Mizuho Financial Group's profits, despite declines at the other two top Japanese banks, Mitsubishi UFJ and Sumitomo Mitsui. In the main rankings based on Tier 1 capital, a key measure of banking strength, Mitsubishi UFJ retained its position as the 10th largest bank in the world, with \$144 billion in capital. Sumitomo Mitsui ranked 14th with \$94 billion and Mizuho ranked 18th with \$83 billion. Together, the three banks account for 46% of total Japanese bank capital.

The analysis liaise the banking organisations evolution with the specific developments in the economy of the countries, areas considered.

As reflected by the Figure 5, over the transition period between the two global crisis, financial and pandemic crisis, the period 2007-2020, China's economic growth was based on a mix of exports and international trade, domestic market capitalization, corporate bond issuance and infrastructure stimulus.

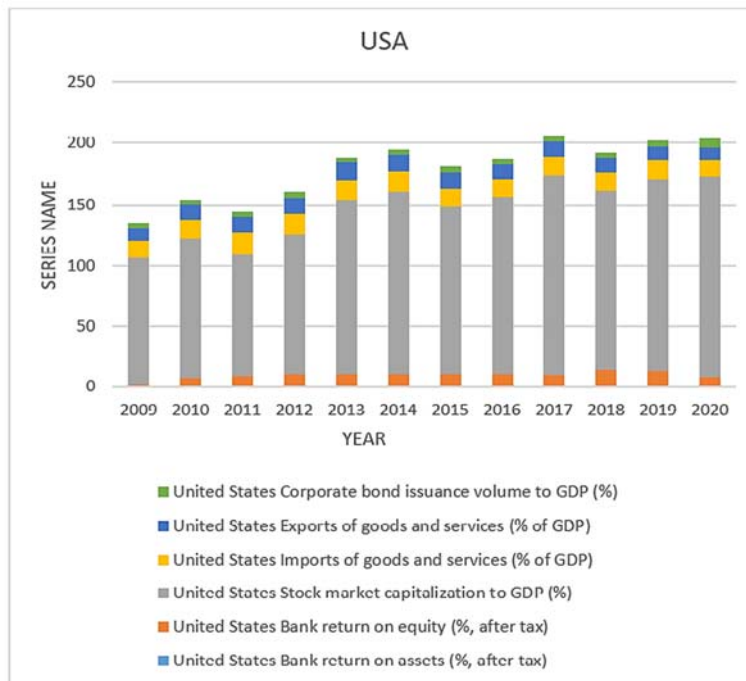
**Figure 5.** Evolution and economic indicators – China



**Source:** authors' own calculations, based on World Bank data.

In case of the US banking market, according to Figure 6, economic growth was based on corporate bond issuance, market capitalization, export and import of goods and services.

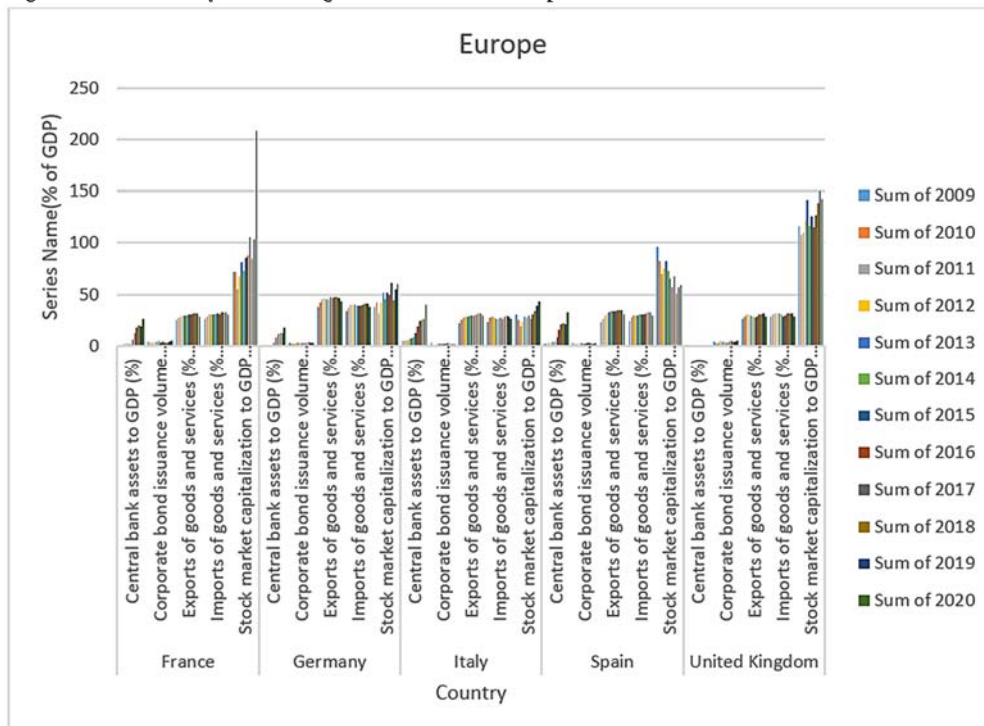


**Figure 6.** Evolution of US economic growth indicators

**Source:** authors' own calculations, based on World Bank data.

For Europe, especially the Euro area, between 70% and 80% of corporate funding is provided via the banking organisations. The percentage for SMEs funding via banks is considerable different in Europe, representing around 85%, compared to US, representing 35%<sup>(3)</sup>.

Considering the same period, between the two global crisis, in Europe, for the five selected countries, the analysis emphasize a fragmented market, focused on specific areas, such as export, import and market capitalization.

**Figure 7.** Evolution of economic growth indicators European countries

**Source:** authors' own calculations, based on World Bank data.

### Banks, performance and strategic interests

The European banking sector, based on the financial governance developed within the post financial crisis context, contributed to the support of the European economy, during the pandemic crisis. Capitalisation, liquidity, governmental guarantees, cooperation between authorities, represented key points for the banking support of the European economy. The Single Resolution Board (SRB), through improved loss absorbency and the massive placement of the Minimum Requirement for Eligible Capital and Liabilities (MREL), contributed to the increase in resilience of the banking sector, during the pandemic crisis. The low profitability of the European banks remained a vulnerability, in terms of future economic growth and support for the European strategic interests.

The research reflect that, over the period 2014-2020, US banks managed to maintain a higher ROE than European banks (average 8.5% vs. 5%). The gap in profitability, between US and European banks, based on net fee and commission income, net trading gains and differences in impairments and provisions, may also reflect a competitiveness gap.

Policy debate at the European level reflect other relevant issues that need to be approached and solved. Overbanking capacity in Europe, resolution for the small and mid sized banks, fragmentation of the European banking market, the relationship between resolution, liquidation and insolvency provisions at the country level represent top concerns.

The diversity of banking business models in Europe may be considered a strength, as it enhances resilience and the ability to meet diverse customer requirements. Within the US banking market diversity is similar, compared to the European banking market.

As the Bearing Point study reflects (Hofele and Steiner, 2022), there is a specific difference within the European and US regulatory frameworks, enabling the US banks to be more profitable and competitive. The ROE of European banks could be 340 basis points higher if they were instead subject to the US capital regime, and the cost-to-income ratio could be 260 basis points lower. Balancing the regulatory differences may represent an opportunity for the European banking system. Other relevant research consider it is a challenge, due to the European Central Bank's interest policy rate, because in periods of substantial inflation, the ECB charges negative rates and purchases assets. The authors consider it is necessary to return to a more conventional monetary policy (Andrès and Truchet, 2022).

The diversity of banking business models in the European and US banking markets, as well as the attraction of new investors by Chinese banks, implies the need for strategic collaboration between large banks and large corporates to achieve long-term sustainability, digitization and cyber risk objectives.

**Table 4.** *Largest companies by market capitalisation in 2022*

American Companies	European Companies	Chinese Companies
Apple	LVMH	Tencent
Microsoft Corporation	Nestle AG	Kweichow Moutai
Alphabet	Roche Holding AG	Alibaba
Amazon	ASML Holding	CATL
Facebook	Prosus	Ping An Insurance
Tesla Inc.	L'oreal	China Mobile
Berkshire Hathaway	Accenture	PetroChina
Nvidia Corporation	Novo Nordisk A/S	Meituan
Visa Inc.	Novartis AG	China Life Insurance Company
ExxonMobil	Royal Dutch Shell	China Railway Engineering Corporation

**Source:** Authors' processing, based on companiesmarketcap.com data

As a result of the pandemic crisis, and the increased pressure from the non-financial sector, business models of banks need to be adapted to the digitization process which creates new opportunities but also risks. The increased speed of innovation and greater interconnectedness between intermediaries and banking sectors have contributed to the broadening of the traditional definition of cyber and operational risk, leading the industry and banking supervisors to consider cyber risk as one of their specific top priorities.

Other factors that may drive changes in business models, shifting the profit of banking organisations to other sectors of the economy, are represented by the correlation between digitalisation, decarbonisation, automation, post-pandemic structural changes and geopolitical changes. These changes imply important investments and financing needs, not in a traditional approach, as they imply higher risks and medium to long-term investments. According to (Dinu, 2021) geography and behaviour, of all the relevant actors of the economy, matter. Knowledge and competition represent key drivers towards a more inclusive society, Europe being a frontrunner.

In accordance with Table 4, the major US, European and Chinese banks have developed and deepened strategic relationships with major players in IT and automotive industry, to support the medium and long term goals of sustainability and digitalisation.

The European, US and Chinese banks are investing in the digitalisation processes, cooperating and also competing with technological global players (Apple, Microsoft, and Google), developing and integrating new alternative and innovative payment solutions. The largest banks in Europe, US and China, are funding the automotive manufacturers, chip companies and renewable energy producers, to support the transformation of the economy in accordance with the sustainability objectives.

From a strategic point of view, European, U.S. and Chinese banks are promoting relationship management between Big Tech and automotive, oil and renewable energy companies, as a catalyzer for medium and long-term investments in sustainability, leading to the reduction of the carbon footprint, in accordance with the global agenda.

The research formulates an answer to Question 1. For Europe, the main factors influencing a difficult recovery within the post financial crisis context include market fragmentation, strategic reorientation of large banks towards domestic markets, regulatory changes and challenges. The US economy has been growing relatively steadily since 2010, while in Europe output has suffered a double-dip recession, from which it has only managed to recover since 2013.

In addition, the greater need for EU banks to raise capital ratios to more prudent levels and the stronger deleveraging has put them at a competitive disadvantage, compared to their US counterparts. There was a clear trend for banks in Europe to shrink their activities by refocusing on domestic markets. This was driven mainly by commercial considerations, such as a rethinking of the broad, undifferentiated expansionary strategy that many banks pursued in the era of cheap, unlimited credit without major capital constraints. Regulatory changes was the other main reason for European banks to refocus on their home markets. Regulation has increasingly evolved to require banks to operate independently, separately capitalised subsidiaries in host countries with their own liquidity holdings.

The European banking market become more fragmented, despite the strategic approach to deepen EU's single market for financial services. National authorities in all European countries have come up with distinct requirements, in an effort to protect the national financial system from potential instability, reduce the risks to their taxpayers. The US banks were not affected by fragmentation because their home market maintains a uniform (albeit unconsolidated) regulatory framework and they are also under much less pressure to withdraw from foreign markets (in general, US banks have never been nearly as active cross-border as their European counterparts).

Regarding the Question 2, the research emphasize specific elements that have contributed to the rapid rise of Chinese financial-banking groups. Large-scale capital investments were financed as a result of high foreign exchange reserves. Investment in major infrastructure projects, under specific programs, such as the Belt and Road, major investment in agriculture and rural industry, rapidly increase in productivity, subsequently leading to significant growth in foreign trade, are the most relevant factors, during the analysed period.

## Conclusions

The research analysed the main indicators for top banking organisations, part of the European, US and Chinese banking sectors. The strategic interests of the three global actors reflects a strong connection between banking organisations, performance, governmental support programs, strategic decisions and expansion of corporate companies.

The study analysed the effects of the 2008 financial crisis and the impact of the pandemic crisis in 2020, on the volume of assets, Tier 1 capital size for the largest banks, and profitability, as measured by the indicators return on assets (ROA) and return on equity (ROE).

The analysis shows that in international banking, between 2007 and 2020, the rapid and steady development of profitability played a key role for US banks, due to the strong connection between banks and capital markets and the strong development of investment banking activities. The Chinese banking system, via the largest banking organisations, focused on supporting the international trade, strategic infrastructure programs and exports. Defining strategic interests and objectives, developing and using specific financing mechanisms, programs and instruments, enabled the US and Chinese banking organisations to support their economies and build competitive advantages.

Although in 2007 the largest European banking organisations were in the top ranking as the most profitable banks, the financial and pandemic crises changed dramatically this situation.

During the financial and pandemic crises, European banks were primarily affected by the fragmentation of banking markets, different approach on banking regulations, for each national countries, low net trading growth.

Cross-border banking in Europe, mergers and acquisitions between the European banks may support the consolidation of the banking sector. A new architecture to integrate European strategic interests, to provide economic competitiveness to the European companies, needs to be supported by strong European banking organisations.

As a result of the changes in bank rankings, following the global and pandemic financial crisis, US and European banks need to diversify their markets, business models, connect more deeply with the strategic interests of US and European companies, build competitive advantages, accommodate digitalization and sustainable projects financing. SME financing represent a strategic opportunity, both for banking and capital markets, to mix debt and equity, to connect the interests of the banks with the interests of the investors.

From the perspective of future research approaches, the micro-level analysis of major US, European and Chinese banks/groups of banks, on the implementation of the transition towards a green economy and the evolution of the global competitiveness-sustainability relationship represent topics of great interest, both scientific research and empirical area.

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**Notes**


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- (1) List of economic crises – Wikipedia, 2022, pp. 1-3.  
 (2) <https://www.oecd.org/finance/Chinas-Belt-and-Road-Initiative-in-the-global-trade-investment-and-finance-landscape.pdf>  
 (3) <https://www.caixabankresearch.com/en/sector-analysis/banking/banking-sector-and-capital-markets-union-creates-strength>  
 (4) <https://top1000worldbanks.com/2020/>  
 (5) <https://databank.worldbank.org/source/global-financial-development>  
 (6) <https://databank.worldbank.org/source/world-development-indicators>

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**References**


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- Ager, P. and Spargoli, S., 2013. Bank Deregulation, Competition and Economic Growth: The US Free Banking Experience, *Ehes Working Papers In Economic History*, No. 50, pp. 3-59.
- Ahi, K. and Laidroo, L., 2019. Banking market competition in Europe financial stability or fragility enhancing?, *Quantitative Finance and Economics*, Volume 3, Issue 2, pp. 257-285.
- Aldasoro, I., Eren, E. and Huang, W., 2021. Dollar funding of non-US banks through Covid-19. *BIS Quarterly Review*, March 2021, pp. 1-10.
- Andrès, M.J. and Truchet. M., 2022. *BANKING AND INSURANCE POLICY PRIORITIES*, pp. 41-55, <[https://www.eurofi.net/wpcontent/uploads/2022/05/summary\\_the-eurofi-high-level-seminar\\_paris\\_february-2022.pdf](https://www.eurofi.net/wpcontent/uploads/2022/05/summary_the-eurofi-high-level-seminar_paris_february-2022.pdf)>
- Andrès, M.J. and Truchet. M., 2022. *POST-COVID ECONOMIC PROSPECTS AND REFORMS*, <[https://www.eurofi.net/wpcontent/uploads/2022/05/summary\\_the-eurofi-high-level-seminar\\_paris\\_february-2022.pdf](https://www.eurofi.net/wpcontent/uploads/2022/05/summary_the-eurofi-high-level-seminar_paris_february-2022.pdf)>
- Andrievskaya, I. and Semenova, M., 2016. Does banking system transparency enhance bank competition? Cross-country evidence. *Journal of financial stability*, 23, pp. 33-50.
- Berndt, M. et.al., 2016. *Restoring EU competitiveness*, European Investment Bank, <[https://www.eib.org/attachments/efs/restoring\\_eu\\_competitiveness\\_en.pdf](https://www.eib.org/attachments/efs/restoring_eu_competitiveness_en.pdf)>
- Bijlsma, M.J. and Gijsbert, T.J., 2013. *The changing landscape of financial markets in Europe, the United States and Japan*, (No. 2013/02). Bruegel working paper <[https://www.bruegel.org/wp-content/uploads/imported/publications/WP\\_2013\\_02\\_01.pdf](https://www.bruegel.org/wp-content/uploads/imported/publications/WP_2013_02_01.pdf)>
- Borst, N., 2020. *Has covid-19 led to financial instability in China?* <<https://www.seafarerfunds.com/prevaling-winds/has-covid-19-led-to-financial-instability-in-china/>>
- Bremus, F. and Fratzscher, M., 2015. Drivers of structural change in cross-border banking since the global financial crisis. *Journal of International Money and Finance*, 52, pp. 32-59.
- Brückmann, C. et.al., 2021. German banking returns to the playing field, *McKinsey & Company*, No.7/2021, pp. 1-53.
- Buch, C., 2018. Competition, Stability, and Efficiency in Financial Markets, *Deutsche Bundesbank*, pp. 1-32.
- Caplen, B., 2020. The Top 500 Banking Brands, *The Banker*, Vol. 170, No. 1129, pp. 26-36.
- Caplen., B, 2020. The Top 1000 World Banks, *The Banker*, Vol. 171, No. 1134, pp. 117-159.

- Carletti, E. and Leonello, A., 2018. Credit Market Competition and Liquidity Crises, *Review of Finance*, 2019, pp. 855-892.
- Carlson, M., Correia, S. and Luck, S., 2022. The effects of banking competition on growth and financial stability: Evidence from the national banking era. *Journal of Political Economy*, 130(2), pp. 1-58.
- Casanova, C. et. al., 2021: *The global footprints of Chinese banks*, VoxEU, November 2021, <<https://voxeu.org/article/global-footprint-chinese-banks>>
- Cerutti, E., Casanova, C. and Pradhan, S.K., 2020. Banking across borders: Are Chinese banks different? Bank for International Settlements *Working Papers* No. 892. <<https://www.bis.org/publ/work892.pdf>>
- Cerutti, E., Casanova, C. and Pradhan, S.K., 2021. *The global footprint of Chinese banks*, <<https://voxeu.org/article/global-footprint-chinese-banks>>
- De Haan, L. and Kakes, J., 2020. European banks after the global financial crisis: Peak accumulated losses, twin crises and business models. *Journal of Banking Regulation*, 21(3), pp.197-211.
- Dinçer, H., Olgu Akdeniz, O. and Hacıoglu, U., 2018. Competitive strategy selection in the European banking sector using a hybrid decision-making approach. *Zbornik radova Ekonomskog fakulteta u Rijeci: časopis za ekonomsku teoriju i praksu*, 36(1), pp. 213-242.
- Dinu, M., 2021. *Facerea economiei - Îndreptar epistemic*, Editura Economică, București.
- Dutta, K. and Saha, M., 2021. Do competition and efficiency lead to bank stability? Evidence from Bangladesh, *Future Business Journal*, No7:6, pp. 1-12.
- ECB, 2021. *European banks in the post-COVID-19 world*. <<https://www.bankingsupervision.europa.eu/press/speeches/date/2021/html/ssm.sp210316~55c3332593.en.html>>
- Erlor, A., Gischer, H. and Herz, B., 2017. Regional Competition in US Banking: Trends and Determinants. *Working Paper Series*. No 8/2017, pp. 1-31.
- Giese, J. and Haldane, A., 2020. COVID-19 and the financial system: a tale of two crises, *Oxford Review of Economic Policy*, Volume 36, Number S1, 2020, pp. 200-214.
- Goodhart, C. and Schoenmaker, D., 2016. The United States Dominates Global Investment Banking: Does it matter for Europe?, *Bruegel Policy Contribution*, Issue 2016, No.06, pp. 1-14.
- Hofele, F. and Steiner, T., 2022. *Are European banks lagging in digitalization?* <<https://www.bearingpoint.com/en-us/insights-events/insights/a-comparison-of-the-banking-markets-in-asia-europe-and-the-usa/>>
- Investopedia, 2021. *Too Big to Fail Banks: Where Are They Now?* <<https://www.investopedia.com/insights/too-big-fail-banks-where-are-they-now/>>
- Ioannis, S., 2013. Bank competition and financial (in)stability in Europe: A sensitivity analysis, *Munich Personal RePEc Archive*, No. 51621, pp. 1-42.
- Khan, H.H., Ahmad, R.B. and Gee, C.S., 2016. Bank competition and monetary policy transmission through the bank lending channel: Evidence from ASEAN. *International Review of Economics & Finance*, 44, pp. 19-39.
- Li, L., Willett, T.D. and Zhang, N., 2012. The effects of the global financial crisis on China's financial market and macroeconomy. *Economics Research International*, 2012, pp. 1-7. <<https://doi.org/10.1155/2012/961694>>
- Martín, S. and Antonio, J., 2020. *Why are European banks less profitable than American banks?* <[https://biblioteca.cunef.edu/files/documentos/TFG\\_Jose\\_Antonio\\_Soler\\_Martin.pdf](https://biblioteca.cunef.edu/files/documentos/TFG_Jose_Antonio_Soler_Martin.pdf)>
- Morrison, W., 2019. Ascensiunea economică a Chinei: istorie, tendințe, provocări și implicații pentru Statele Unite ale Americii, *Congressional Research Service*, No. RL33534, pp. 1-43.

- Noman, A.H.M., Gee, C.S. and Isa, C.R., 2017. Does competition improve financial stability of the banking sector in ASEAN countries? An empirical analysis. *PloS one*, 12(5), pp. 1-27.
- Poenisch, H., 2021. The Globalisation of Chinese Banks, *International Monetary Institute*, No. 12/2021, pp. 1-5.
- Pozsar, Z., Adrian, T., Ashcraft, A. and Boesky, H., 2010. Shadow banking. *New York*, 458(458), pp. 3-9.
- Růžičková, K. and Teplý, P., 2015. Are bank fees in the Czech Republic excessive?. *Procedia Economics and Finance*, 25, pp. 264-277.
- Samantas, I.G., 2017. On the optimality of bank competition policy. *International Review of Financial Analysis*, No 54, pp.39-53.
- Schildbach, J., 2017. Large or small? How to measure bank size, <[https://www.dbresearch.com/PROD/RPS\\_ENPROD/PROD000000000443314/Large\\_or\\_small%3F\\_How\\_to\\_measure\\_bank\\_size.pdf?undefined&reload=v2GoAKe~0p9CKJaGMMZdgin2YS4~1sF54shMBY9oWGFmuh~0yXCjhoLG9nyUVaAI](https://www.dbresearch.com/PROD/RPS_ENPROD/PROD000000000443314/Large_or_small%3F_How_to_measure_bank_size.pdf?undefined&reload=v2GoAKe~0p9CKJaGMMZdgin2YS4~1sF54shMBY9oWGFmuh~0yXCjhoLG9nyUVaAI)>
- Schildbach, J., Schneider, S. and AG, D.B., 2017. *Where do European banks stand*. Deutsche Bank Research, <[https://www.dbresearch.com/PROD/RPS\\_EN-PROD/PROD000000000450356/Where\\_do\\_European\\_banks\\_stand%3F\\_10\\_years\\_after\\_the\\_.pdf?undefined&reload=vJTUIxzdDiSEa8QjPfbSMewKLDjadH92npS1fo2ywgmwDZ3Oz0203OrI53jnnh8D](https://www.dbresearch.com/PROD/RPS_EN-PROD/PROD000000000450356/Where_do_European_banks_stand%3F_10_years_after_the_.pdf?undefined&reload=vJTUIxzdDiSEa8QjPfbSMewKLDjadH92npS1fo2ywgmwDZ3Oz0203OrI53jnnh8D)>
- Schildbach., J., 2013. Bank performance in the US and Europe, *DB research*, No. 26, september 2013, pp. 1-20.
- Schildbach., J., 2020. European banks suffer more than US peers in the corona crisis, EU Monitor Global financial markets, *Deutsche Bank Research*, No. 08/2020, pp. 1-8.
- Subacchi, P., 2021. *A Made-in-China Financial Crisis?*, <<https://www.project-syndicate.org/commentary/evergrande-bankruptcy-spillovers-trigger-global-financial-crisis-by-paola-subacchi-2021-10>>



## The importance of demand, uncertainty and monetary policy shocks from the euro area for the Romanian economy

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**Abstract.** *This paper is evaluating the impact of external shocks that are affecting the Romanian economy by employing a Bayesian approach. By employing three Bayesian VAR models this paper provides an answer on the importance of external shocks using the impulse response functions, variance and historical decompositions. The relevance of the study is a major one as it quantifies the intensity of external shocks coming from the euro area that have the potential to affect the Romanian economy in terms of external demand, uncertainty and monetary policy, aspects which are of high interest especially in the new economic context of the COVID-19 health crisis.*

**Keywords:** external demand, uncertainty, monetary policy, Bayesian VAR, variance, impulse response.

**JEL Classification:** C11, D81, E52, O47.

## 1. Introduction

The great recession highlighted close links between developed economies and emerging ones, in particular through the considerable impact of external shocks on emerging economies, the same is the case of Romania in relation to the euro area. For an economy in close connection with the euro area such as Romania, it is essential to define how much of the fluctuations of key macroeconomic variables, such as economic growth or the unemployment rate are due to external shocks.

The objective of this paper is to quantify the importance of three key external shocks coming from the euro area that are affecting the Romanian economy. This paper aims to evaluate the impact of the demand, uncertainty and monetary policy shocks coming through the main trading and financial partner of the Romanian economy. The motivation for quantifying the importance of external shocks comes from the major impact that the great recession had on Romania and on top from the interest on developing a very important perspective of the economic outlook going forward.

Therefore, this paper becomes relevant both for the present and future perspectives for the Romanian economy as it will highlight to what extent Romania is affected by the euro area in terms of output growth, uncertainty, and monetary policy level.

## 2. Literature review

The relationship between external economic activity from developed countries to emerging economies is a topic of interest for many studies, the most notable papers in this area have grown since 2005, when the shocks from the US to emerging economies in Latin America were studied by Canova (2005) or by Mackowiak (2007) which studied the impact external shocks from US to Asian emerging economies. Other recent approaches are still focused on the external shocks coming from US impacting emerging economies such as Turkey, South Africa, Argentina, Brazil, Peru or Mexico (Akinci, 2013) or even for Eastern European countries such as Hungary or Poland (Horvath and Zhong, 2019; Andrlle et al., 2013).

One approach that seeks to emphasize the importance of euro area demand shocks to emerging Asian countries is the one developed by Erten in the paper “Macroeconomic Transmission of Eurozone Shocks to Emerging Economies”, where the results highlight the major importance of demand shocks that could severely impact the economic growth capacity of emerging countries (Erten, 2012; Gruss et al., 2019). Also, an important study is the one developed by Andrlle et al. (2013), which focuses on the shocks coming from the euro area to Poland, this study is closely related to the approach in the current paper and concludes using similar econometric techniques that up to 50% of the variance in the output growth rate is given by external shocks coming from the euro area to Poland. Almansour et al. (2015) is as well supporting the high degree of vulnerability of emerging economies to external shocks stating that external shocks can contribute to half or maybe even more in some cases in terms of the output growth variance for the emerging economies.

The study developed by Erten (2012) is evaluating the impact of external demand shocks on output growth performance for emerging economies by employing Bayesian VAR model. This study is using quarterly data from 1993 to 2011 in order to capture the effects of the shocks created by proxy variables for global financial conditions and external demand. Erten (2012) is studying the extent of the external shocks from the euro area on emerging economies from Asia and Latin America. This article finds out that more than 50% of the output growth rate for emerging economies in Latin America and emerging economies in Asia is explained by external factors. Conditional forecasts of the various scenarios indicate that a deepening recession in the euro area could create a severe and persistent contraction for emerging economies.

The working paper developed by Andrle et al. (2013) at the International Monetary Fund is of great relevance in terms of certifying the robustness of the results for the current paper, as it highlights the links between Poland and the euro area, using a simple econometric approach. The authors estimate a VAR model, using data for real and nominal variables, imposing robust hypotheses that allow them to identify how external factors affect the evolution of output growth in Poland between 1999 and 2012. The results of this paper suggest that external shocks in the euro area can be able to explain about 50% of Poland's output growth variance and up to 25% on interest rates and inflation.

The VAR models estimated by Mackowiak (2007) show that external shocks lead to macroeconomic fluctuations for emerging economies. In addition, US monetary policy shocks are rapidly and strongly affecting the exchange rate of emerging economies. It is important to note that US monetary policy shocks affect the real economic activity of emerging economies in a much stronger manner than it affects its own real economic activity.

The current study will focus on an approach similar to the one developed by Horvath and Zhong (2019) in terms of variable selection. This paper is taking as main subject the external shocks of demand, uncertainty and monetary policy coming from the euro area (the main financial and trade partner of Romania). Horvath and Zhong (2019) are combining these perspectives in a fascinating way and aggregate in a single study all these three types of external shocks employing Panel VAR model and using classical methods to identify these effects such as impulse response functions and variance decomposition. The ordering of the variables in the VAR model developed by Horvath and Zhong (2019) is essential to obtain a correct empirical estimate. The authors are ordering the variables in the model in such a way that macroeconomic variables like inflation or output growth lead to immediate changes in financial variables in emerging economies, such as stock returns, monetary policy interest rates or the real exchange rate, while financial variables will affect macroeconomic variables with a lag. The same variable ordering approach will be employed also in the current paper.

### 3. Model specification

In this section I will summarize the form of the general VAR model for the particular case of this paper and afterwards I am exposing the three different Bayesian approaches highlighting also the main economic implications of each one of them.

#### 3.1. Formulation of the general VAR model

The VAR models estimated in this paper contain 8 endogenous variables, 4 lags, and one vector of exogenous regressors. In a compact form the general model can be summarized in the following equation:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + A_3 Y_{t-3} + A_4 Y_{t-4} + C X_t + \varepsilon_t \quad (1)$$

Where:

$Y$  is a matrix of dimension  $n \times 1$  ( $8 \times 1$  in this particular case) and it represents the vector of endogenous variables.

$A_1, A_2, \dots, A_p$  are  $p(4)$  matrices of parameters with dimensions  $n \times n$  ( $8 \times 8$  in this particular case).

$C$  is a matrix of dimension  $n \times m$  ( $8 \times 8$  in this particular case) and  $X_t$  is a vector of constant exogenous regressors (constant terms).

$\varepsilon_t$  is the vector of residuals, where:  $\varepsilon_t = (\varepsilon_{1,t}, \varepsilon_{2,t}, \dots, \varepsilon_{n,t})$  with  $\varepsilon : N(0, \Sigma)$

In a more compact notation, the model can be summarized as exposed in equation (2):

$$Y = XB + \varepsilon \quad (2)$$

#### 3.2. Bayesian VAR with Minnesota prior

One of the widely used prior distributions in macroeconomic research is the Minnesota prior (Giannone et al., 2017; Fuleky, 2020). Reflecting the fact that the variance-covariance matrix is known and the only thing that remains to be estimated is the vector of parameters (Dieppe et al., 2018). This implies the prior belief that the variables in the model cannot be predicted, as they follow an unobservable trend. Therefore, in order to calculate the shape of this posterior distribution I will follow the computational steps developed in Dieppe et al. (2018). To obtain the posterior distribution for  $\beta$  two elements will be necessary: the likelihood function  $f(Y | \beta)$  for the data and the prior distribution for  $\beta : \pi(\beta)$ .

One should start from the likelihood function, this formulation implies that the residuals follow a normal multivariate distribution of mean equal to 0 and a variance-covariance matrix  $\bar{\Sigma}$ . In this case the data would follow as well a normal multivariate distribution of mean  $\bar{X}\beta$  and a variance-covariance matrix  $\bar{\Sigma}$ . Therefore, the likelihood function for  $Y$  will have the following form:

$$f(Y|\beta, \bar{\Sigma}) = (2\pi)^{-nT/2} |\bar{\Sigma}|^{-1/2} \exp \left[ -\frac{1}{2} (Y - \bar{X}\beta)' \bar{\Sigma}^{-1} (Y - \bar{X}\beta) \right] \quad (3)$$

Ignoring the constant terms, equation (3) will be simplified and will take the following form:

$$f(Y|\beta, \bar{\Sigma}) \propto \exp \left[ -\frac{1}{2}(Y - \bar{X}\beta)' \bar{\Sigma}^{-1}(Y - \bar{X}\beta) \right] \quad (4)$$

The prior  $\beta$  will follow as well a normal multivariate distribution of mean  $\beta_0$  and variance covariance matrix  $\Omega_0$ :

$$\pi(\beta) \sim N(\beta_0, \Omega_0) \quad (5)$$

Similar to the previous approach the constant terms will be excluded and the simplified equation will take the following form:

$$\pi(\beta) \propto \exp \left[ -\frac{1}{2}(\beta - \beta_0)' \Omega_0^{-1}(\beta - \beta_0) \right] \quad (6)$$

By combining the likelihood with the prior, the posterior distribution will take the form of a multivariate normal distribution:

$$\pi(\beta|Y) \propto \exp \left[ -\frac{1}{2}(\beta - \bar{\beta})' \bar{\Omega}^{-1}(\beta - \bar{\beta}) \right] \quad (7)$$

$$\pi(\beta|Y) \sim N(\bar{\beta}, \bar{\Omega}) \quad (8)$$

### 3.3. Bayesian VAR with normal-diffuse prior

A possible alternative to the Minnesota prior can be represented by the normal-diffuse prior and it can be used when one wants to remain agnostic about the value of  $\Sigma$ . Thus, the main change will be the distribution for  $\Sigma$  which will be now defined by the “Jeffrey’s” distribution or diffuse prior:

$$\pi(\Sigma) \propto |\Sigma|^{-(n+1)/2} \quad (9)$$

The peculiarity related to this prior distribution would be that it is a non-informative distribution, which means that the data will bring the biggest contribution when it comes to the estimated results.

Following the same steps as exposed in the previous section and by starting from the likelihood function and the prior distribution this will lead again the posterior to take the form of a normal multivariate distribution:

$$\pi(\beta|Y) \propto \exp \left[ -\frac{1}{2}(\beta - \bar{\beta})' \bar{\Omega}^{-1}(\beta - \bar{\beta}) \right] \quad (10)$$

$$\pi(\beta|Y) \sim N(\bar{\beta}, \bar{\Omega}) \quad (11)$$

### 3.4. Mean-adjusted Bayesian VAR

A reformulation compared to the classical Bayesian VAR is the one in which prior information about the trend of the steady-state values can be introduced in the model, meaning that the steady state values will not be represented by constant terms (Villani, 2009) which was the case for the last two sections.

In this case, the steady state parameters will become variable in time. The vector  $\bar{Z}\Delta$  introduces this property for the steady state values. The compact form of the VAR model of section 3.1 will change and it can be formulated as follows:

$$Y = \bar{X}\beta + \bar{Z}\Delta + \varepsilon \quad (12)$$

#### 4. Database and variable selection

##### 4.1. Variable selection

In order to evaluate the impact of external shocks of demand, uncertainty and monetary policy from the euro area on the Romanian economy, the current paper is following the approach developed by Horvath and Zhong (2019) regarding the variable selection process and data transformation. On top of that I will approach the empirical study by using two vectors instead of one in order to certify the robustness of one critical proxy variable, and as exposed in the previous section I will employ three different Bayesian estimations instead of the classical OLS approach used in Horvath and Zhong (2019). The vectors that I will use in my estimations will contain three external variables and five domestic variables. More specifically:

$$Y_t = [D_t, \pi_t, D_t^E, r_t^E, U_t^E, r_t, s_t, x_t] \quad (13)$$

$$Z_t = [u_t, \pi_t, D_t^E, r_t^E, U_t^E, r_t, s_t, x_t] \quad (14)$$

In the case of the vector  $Y_t$  the domestic variables are the following:  $D_t$  which denotes the year-on-year output growth,  $\pi_t$  represents the year-on-year CPI inflation rate,  $r_t$  captures the 3M Romanian Interbank Offer Rate (ROBOR3M),  $s_t$  measures the year-on-year stock return, and  $x_t$  stands for real effective exchange rate.

In the case of  $Z_t$ :  $u_t$  denotes the unemployment rate which serves as a proxy for real economic activity (the same significance as  $D_t$ ) while the rest of the variables are the same as in the case of  $Y_t$ . The purpose of the second vector is to evaluate the effects of external shocks on unemployment dynamics in order to see if they are different compared to the output growth.

The external block of variables contains measures for external demand  $D_t^E$  proxied by the euro area output growth rate,  $r_t^E$  proxied by the Euro Interbank Offered Rate (EURIBOR3M), and a measure of external uncertainty  $U_t^E$ , proxied by the VSTOXX index (Bonciani and Van Roye, 2016) which represents the stock market expectations in terms of volatility for the euro area.

## 4.2. Database

The current paper is using monthly data starting from January 2002 to March 2020 (2002M1 – 2020M3). The data used in the models was transformed according to Horvath and Zhong (2019). Transformations were performed as follows:

$\pi_t$  – denotes the year-on-year domestic CPI inflation rate excluding energy, food, alcohol and tobacco. For this case the overall index has been extracted from Eurostat and year-on-year inflation has been calculated using monthly data.

$D_t$  – the domestic output growth has been calculated using seasonally adjusted data for the GDP at market prices from the Eurostat database. In order to transform the data from quarterly to monthly series a quadratic temporal disaggregation was necessary, this one has been performed using Eviews 10. Afterwards the year-on-year growth rates have been calculated.

$r_t$  – the proxy used for the domestic interest rate was ROBOR3M for which I used the monthly average of the daily series extracted from the interactive database of the National Bank of Romania.

$S_t$  – for the year-on-year stock return the BET index has been used. The BET index is known as the representative index for the Romanian stock market, the market quotes have been extracted from the Bloomberg database and year-on-year returns have been calculated.

$x_t$  – the real effective exchange rate for Romania vs the euro area has been extracted from the European Commission database and it is used in logarithm following the approach from Horvath and Zhong (2019).

The external group of variables is constructed in a similar way. External Demand  $D_t^E$  has been extracted from Eurostat and transformed exactly like the domestic output growth ( $D_t$ ), the external interest rate  $r_t^E$  (EURIBOR3M) is used as monthly average of the daily series in the same manner I transformed the domestic interest rate. In the case of external uncertainty ( $U_t^E$ ) the VSTOXX index has been extracted from the Reuters Eikon database and is used in logarithm following the approach of Horvath and Zhong (2019).

## 5. Results

As mentioned before, three models are simulated for the two vectors of variables in order to ensure additional robustness checks. As the obtained results are fairly similar in all the 6 developed models, I will take a parsimonious approach and present in this section the results obtained for the vector  $Y_t$  using the Minnesota prior. As previously mentioned, the impulse response functions, variance decomposition and historical decomposition will be used for interpretation purposes.

It is very important to mention that the simulated models contain 4 lags and the identification method used was the Cholesky decomposition following the approach used

in Erten (2012). The method of identification is also in line with Horvath and Zhong (2019), the authors of the article using a recursive ordering approach with the contemporaneous matrix being lower triangular and with the elements on the diagonal normalized to one. Following the approach of Erten (2012) and Horvath and Zhong (2019), the block-exogeneity restriction will be used for the current paper as well, the main reason is that domestic variables in Romania will be restricted so that they do not produce any impacts on the variables from euro area. The GDP of Romania relative to the euro area GDP represents at the moment of writing this paper about 1.6%. Therefore, the hypothesis that the domestic variables will have a negligible impact on the euro area variables is a reasonable one.

### 5.1. Impulse response functions

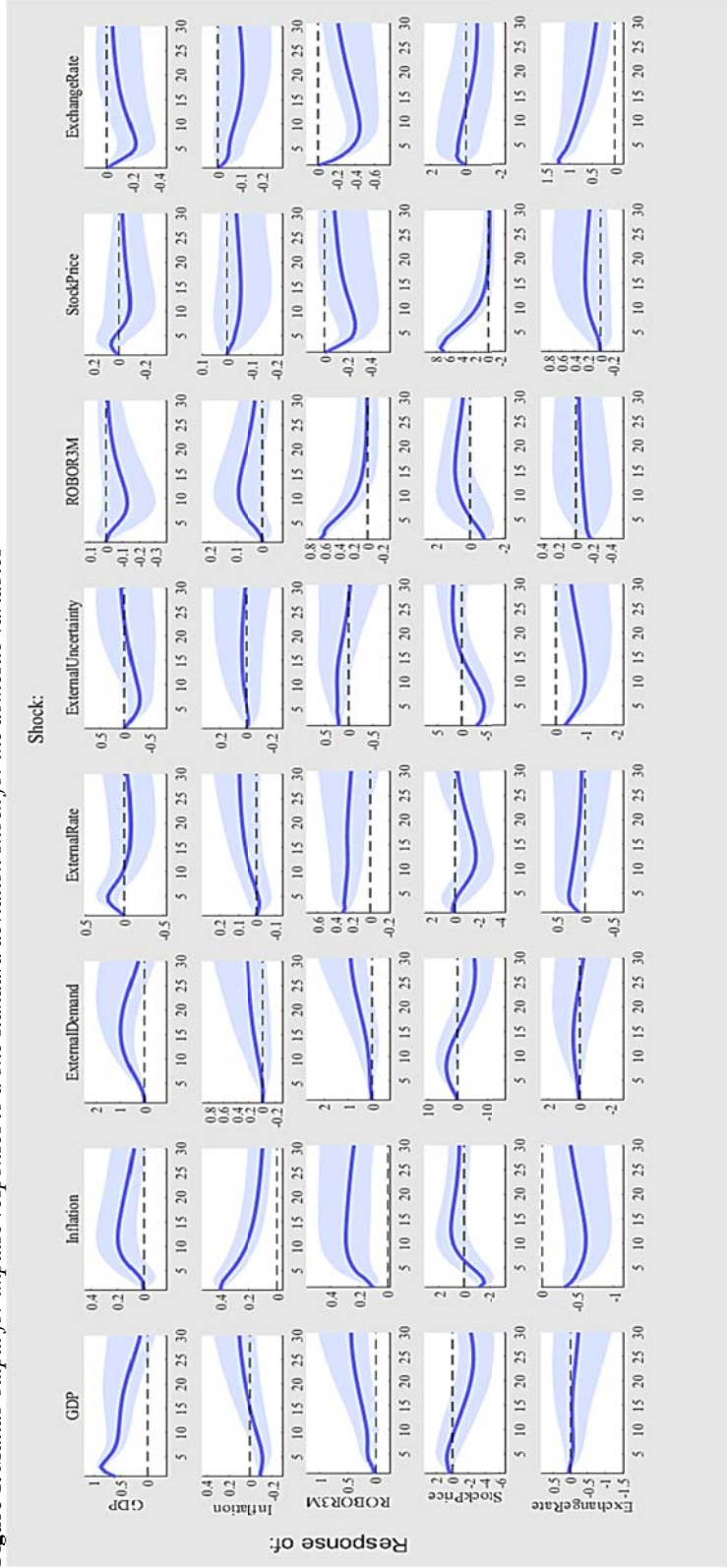
It can be observed in Figure 1 that the external variables in the euro area have a significant influence on the macroeconomic and financial variables of Romania.

Shocks generated by external demand affect in a positive and persistent way the domestic output growth, the shock begins to be significant, with a confidence level of 95% starting with month 5 and it lasts until month 24 when the lower bound of the 95% confidence interval is reaching 0. The euro area interest rate generates a positive impact on the domestic interest rate, the shock is statistically significant and persists until period 22. The external monetary policy instrument does not create significant shocks in connection to output growth and inflation for Romania.



## Bayesian VAR with Minnesota prior

Figure 1. Matlab output for impulse responses to a one standard deviation shock for the domestic variables



External uncertainty mostly affects the real exchange rate and stock market return, the effects being statistically significant until periods 24 and 10. No significant impacts can be found generated by external financial uncertainty on variables that express the real economic activity of Romania.

These impulse response functions confirm that the Romanian economy is in close connection with the euro area in terms of real economic activity but also financial activity. A negative shock of external demand can generate a negative impact on Romania's economic growth over a horizon of up to 2 years, however, the external financial variables at the level of the euro area do not significantly affect real economic activity of Romania but they do affect domestic financial variables like the stock market return or the exchange rate.

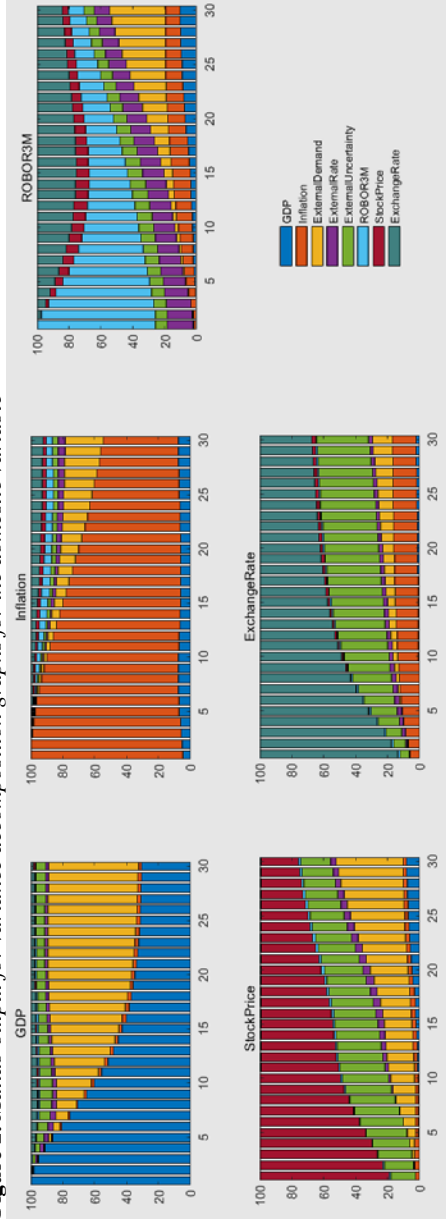
## 5.2. Variance and historical decomposition

The variance decomposition highlights how much each shock contributes to the variance of each endogenous variable in the model. With this technique I aim to quantify the expected importance of each type of external shock in relation to the domestic macroeconomic and financial variables. One of the most important findings of this paper can be found in the graphs from Figure 2 where it can be seen very easy that the external demand is the most important influencing factor for the output growth variance.

The historical decomposition is exposed below in Figure 3 in order to measure the contribution of historical shocks by decomposing the series into the contribution of each variable and summing up the impact in order to explain the past values of each component in the model. The purpose of the historical decomposition here is to measure the impact of the external shocks during the great recession and the first year of recovery.

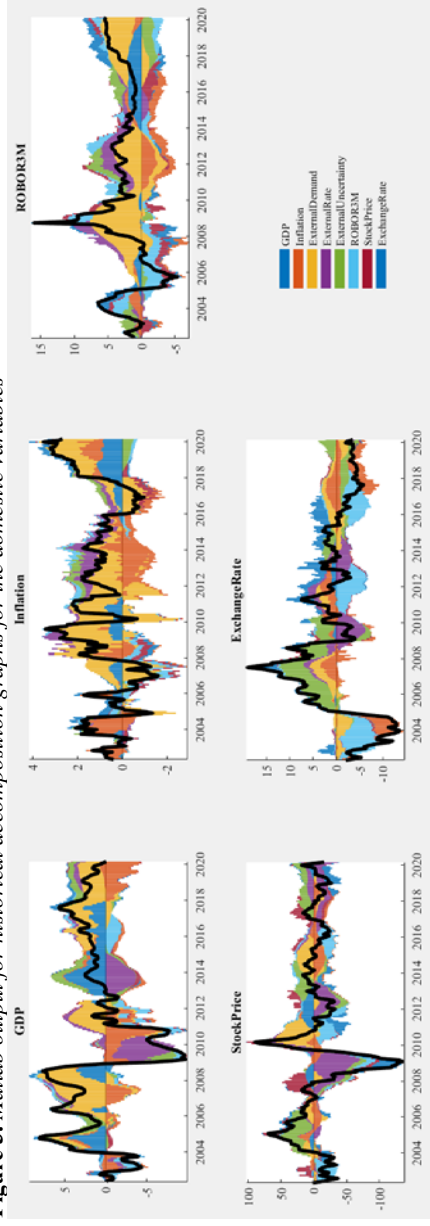
## Bayesian VAR with Minnesota prior

Figure 2. Matlab output for variance decomposition graphs for the domestic variable



## Bayesian VAR with Minnesota prior

Figure 3. Matlab output for historical decomposition graphs for the domestic variables



## 6. Main findings

After exposing the variance decomposition, it can be observed that the shocks coming from the external demand can represent 30% of the variance of the output growth on a horizon of 12 months. At the same time, these shocks can explain 50% of the variance in output growth and the unemployment rate over a time horizon of 2 years. For a more detailed overview Table 1 is presenting the median of the variance decomposition for GDP growth and unemployment rate. The results are in line with Erten (2012) which concludes that a severe external demand shock will create a deterioration in the economic growth of emerging economies. The conclusions of Andrlle et al. (2013) are also in line with the current paper showing that 50% of the output variance in Poland is due to external shocks from the euro area.

**Table 1.** Variance decomposition for the output growth and unemployment rate

Variance Decomposition (Median in %) GDP:								
Period	$D_t$	$\pi_t$	$D_t^E$	$r_t^E$	$U_t^E$	$r_t$	$s_t$	$x_t$
1	100	0	0	0	0	0	0	0
6	79	0.5	4.2	3.4	5.8	0.5	0.4	3.5
12	49.7	2.1	30.3	2	6.8	1.1	0.7	3.4
18	35.6	2.2	47.5	1.7	5.1	0.9	0.6	2.4
24	30.7	2.1	53	1.7	5.1	0.7	0.6	2
30	29	2.1	53.9	1.9	5.7	0.7	0.6	1.9
Variance Decomposition (Median in %) Unemployment:								
Period	$u_t$	$\pi_t$	$D_t^E$	$r_t^E$	$U_t^E$	$r_t$	$s_t$	$x_t$
1	100	0	0	0	0	0	0	0
6	91.1	0.3	3.7	0.59	0.7	0.7	0.3	0.3
12	69.2	0.4	21.8	0.98	1.3	1	0.5	0.6
18	49.4	0.4	39.9	1.13	1.8	0.8	0.6	0.9
24	39.1	0.4	49.1	1.28	2.3	0.7	0.5	1
30	34.8	0.4	51.9	1.49	2.8	0.7	0.5	1.2

The domestic monetary policy instrument (ROBOR3M) is more responsive to Exchange Rate shocks (20.8%) rather than Inflation (11.8%) over a period of 18 months.

The stock market return is mainly affected by external demand, external uncertainty and domestic output growth. External uncertainty has an immediate impact on the return on stock market returns (12.5% since the first month), while external demand has a much stronger long-term effect (up to 32% over a 24-month horizon). This may suggest that foreign investors have a developed capacity to create volatility in the Romanian stock market. According to the degree of fast and significant reaction it is reasonable to believe that the foreign investors play the most important role in the Romanian stock market.

The real effective exchange rate is mainly affected by external uncertainty in the Eurozone (up to 30% in the long run), Inflation (14%) and External Demand (11%).

The dynamics of the unemployment rate is also governed to a significant extent by external demand, with 50% of the variance in the unemployment rate also being explained by the shocks coming from external demand. The variance decomposition is almost identical when the models were simulated both for output growth and unemployment.

## 7. Conclusions

The most important external shock from the euro area that is affecting the Romanian economy is the external demand which affects both macroeconomic and financial variables. External demand can represent 50% of the variance of the output growth and unemployment rate in the long run. External uncertainty mainly affects the stock market return and the real exchange rate (variations are up to 30% and 25% in the long run) while not having a significant impact on the real economic activity. The foreign monetary policy instrument (euro area interest rate) mainly affects the interest rate in the Romanian money market, with variations of up to 16.7% from the first month, while the domestic monetary policy instrument (ROBOR3M) is more sensitive to the shocks created by the real exchange rate (20.8%) rather than to the inflation shocks (11%). The stock market return does not significantly affect economic growth in Romania, but can be instantly affected by external uncertainty (12.5% from the first month) and in the long run being in a more material way by the external demand (31.9% on a 2 year timeline).

Taking into account the belief that half of the economic growth or contraction can be explained in the long run by external demand, and in the short run by the negative effects generated by real economic activity, the Romanian economy should follow a trend which is in line with the euro area in terms of economic decline and recovery.

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## References

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- Akinci, O., 2013. Global Financial Conditions, Country Spreads and Macroeconomic Fluctuations in Emerging Countries. International Finance Discussion Papers – Federal Reserve Board, 1085, pp. 1-40.
- Almansour, A., Aslam, A., Bluedorn, J. and Duttagupta, R., 2015. How vulnerable are emerging markets to external shocks? *Journal of Policy Modeling*, 37, pp. 460-483.
- Andrle, M., Garcia-Saltos, R. and Ho, G., 2013. The Role of Domestic and External Shocks in Poland: Results from an Agnostic Estimation Procedure. IMF Working Paper.
- Bonciani, D. and Van Roye, B., 2016. Uncertainty shocks, banking frictions and economic activity. *Journal of Economic Dynamics & Control*, 73, pp. 200-219.
- Canova, F., 2005. The Transmission of US Shocks to Latin America. *Journal of Applied Econometrics*, 20, pp. 229-251.
- Dieppe, A., Legrand, R. and Van Roye, B., 2018. The Bayesian Estimation, Analysis and Regression (BEAR) Toolbox. European Central Bank.
- Erten, B., 2012. Macroeconomic Transmission of Eurozone Shocks to Emerging Economies. Centre d'Etudes Prospectives et d'Informations Internationales, pp. 1-39.
- Fuleky, P., 2020. *Macroeconomic Forecasting in the Era of Big Data*. New York City: Springer International Publishing.
- Giannone, D., Lenza, M. and Primiceri, G. E., 2017. Priors for the Long Run. Federal Reserve Bank of New York – Staff Reports, 832, pp. 1-55.

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- Gruss, B., Nabar, M. and Poplawski-Ribeiro, M., 2019. Domestic Amplifiers of External Shocks: Growth Accelerations and Reversals in Emerging Market and Developing Economies. IMF Working Paper, pp. 1-24.
- Horvath, J. and Zhong, J., 2019. Unemployment dynamics in emerging countries: Monetary policy and external shocks. *Economic Modelling*, 76, pp. 31-49.
- Mackowiak, B., 2007. External shocks, U.S. monetary policy and macroeconomic fluctuations in emerging markets. *Journal of Monetary Economics*, 54, pp. 2512-2520.
- Villani, M., 2009. Steady State Priors for Vector Autoregressions. Research Division, Sveriges Riksbank, Sweden, pp. 1-29.

## Fiscal consolidation and public debt in the European Union: Reevaluating the relationship

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**Abstract.** *The initial shock from and response to the Global Financial Crisis (GFC) in 2008 had a profound impact on the fiscal balances and subsequently the government debt ratios of countries in the European Union (EU). This paper examines the relationship fiscal consolidation measures and the changes in debt ratios that followed. The findings highlight that the negative feedback of fiscal consolidation on economic growth in this context can translate into increases, rather than decreases in government debt ratios. As debt levels in most European Union countries are reaching record levels in the aftermath of Covid-19, these results warn of the risks of a stunted recovery if a similar approach as in the aftermath of the GFC is pursued.*

**Keywords:** fiscal policy, public debt, expansionary austerity.

**JEL Classification:** E6, E62, E65, H6.

## 1. Introduction

In 2020, the Covid-19 pandemic triggered the largest downturn and economic shock for the global economy and the European Union (EU) and record deficit spending in member states as part of their response to mitigate the crisis. The effects of the pandemic are still ongoing, and what seemed like a path to a recovery is now put at risk by the spillover effects of Russia's war in Ukraine, including the impact on energy prices, access to energy, and commodity prices overall, as well as a large influx of refugees (IMF Regional Economic Outlook, 2022).

Fiscal policy in the European Union is guided by the rules established through the Maastricht Treaty (1992) which set a limit on deficit spending and targets for overall government debt. In the aftermath of the Global Financial Crisis (GFC) in 2008, these guidelines served as an impetus to re-orient the fiscal policy to focus on reducing the increased deficits and growing debt that resulted from the response to the GFC. The ideas of "expansionary austerity" and dangers to growth of reaches certain debt thresholds were gaining momentum in the economic literature strengthening the case for a rapid shift to fiscal consolidation (Alesina and Ardagna, 2010; Reinhart and Rogoff, 2010). The resulting shift towards rapid fiscal consolidation resulted in a stunted recovery for the European Union and a double-dip recession in 2012, persisting high unemployment and low growth (IMF World Economic Outlook, 2022).

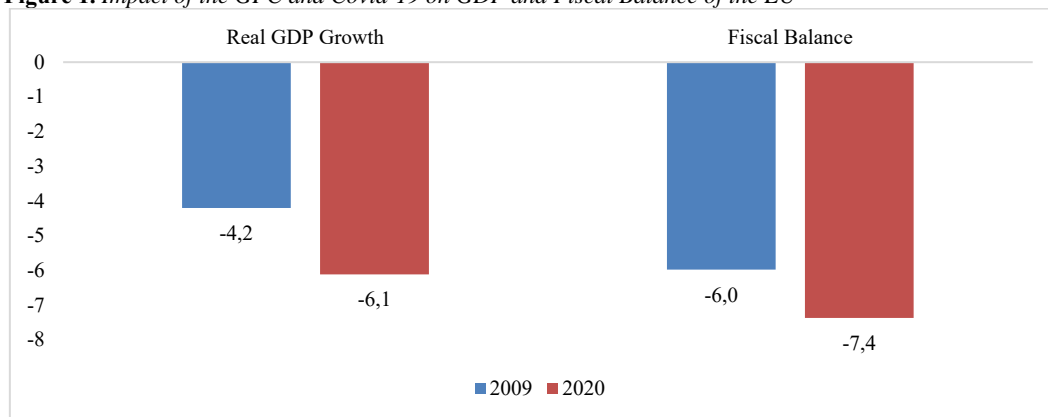
In the current uncertain and fragile context, a misguided policy response from the European Union can put a recovery at risk and have long-term consequences for Europe's future, its competitiveness and social cohesion. Through this study, we aim to strengthen the understanding on how the actual results of the post-GFC response were different than what policymakers expected and draw lessons from those errors. The European Union has put its fiscal rules on pause as part of the pandemic response and is looking to reevaluate whether they are fit for purpose.

This paper provides a reevaluation of the relationship between fiscal consolidation on government debt in the post GFC period, through an analysis of the scale of consolidation undertaken by countries in the European Union, the expected impact it would have on government debt, and the actual impact. The analysis builds on a Blanchard and Leigh (2013) study that showed that economic forecasts failed to correctly predict the negative impact of fiscal consolidation on growth in the immediate post GFC period. This paper extends a similar analysis to look at the impact of changes in fiscal balance to gross government debt from 2012 until 2019, highlighting a pattern of overestimating the expected reductions in debt.

## 2. Macroeconomic context

The global economic has faced two major shocks and economic downturns in recent years. First the GFC, triggered by a crisis in the financial system in 2008, that impacted Europe most severely in 2009. In 2020, Covid-19 spread through the world, as the pandemic brought economic activity to a halt, creating both a sanitary and economic crisis. Figure 1 illustrates the impact of these shocks on the EU.

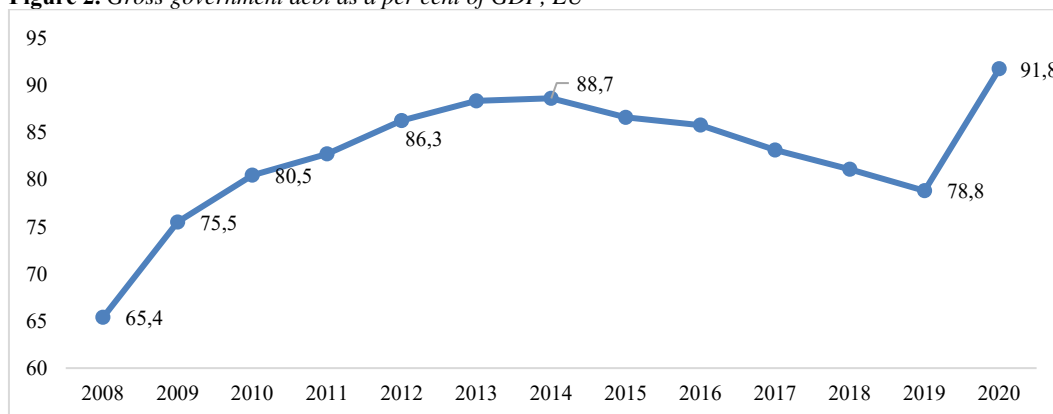


**Figure 1.** Impact of the GFC and Covid-19 on GDP and Fiscal Balance of the EU

Source: IMF WEO 2022, <https://www.imf.org/en/Publications/WEO/weo-database/2022/April>

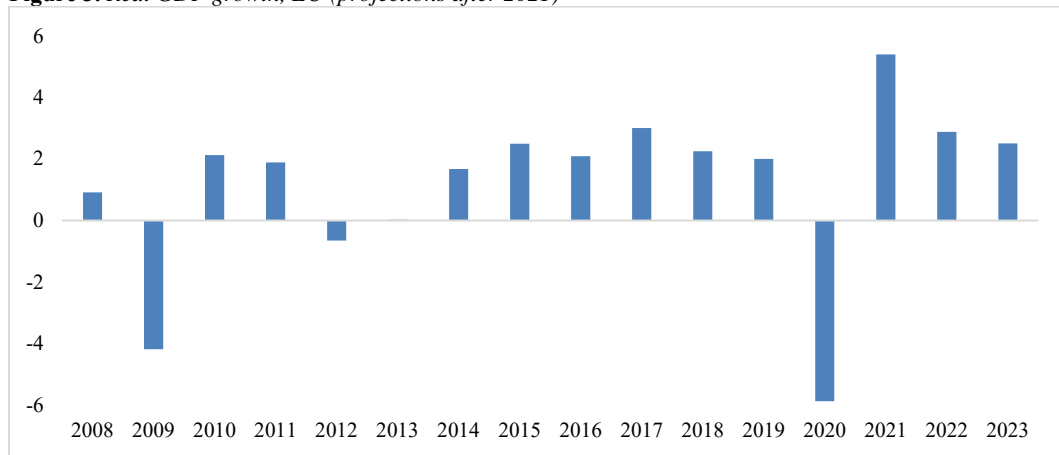
Overall, growth in the EU declined by about 4.5 per cent of GDP in 2009, compared to 6 percent in 2020. The impact to the fiscal balance was also more pronounced in 2020, with deficits reaching 7.4 per cent. The EU mobilized to respond to the pandemic and put in place measures of support for businesses and workers alike, stepping up spending on health. The initial debt level prior to the pandemic did not hamper the response.

Figure 2 shows the gross government debt ratio in the EU from 2008 until 2020. In the aftermath of the GFC the rising debt in 2009 and 2010 was seen as a cause of panic with calls for action on reducing the deficit. The Group of 20 Finance Ministers endorsed exiting crisis policies, in part to rebuild financial buffers and called for “growth-friendly” consolidation plans (G20, 2010).

**Figure 2.** Gross government debt as a per cent of GDP, EU

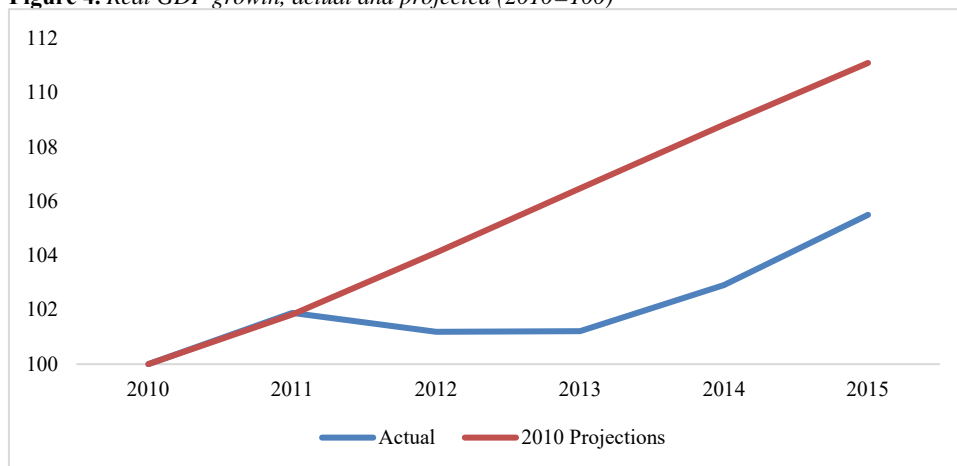
Source: IMF WEO 2022, <https://www.imf.org/en/Publications/WEO/weo-database/2022/April>

As shown in Figure 3, the pace of the recovery slowed down in the EU in 2011, and negative growth returned in 2012. While the initial impact of Covid-19 was larger, the strong response was followed by a rebound in 2021, and expectations for the recovery to continue in 2022 and 2023. However, since, Russia’s war in Ukraine and the continued spread of the virus have added to the downside risks in this forecast (IMF REO, 2022).

**Figure 3.** Real GDP growth, EU (projections after 2021)

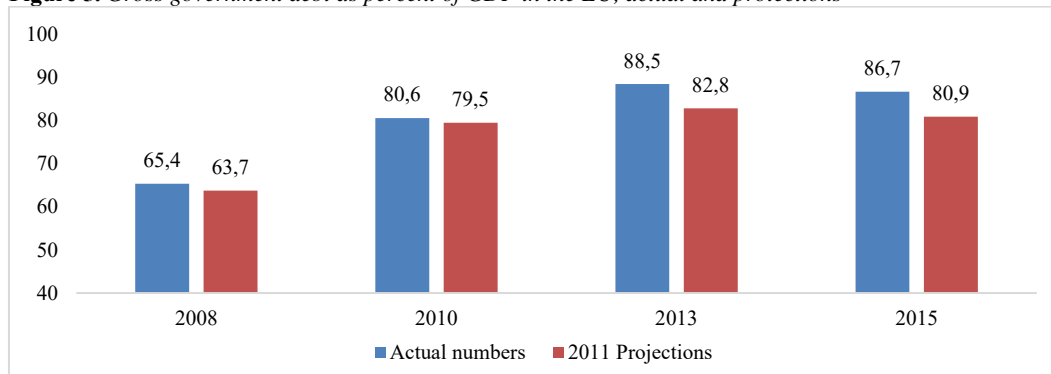
Source: IMF WEO 2022, <https://www.imf.org/en/Publications/WEO/weo-database/2022/April>

The risks of a premature shift in the supportive policy stance are reflected in Figure 4, which shows the expected recovery path for the EU in 2010, when authorities push to pursue a more aggressive fiscal consolidation strategy and prioritize debt reduction. The actual growth path was much lower, and by 2015 the GDP level in the EU was almost 6 per cent that it was forecast in 2010. The lower-than-expected growth meant that the goal of reducing debt ratios was not met either, with expected debt-to-GDP ratios higher than envisioned despite the reduced spending levels.

**Figure 4.** Real GDP growth, actual and projected (2010=100)

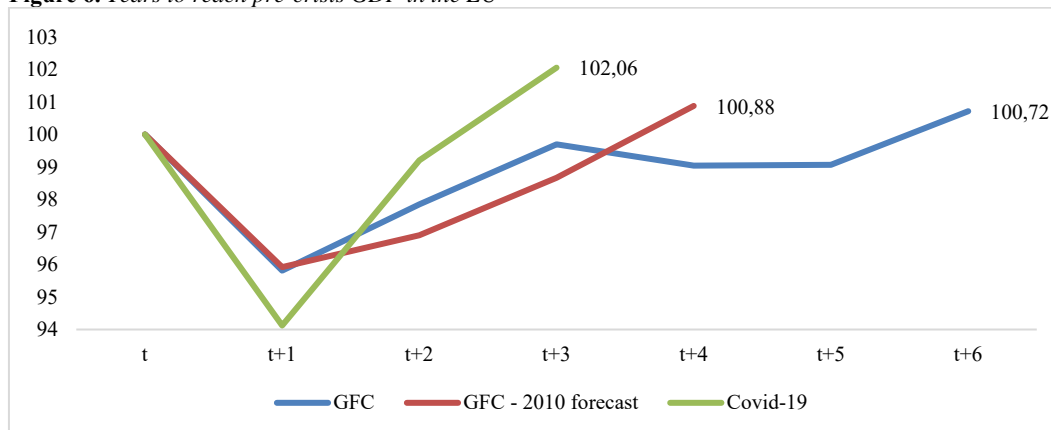
Source: IMF WEO 2022, <https://www.imf.org/en/Publications/WEO/weo-database/2022/April>; IMF WEO 2011, <https://www.imf.org/en/Publications/WEO/weo-database/2011/April>

Figure 5 shows the gross government debt ratio in the EU for selected years since the onset of the GFC, comparing the actual levels with the expected levels predicted in 2011. This is to be expected given the much lower actual GDP growth, since the debt burden is calculated as a share of the overall size of the economy.

**Figure 5.** Gross government debt as percent of GDP in the EU, actual and projections

**Source:** IMF WEO 2022, <https://www.imf.org/en/Publications/WEO/weo-database/2022/April>;  
IMF WEO 2010, <https://www.imf.org/en/Publications/WEO/weo-database/2010/October>

Figure 6 shows the expected time to reach the pre-crisis output after the GFC and after Covid-19, as well as the actual number of years it took for the EU to reach its 2008 GDP after the GFC. With what seemed to be the onset of a recovery, in 2010 the IMF predicted the EU would reach its pre-GFC size in 3 years. With the EU sliding back into a recession in 2012, it took until 2014 to reach the same level of output as in 2008. The EU is now predicted to reach its 2019 pre-Covid level of output in 2022. However, a shift in policy stance, as well as other risks building up could derail this recovery.

**Figure 6.** Years to reach pre-crisis GDP in the EU

**Source:** IMF WEO 2022, <https://www.imf.org/en/Publications/WEO/weo-database/2022/April>;  
IMF WEO 2011, <https://www.imf.org/en/Publications/WEO/weo-database/2011/April>

### 3. Literature review

The slow and uneven recovery from the GFC had a negative impact on employment levels, as well as other social indicators in the EU. Szczepański (2013) finds that as a result of fiscal consolidation and lower growth, poverty levels in the EU increased, and the EU went off track from meeting its own employment and well-being goals set for 2010. Additionally, the large spending cuts implemented in the EU in the aftermath of the GFC are linked to rising income inequality and disproportionately affected youth and women (Szczepański 2013).

A rise in unemployment and subsequently an increase in poverty and material deprivation as a result of austerity measures implemented by the EU, and growing polarization between Northern and Southern Europe is found by Darvas and Tschekassin (2015). Fiscal consolidation executed mostly through spending cuts resulted in cuts in public spending for research and development, increasing the gap in research and innovation between EU members, and hurting the competitiveness of the EU overall (Veugelers, 2014).

Blanchard and Leigh (2013) published a seminal paper on the growth forecast errors in the aftermath of the GFC, between 2010 and 2013, based on underestimating the negative impacts of fiscal consolidation on growth. Their paper studied the relationship between levels of fiscal consolidation and growth and found that for each additional per cent of fiscal consolidation GDP growth was one per cent lower than forecast. This shows that the shift to fiscal consolidation slowed the recovery and did not have an expansionary impact. Kareem et al. (2020) extended this methodology to cover a longer timeline, from 2003 to 2017, finding the larger than envision impact on growth extends for that entire period.

These empirical findings are in contradiction with what prominent voices within the economics literature predicted as the impact of implementing fiscal consolidation measures. The most widely cited literature on the expansionary potential of austerity measures is the work of Alberto Alesina et al. (1997, 2010, 2012). According to Alesina et al. (1997, 2010, 2012) fiscal consolidation episodes have an expansionary impact on growth, particularly if the measures implementing to reduce the fiscal balance are centered on spending cuts, particularly public wages and transfers. The expansionary effect is expected from increased confidence and private investment that follow from consolidation measures.

Reinhart and Rogoff (2010) published a paper that warned of a fiscal cliff and reduced growth once countries reach a gross public debt level above 90 per cent of GDP, as a result of a decrease in confidence that would put pressure on a government's ability to continue borrowing and funding its deficit. This paper was famously found by a then graduate student to contain a spreadsheet error that once corrected resulted in the analysis no longer finding the same relationship for the 90 per cent threshold (Herndon et al., 2014).

Beyond the spreadsheet error, Guajardo et al. (2013) and Baker and Rosnick (2014) raised additional issues with the methodology underpinning both the Reinhart and Rogoff (2010) results and Alesina et al. (1997, 2010, 2012) pointing to the inability of their studies to distinguish between the relationship of causality. While some relationship between growth level and fiscal deficits might exist in the data, it can also be interpreted in a different manner, namely that during episodes of faster growth deficit and debt levels fall.

Botta and Tori (2018) conducted an empirical examination of the transmission mechanisms through which Alesina (1997, 2010, 2012) argues austerity measures are expansionary. Assuming fiscal consolidation measures are constructed to reflect the optimal type of consolidation proposed by proponents of expansionary austerity, the effects are transmitted through expectation and financial channels. Particularly in the context of the Eurozone, fiscal consolidation measures triggered hikes in sovereign bond yields in countries implementing them, worsened financial distress, and did not increase confidence and credibility of governments for financial markets (Botta and Tori, 2018).

Rather, yields for European countries stabilized as a result of interventions from the European Central Bank (ECB) and its introduction of unconventional monetary policies (Galariotis et al., 2018). The actions of the ECB spillover to non-eurozone countries that are part of the EU, stabilizing their yields as well (Trifonova et al., 2018). Zabala and Prats (2020) attribute the improved growth performance and increased stability in the EU since 2015 to the ECB ramping up its asset purchase program and the increase in the ECB's balance sheet. Foresti and Marani (2014) find that when certain episode of expansionary austerity are identified, the expansionary effects are the result of a policy mix where the behavior and support from the central bank is key.

#### 4. Methodology

To examine the relationship between fiscal consolidation and debt levels, we build on the Blanchard and Leigh (2013) paper that constructed a methodology to analyze the relationship between fiscal consolidation and economic growth. With debt levels reported and measures as a share of GDP, we expect the findings on underestimating the negative impact on growth to translate to overestimating the impact of fiscal consolidation in this context to reducing debt levels. This methodology was tested to control for initial levels of debt, initial levels for the fiscal balance, the presence of a banking crisis, level of fiscal consolidation of trading partners, stock of foreign liabilities (Blanchard and Leigh, 2013). None of these factors changed impacted the results.

We focus on 2012 as a starting point for this analysis, looking at the projections made for that year from 2010. The analysis is extended to 2019. Given that 2015 is when the ECB ramps up its asset purchases and interventions, we analyze both the entire period 2012 to 2019, as all as 2012 to 2015 and 205 to 2019. As data for the analysis, we use the IMF World Economic Outlooks release and forecasts made yearly from 2010 onwards and compile them into one data set compatible with STATA.

We then proceed to measure the debt forecast error as the difference between the change in the gross government debt forecast and actual historical timeline values for government debt. This is regressed over the forecast for fiscal consolidation that represents the targeted change in the net fiscal balance from the previous year. The debt forecast error in the year is then regressed over the planned fiscal consolidation and debt forecast from the year  $t$ . We follow this formula:

$$\text{Forecast error } \Delta GGD_{i,t:t+1} = \alpha + \lambda_t + \beta \text{ Forecast } \Delta F_{i,t:t+1|t} + \epsilon_{i,t:t+1}$$

$\Delta GGD_{i,t:t+1}$  is the change from year  $t$  to year  $t+1$  of gross government debt in country  $i$ .

$\Delta F_{i,t:t+1|t}$  is the change in the net fiscal balance (a positive number means fiscal consolidation)

$\lambda_t$  represent the fixed-year effects. If the forecast was accurate, in the null hypothesis  $\beta$  is zero.

The regressions are run through STATA with Huber-White standard errors that adjust for heteroskedasticity. To down-weight outliers we run a robust regression (Andersen, 2008) and the Cook's distance method that discards observations with a Cook's distance greater  $\frac{1}{4}$  of the sample size (Hamilton, 2012).

## 5. Results

The results are reported with heteroskedasticity-robust standard errors.

**Table 1.** Results for all EU members and Eurozone members for 2012

	All countries	Outliers: Cook's Distance	Outliers: Robust regression	Eurozone	Eurozone Outliers: Cook's Distance	Eurozone Outliers: Robust regression
Coefficient	3.064 (1.847)	1.512** (0.539)	1.577* (0.837)	3.323 (1.966)	1.674*** (0.443)	1.798** (0.835)
Constant	-4.779 (4.398)	-0.516 (1.580)	-1.863 (1.342)	-7.471 (5.166)	-2.210* (1.107)	-1.776 (1.322)
Observations	27	25	25	19	17	17
R-squared	0.190	0.063	0.134	0.258	0.197	0.236

**Table 2.** Results for all EU members and Eurozone members for 2012-2019

	All countries	Outliers: Cook's Distance	Outliers: Robust regression	Eurozone	Eurozone Outliers: Cook's Distance	Eurozone Outliers: Robust regression
Coefficient	1.445** (0.567)	1.216*** (0.207)	1.041*** (0.164)	2.022*** (0.723)	1.390*** (0.335)	1.261*** (0.195)
Constant	-0.737 (0.826)	-0.703** (0.312)	-0.706*** (0.270)	-1.751 (1.101)	-0.881** (0.393)	-1.087*** (0.323)
Observations	210	203	209	148	142	147
R-squared	0.082	0.124	0.162	0.144	0.133	0.224

Table 1 shows the results for 2012 and Table 2 covers the period from 2012-2019. The coefficient for both the entire group and Eurozone members is much larger for 2012 but the results are outside of the 0.01, 0.05, and 0.10 confidence level. When applying the additional tests to remove outliers, the coefficient after Cook's distance test is used for the Eurozone countries falls in the 0.01 confidence level and shows a relationship that denotes that for each additional point of fiscal consolidation, the government debt was 1.67 per cent higher than expected.

In the larger sample included in Table 2 all coefficients are significant at the 0.05 or 0.01 level. A similar relationship is detected but with a smaller coefficient. For all countries we find that each additional point of fiscal consolidation, debt is 1.445 per cent higher with a confidence level of 0.05. For Eurozone countries this is more pronounced, with a coefficient of 2.022 at a 0.01 confidence level. When removing the outliers in this case the coefficients drop for all samples but remain higher than 1 per cent and are statistically significant at the 0.01 level.

**Table 3.** All EU countries, 2012-2015 and 2015-2019

Years	All countries		Outliers: Cook's Distance		Outliers: Robust regression	
	2012-2015	2015-2019	2012-2015	2015-2019	2012-2015	2015-2019
Coefficient	1.416* (0.717)	0.553 (0.406)	1.127*** (0.259)	1.216*** (0.207)	0.774*** (0.238)	0.762*** (0.255)
Constant	0.314 (1.478)	-0.796* (0.411)	0.629 (0.578)	-0.703** (0.312)	0.597 (0.495)	-0.905*** (0.295)
Observations	105	130	101	203	105	130
R-squared	0.074	0.024	0.093	0.124	0.093	0.065

**Table 4.** Eurozone countries, 2012-2015 and 2015-2019

Years	Eurozone		Eurozone Outliers: Cook's Distance		Eurozone Outliers: Robust regression	
	2012-2015	2015-2019	2012-2015	2015-2019	2012-2015	2015-2019
Coefficient	2.183** (1.047)	0.600 (0.443)	1.168*** (0.439)	0.947*** (0.278)	1.145*** (0.293)	0.854*** (0.265)
Constant	-1.479 (2.118)	-0.921* (0.497)	0.279 (0.688)	-1.039*** (0.302)	-0.106 (0.604)	-1.207*** (0.338)
Observations	74	92	71	85	73	92
R-squared	0.139	0.037	0.095	0.124	0.177	0.103

**Note:** In the tables, \*\*\*, \*\*, \* respectively denote statistical significance at the 0.01, 0.05, 0.10 level.

The following step looks at the period up to the ramp up in asset purchases from the ECB and after, first for all EU members and then just for the sample of Euro area countries. This breakdown highlights the lower errors in the debt forecast after 2015 for both samples. When removing the outliers there is still a statistically significant relationship between consolidation and the errors on debt forecasts. For the Eurozone, which is directly impacted by ECB policies this coefficient falls below 1 for the two statistically significant results obtained when removing the outliers.

## 6. Conclusions

The EU appeared to be on a path to recovery following the Covid-19 shock. However, with risks once again on the downside, any missteps from policymakers risk protracting the crisis. The EU has currently suspended its fiscal rules as part of the pandemic response and plans to undertake an evaluation of these principles (European Commission, 2021). In the aftermath of the GFC the push for rapid fiscal consolidation in pursue of reducing debt levels backfired: expectations for expansionary effects of austerity policies did not materialize overall, while the protracted crisis was damaging to growth prospects, as well as social indicators.

Our results add to the case that fiscal consolidation, particularly in a post-crisis context does not effectively reduce debt ratios. Furthermore, the post-2015 results suggest the ECB policy played a larger role in stabilizing debt levels. When reviewing the fiscal rules of the EU these issues should be considered, as a pro-growth stance supported by the ECB can be a more effective way to reduce debt burdens without pursuing fiscal consolidation measures with potentially negative impacts on inequality, poverty, and unemployment.

## References

- Alesina, A. and Ardagna, S., 2010. Large changes in fiscal policy: Taxes versus spending. *Tax Policy and the Economy*, 24(1), pp. 35-68.
- Alesina, A. and Ardagna, S., 2013. The design of fiscal adjustments. *Tax Policy and the Economy*, 27(1), pp. 19-68.
- Alesina, A., Favero, C. and Giavazzi, F., 2019. Effects of Austerity: Expenditure- and Tax-based Approaches. *Journal of Economic Perspectives*, 33(2), pp. 141-162, <<https://doi.org/10.1257/jep.33.2.141>>
- Alesina, A. and Perotti, R., 1997. Fiscal adjustments in OECD countries: composition and macroeconomic effects. *Staff Papers*, 44(2), pp. 210-224.

- Andersen, R., 2008. *Modern methods for robust regression* (No. 152). Sage.
- Blanchard, O.J. and Leigh, D., 2013. Growth forecast errors and fiscal multipliers. *American Economic Review*, 103(3), pp. 117-120.
- Botta, A., and Tori, D., 2018. The theoretical and empirical fragilities of the expansionary austerity theory. *Journal of Post Keynesian Economics*, 41(3), pp. 364-398. <<https://doi.org/10.1080/01603477.2018.1431789>>
- Darvas, Z.M. and Tschekassin, O., 2015. *Poor and under pressure: The social impact of Europe's fiscal consolidation*. Bruegel policy contribution.
- DeLong, J.B. and Summers, L., 2012. Fiscal Policy in a Depressed Economy. *Brookings Papers on Economic Activity*, 43(1), pp. 233-297.
- Directorate-General for Parliamentary Research Services (European Parliament) and Lecerf, M., 2016. Poverty in the European Union: The crisis and its aftermaths: in depth analysis. Publications Office of the European Union. <<https://data.europa.eu/doi/10.2861/128014>>
- Foresti, P. and Marani, U., 2014. Expansionary Fiscal Consolidations: Theoretical Underpinnings and Their Implications for the Eurozone. *Contributions to Political Economy* 33(1), pp. 19-33.
- Galariotis, E., Panagiota, M. and Spyros, S., 2018. The impact of conventional and unconventional monetary policy on expectations and sentiment, *Journal of Banking and Finance* 86, pp. 1-20.
- Goldey, W. and Lavoie, M., 2007. Fiscal policy in a stock-flow consistent (SFC) model. *Journal of Post Keynesian Economics*, 30(1), pp. 79-100. <<https://doi.org/10.2753/PKE0160-3477300104>>
- Hamilton, L.C., 2012. *Statistics with Stata: version 12*. Cengage Learning.
- Herndon, T., Ash, M. and Pollin, R., 2014. Does high public debt consistently stifle economic growth? A critique of Reinhart and Rogoff. *Cambridge Journal of Economics*, 38(2), pp. 257-279.
- International Monetary Fund, 2010. Exiting from Crisis Intervention Policies. *Policy Papers*, 2010(22). <<https://doi.org/10.5089/9781498337892.007>>
- International Monetary Fund, 2019. 2018 Review of Program Design and Conditionality. *IMF Policy Paper*.
- Ismail, K., Perrelli, R., Yang, J. and Duttagupta, R., 2020. Optimism Bias in Growth Forecasts-The Role of Planned Policy Adjustments. IMF Working Papers 229. <<https://doi.org/10.5089/9781513560373.001.A001>>
- Pillay, N., 2013. Report on Austerity Measures and Economic and Social Rights. Geneva: Office of the High Commissioner for Human Rights.
- Reinhart, C.M. and Rogoff, K.S., 2010. Growth in a Time of Debt. *American Economic Review*, 100(2), 573-578. <<https://doi.org/10.1257/aer.100.2.573>>
- Szczepanski, M., 2013. *Social dimension of austerity measures: Cases of four EU countries in receipt of financial assistance*.
- Trifonova, S., Atanasov, A. and Kolev, S., 2016. The Effects of the ECB's Unconventional Monetary Policy on the Non-Euro Area EU Member States. *International Journal of Economics and Business Administration*, IV, Issue 4, pp. 93-112. <<https://doi.org/10.35808/ijeba/114>>
- Veugelers, R., 2014. *Undercutting the future? European research spending in times of fiscal consolidation*. Bruegel Policy Contribution.
- Wieland, V., 2022. Overview of how major economies have responded to the Covid-19 pandemic.
- Zabala, J.A. and Prats, M.A., 2020. The unconventional monetary policy of the European Central Bank: Effectiveness and transmission analysis. *The World Economy*, 43(3), pp. 794-809.



## Measuring the impact of philanthropy on small businesses: A case study of small business in Israel

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**Abstract.** *Despite the extent of philanthropic activity in the 21st century, where billions of dollars are invested and spent worldwide in philanthropic projects, measuring the impact of philanthropy is still not standardized. This research aims to examine the impact of philanthropy on small businesses, using the case study of 3 philanthropic funds assisting small businesses in Israel between 2015-2017. It uses the theory of “life cycle of businesses” to understand what is the best timing to assist a small business and what type of assistance is the most beneficial at each stage, to maximize the impact of philanthropic investment. The study found a correlation between the location of the business on its life cycle curve and the impact of the help it receives from the philanthropic fund. Another conclusion is that small businesses in their early life cycle benefit from business consultation in addition to the financial assistance offered by the philanthropic fund.*

**Keywords:** philanthropy, impact, impact measurement, small businesses, Israel.

**JEL Classification:** M29, C54, P42.

## Introduction

Philanthropy as a modern form of charity, which has emerged at the end of the 19th century (Brenner, 2017), and it has become today a global phenomenon, exceeding in the last decade \$300 billion annually. Hundreds of billions of dollars are invested every year by individuals and philanthropic foundations globally for various causes starting from the supply of clean water and nutrition to save from starvation, through vaccinations and medical aid, ending with women's empowerment and girls' education. All these initiatives are based on the allocation of philanthropic funds, on international and local philanthropic organizations and activities that are based on philanthropy.

Despite the scope of philanthropic activities in the 21st century on national, regional, and transnational levels in many fields and areas, and although much of the philanthropic activities are very business-oriented, involving many consultants and experts in the "third sector", still defining the impact of the philanthropic activity and measuring it, has not yet become a golden standard in philanthropic practices and theory.

The definition of impact of philanthropy "is dependent on the goals of the philanthropic activity and the organization which carries it out, as well as the societal problems and challenges it wants to address and solve" (Taskforce, 2014). However, this definition is wide and does not include aspects such as short and long-term social effects; environmental benefits; indirect impacts; and impacts that cannot or are hard to be measured. Another difficulty to include questions of impact as a standard in philanthropic funds activity refers to problems of assessment and evaluation and the way to conduct it. This involves also the cost-benefit considerations of such an evaluation process and the questions of how the results ought to be interpreted and understood in order to use them in an operative way.

## Small business

There is a wide range of definitions for a small-medium business. Table 1 below summarizes the settings of small businesses as recommended by the largest entities in the world.

**Table 1.** *Examples of SME definitions of CE, WB and OECD*

	Micro-entities	Small enterprises	Medium-sized enterprises
European Commission	a. Average number of employees < 10 b. Annual turnover < 2 million Euros or c. Total balance sheet < 2 million Euros;	a. Average number of employees < 50 b. Annual turnover < 10 million Euros; or c. Total balance sheet < 10 million Euros	a. Average number of employees < 250 b. Annual turnover < 50 million Euros or c. Total balance sheet < 43 million Euros
World Bank	a. Less than 10 employees b. Annual turnover < 100.000 dollars c. Total balance sheet < 100.000 dollars	a. Less than 50 employees b. Annual turnover < 3 million dollars c. Total balance sheet < 3 million dollars	a. Less than 300 employees b. Annual turnover < 15 million dollars c. Total balance sheet < 15 million dollars
OECD	1. Between 1-4 employees (small micro) 2. Between 5-19 employees (micro entities)	Between 20-99 employees	Between 100-500 employees

**Source:** Recommendation no. 2003/361/CE, World Bank definition, Organization for Economic Cooperation and Development (OECD) definition, Fitch (2006).

**Table 2.** Definition of small business in different countries

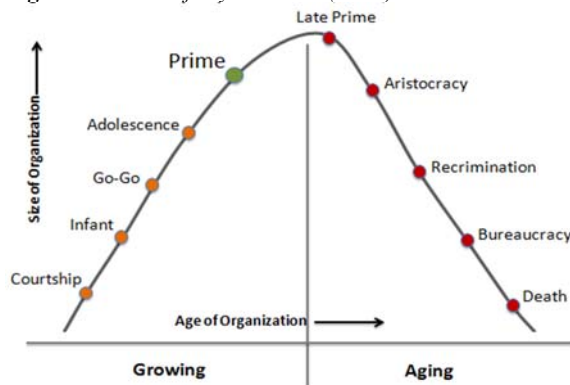
Country	Business size		
	Tiny	Small	Medium
Australia	1-5	5-19	20-199
USA		1-500	
United Kingdom		1-50	51-250
European Union	1-10	11-50	51-250
Korea	1-5	6-10	11-300
Turkey	1-10	11-50	51-250
Japan	production	1-20	21-300
	services	1-5	6-100
Israel	1-5	6-50	51-100
Mexico	production	1-10	11-50
	services	1-10	11-50
Canada	production	1-4	5-99
	services	1-4	5-49
Switzerland	1-10	11-50	51-250
Russia	1-15	16-100	101-250
China		1-100	101-500
Brazil	1-9	11-49	50-249
Indonesia – production	1-3	4-19	20-99

**Source:** IFC – International Finance Corporation, World Bank, How do economies define Micro, Small and Medium Enterprises – MSMEs?, Companion Note for the MSME Country Indicators, by Khrystyna Kushnir, 2010.

“SMEs are of great importance to the Israeli economy (OECD, 2015a) as SMEs account for 99.8% of all employer business in Israel, 68.7% of the business sector workforce and 62.3% of business economy” (SME and Entrepreneurship Policy in Israel, OECD, 2016).

## 1.2. Business life cycle models

Every business regardless of its size has a life cycle. The stage in the life cycle is not defined by the time from starting the business, but rather by its behavioral pattern and the problems that are within the business (Adizes, 2000). Adizes (2000) constructed a life cycle model consisting of ten areas from the stage that the business is only an idea to its death. Each stage has its characteristics and by analyzing the business activity and its personnel, it is possible to find out its actual stage. As we can see from the figure below, according to Adizes (2000), each stage has its own activity and problems.

**Figure 1.** Adizes life cycle model (2000)













Various researchers have developed different five-stage models for small and big businesses (Churchill and Lewis, 1983; Scott and Bruce, 1987; Perenyi, Selvarajah and Multhaly, 2011, Dinu, 2021). Lester and Carraher (2003) conducted an empirical test concluded that among the various life cycle models which include 3-10 stages, the five stages model represents best the life cycle of small businesses. The above models mention also that it might be that a business will not pass all the stages. Some businesses might stop at a certain stage and remain there up to it closing or can even drop back from the stage it is on its life cycle curve in into a lower stage or to be closed. Although not all businesses would go through all the stages and regression is possible, the five stages model is still considered the best model.

Perenyi, Selvaraja and Muthaly (2011) reviewed life cycles models to predict the behavior of a business. They show that the stage in which the business is on its life cycle curve is crucial to understanding its behavior. In this study, the “Five Stages of Small Business Growth” (Churchill and Lewis, 1983) was used. This model delineates five stages of firm development: existence, survival, success, take-off, and resource maturity. Each stage is characterized by an index of size, diversity and complexity and involves management style, organizational structure, the extent of formal systems, major strategic goals, and the owner’s involvement in the business.

Churchill and Lewis model (1983) was used because it is adequate for small and growing businesses, and because it is the only one that is useful in order to identify the location of the business on the life cycle curve without conducting an economic analysis of the business, such analysis involves the business owner's sincere collaboration-something that we can't get.

### 1.3. Churchill and Lewis model

**Table 3.** *Characteristics of small business*

	stage 1	stage 2	stage 3-D	stage 3-G	stage 4	stage 5
	Existence	Survival	Success Disengagement	Success Growth	Take off	Resource Maturity
management style	Direct supervision	Supervision	Functional	Functional	Divisional	Line and staff
organization						
extend of formal systems	Minimal to nonexistent	Minimal	Basic	developing	More refined	full
Major strategy	To remain alive	Survival	Maintaining profitable status quo.	Get resources for growth	Growth	
Business and owner						

**Note:** Smaller circle represents the owner. Large circle represents business.

**Source:** Churchill and Lewis model, 1983.

Two points of the business life cycle are easy to distinguish: the birth and death of the business. The other points need to be detected with help of questions. Since, usually, the

business owner cannot define the stage in which the business is, we have to find that through questions regarding the activities in the business at the time of applying for a help/loan.

Since it is not always possible to significantly identify the transition point from one stage to another, we grouped some of the stages in the original model together and added the stage. Before setting up the business, the stages for the research are:

Stage No. 1 in the study – The Stage before starting the business.

Stage No. 2 in the study – Stage #1 and Stage # 2 in the original model were consolidated.

Stage No. 3 in the study – Stage # 3 and Stage # 4 in the original model were consolidated.

Stage No. 4 in the study – Stage #5 in the original model was defined.

Stage No. 1. Is the stage before or at the time of starting the business.

Stage No. 2. The Existence stage is the one in which the business's existence is questionable; the owner is doing most of the work, most significant activity points are obtaining customers and delivering the product or service. This stage is completed once the business has customers that are satisfied with its products or services. The Survival stage is part of this stage, after realizing the idea of the business; during this stage, the business has slow growth in sales, and the cash flow is not stable. The main difference between the first and second parts of this stage is shifting attention from existence to profitability over time. The transition point between the two stages cannot be determined by examining external objective data.

Stage No. 3. The Success stage will start once the business has a mature product and customers are re-buying, growth in sales and investment in new equipment, need for additional low-level managers, and working capital. The company owner must decide whether to stay at this stage or move on to the next level of growth. At this stage, the company is profitable, with a stable cash flow. The Take-off stage that is part of stage #3 will be noticed once the manager adds senior staff to run the business and sales are growing rapidly, usually entering new markets and or products. There is no specific definition regarding the passage from Success to Takeoff, so we regard them as one.

Stage No. 4. The stages after Takeoff have one thing in common. Sales decline and all the other changes regarding the behavior of the business managers can't be seen from the outside or through the balance sheet; we consider them as one declining stage.

#### 1.4. Indicators to measure the impact of philanthropic activity

Help is designed to promote the business, and therefore indicators for the impact of the philanthropic aid should be measured to evaluate whether the targets were achieved.

##### 1.4.1. Current loan impact definition

Currently, the majority of philanthropic funds define the lending target as increasing the availability of money for small businesses. The various philanthropic entities have not defined the impact on the business they expect the loan to make. The philanthropic entities assume that the loan recipients know what to do with it.

In the study “The Effectiveness of Public Credit Guarantees in the Japanese Loan Market” (2010), Uesugi, Sakai, and Yamashiro examined the results of state-guaranteed loans, thus they found out that “the availability of loans increased the ex-post performance of the program participants deteriorated relative to their non-participating counterparts”. So that assumption is not necessarily correct.

#### **1.4.2. Time factor**

The decision regarding the period after the loan was granted which the impact of the business should be checked must balance several factors. On the one hand, to give the business enough time to develop as a result of receiving the help, but, on the other hand, to limit the time to avoid unrelated variables to impact the business. Such variables can be changes in market conditions or entry of new competitors into the market. We estimate that to check the impact after two years is the right time.

#### **1.4.3. Profitability**

Business profitability is the ultimate goal of a company – whether privately owned or a social enterprise. In order to measure the impact through the profits, we need the cooperation of the fund managers and business owners. The fund managers and many small business owners resist sharing this information. The only entity that has information that can be true and reliable is the Tax Authority, according to Israeli law, the Tax Authority is prevented from exposing detailed data regarding the businesses. Even if the business owners will provide such information no one can be sure that those who give that information are telling the truth, either because they deliberately will provide wrong figures or they don't know the precise details. Therefore, this parameter will not be used.

#### **1.4.4. Numbers of employees**

Another indicator for the success of a business and the philanthropy impact can be the change in the number of employees. An increase in the number of employees will be considered as a positive impact and vice versa. This data is attainable but not accurate. In some cases, a loan is given to purchase automatic equipment, which will reduce the number of employees and increase profitability, so reducing the number of employees is a success.

In some cases where the purpose of the help is to rescue the business from a complete liquidation, staying at the same size or even smaller is a positive impact. Despite the reservations mentioned above, success can be measured as an increase in the number of employees in most cases.

### **1.5. Types of philanthropic help programs for SBEs in Israel**

According to The Agency of Small and Medium Business, at the Israeli Ministry of Economy and Industry, the number of philanthropic foundations in Israel assisting small businesses through loans is unknown, and the extent of their aid varies. However, depending on the same source, the foundations operate in three different methods.

#### **1.5.1. Providing guarantees for loans from banks**

The Jewish Federation Funds are part of the Jewish Federation of North America (JFNA), the most significant Jewish fund for small businesses in Israel. Their model is that the fund deposits money in a bank; based on that money as collateral, the bank offers loans with

reduced interest and reduced collaterals up to 7 times the deposit usually with better terms than the private market. If the bank cannot collect all the returns, it will take from the deposit 70-90% of the balance. As announced in the yearly report of JFNA for the year 2020 up to 2018, the banks gave out based on the deposit loans to 1,900 businesses for the amount of 325 million NIS and added 9,500 working places.

### **1.5.2. Providing a loan from donor funds**

The Israel Free Loan Association helps small businesses with interest-free loans. The fund gets donations from different sources and offers loans for small businesses for expanding. To ensure loan repayments, the borrower signs guarantor or guarantors as per the fund's decision. The guarantors undertake to repay the loan in case the original borrower does not meet his obligation. As per the organization's website: <https://www.ogen.org> over the years up to 2021, the foundation has helped 65,000 people. The loan repayments are used for providing new loans so that every NIS given as a donation is used to provide further loans over the years. The fund has only one branch and it operates only online. In addition, during the loan approval process or during the period in which the borrower returns the money there is no personal meeting between the borrowers and the fund members.

### **1.5.3. Providing some mentoring and a loan from donor funds**

As per the fund website: <https://www.galileefund.org>, The Galilee Fund provided up to 2021 about 600 loans in the total amount of about NIS 70 million. The philanthropic foundation office is located near to the entrepreneur's area – in Galilee. The foundation is in direct contact with the client. Some of the meetings take place at the business. The loans are interest-free and without physical guarantees and are intended mainly for small businesses that have difficulties obtaining a bank loan or bank loan with reasonable terms (existing business or once that are before starting). To ensure the repayment of the loan, a guarantor or guarantors that the fund approves signs a commitment note that if the original borrower does not meet its obligation to repay the loan money, they will repay on his behalf. The fund is a regional one and operates only in Galilee. The entrepreneur applies through the fund website. The fund representative meets the client at his business or his home to review the business plan, during the meeting or meetings, the fund's representatives share with the entrepreneur their professional knowledge and experience and offer changes or adjustments to the business plan prepared by the entrepreneur and together they decide on the loan flow rate.

## **Research**

The aim of this study is to measure the impact of philanthropic aid given to small businesses in Israel. The study analyzes the impact of philanthropic assistance given by three Israeli philanthropic funds. Each fund offered the business a different combination of loan and personal contact. The small businesses that got the help were at different points on their life cycle. The questions examined were: whether the impact of helping small businesses that are at the same point on the business life cycle varies depending on the fund's operation way and whether one fund operating system is better than the others.

In this study, the “Five Stages of Small Business Growth” model (Churchill and Lewis, 1983) was used. Based on this model definitions and answers given by the business owners we defined the stage on the life cycle curve the business was before and after getting the help.

### 2.1. Definition of Impact/ success

In this case study, we defined the desired results of a philanthropic loan to a small business as increasing the number of employees; and increasing sales turnover. We examined the following loan success indicators:

- The increase of the number of employed persons in general.
- The increase of the sales turnover.
- The increase of the number of foremen.
- The rise in the number of senior executives.
- The addition of unique products or services.

### 2.2. Hypotheses

- A. Philanthropic help that combines money and counseling will have bigger impact than a philanthropic help that includes only money.
- B. Philanthropic help will make businesses move to the next level on the life cycle line.

## 3. Methodology

### 3.1. Research tools

This is a quantitative research. The research tool chosen for collecting the data is the questionnaire. The questionnaire can be used to collect data from the type and quality needed to get empirical answers to the research questions. The quality and adaptability of the data collected by the questionnaire determine the validity and reliability of the findings and the questionnaire (Goetz and Le Compte, 1984). A research questionnaire is designed to collect data of the type and quality required to achieve the research objectives and find empirical answers to the research questions.

To statistically analyze the questioners, we used the ANOVA method (Regression).

### 3.2. Questionnaire

The questions in the questionnaire are designed to obtain information in three areas. (See Appendix A)

- A. Define the business status before getting assistance in terms of business size, activities, different manpower, and products.
- B. Getting data regarding the type of help received.
- C. Define the business status two years after receiving help in terms of business size, activities, different manpower, and products.



### 3.3. Research population

The study is based on data obtained from businesses that received loans from the three philanthropic funds in the years 2015-2017. The information obtained from the funds was only telephone numbers without identifying data of the businesses that received the loans. The questionnaires did not include questions that can enable to identification of the business. The answers to the questionnaires were automatically added to the data concentration sheet so that the answers received could not be linked to a telephone number to which the questionnaires were sent. It is also not possible to check why the other questionnaires were not returned.

## 4. The research process

1,200 questionnaires were sent using the We Bot – What's App system to businesses that actually received help from the funds during 2015-2017. Answers were received through the WhatsApp. After some time, using lists that included only telephone numbers provided by the funds regarding businesses that received assistance, telephone calls were done to random businesses. The call center asked the business if he already answered the questionnaire if the answer was yes – they thanked him, if the answer was no- the call center asked him to do so and offered help if he needs. If the call center fills in the questionnaire by telephone, the questionnaires received from the call center did not include any identifying marks regarding the participant. The data received from the call center was processed and mixed with the data received directly from the participants who returned the questionnaires. We got information from 226 businesses.

The WeBot system allows to attaching questionnaires to the message. In the message, we reminded the participant that he previously received a loan from a philanthropic fund, and to streamline processes an anonymous survey is being conducted with the help of a university that will help streamline the process of granting loans in the future. The business was assured that the answers would be received anonymously so that the sender could not be identified.

After receiving the responses they were sorted according to the sort of help the participant received (i.e., from which fund they got the help), and according to the location of the business life cycle curve (See Appendix B for results as obtained from the questionnaires).

## 5. Statistical process and results

Five statistical tests were performed to test the relationship between the fund, the life cycle stage, and their interaction with five different Success indices:

- 1) The percentage change in the number of employees.
- 2) A binary variable indicating whether there was an increase in sales.
- 3) A binary variable indicating whether there was an increase in low level-managers.
- 4) A binary variable indicating whether there was an increase in high level-managers.
- 5) A binary variable indicating whether there was a new unique product.

A significant relationship was found between the interaction variable of fund and life cycle stage with the change in the number of employees. In Galilee fund at stage 1, the average employees increase is 389 percent while in the Jewish Agency at the same stage it stands at 158 percent and in Israel Free Loan Association at 47 percent. As the life cycle stage increases to stage 2 and 3, there is a sharp decline in Galilee fund, which becomes relatively like the average of the other foundations.

Another two significant relationships were found between the fund and the increase in the number of sales, and between the life cycle stage and the increase in the number of sales. As the life cycle stage increases, the probability of an increase in sales is bigger. In addition, this probability found to be the highest in the Galilee fund. The odds ratio higher by 5.5 compared to the base group of the Israel Free Loan Association and higher by 2 than the Jewish Agency.

The other indices do not appear to be statistically significantly related to the independent variables fund and life cycle stage.

## 6. Discussion

To this date, no one has ever examined whether any specific philanthropic program has a bigger impact in helping small businesses that are on different stage on the business life cycle. This study aimed to find the preferred philanthropic way to help small businesses based on their location on the life cycle curve.

Our first hypothesis was that a philanthropic fund that combines advice and a loan will have a greater impact than other funds, so this is the recommended way to run philanthropic funds that help small businesses. The parameter chosen to test the impact was the increase in the number of employees after a period of two years from receiving the help. After examining the data, it was found that there was a statistically significant relationship between the impact of the assistance and the fund that provided the assistance. The impact on businesses that are in the first stage of their lives is greater when in addition to the money they get also advice. No significant difference was found for businesses that are in more advanced stages on their life cycle curve. Hence if a foundation wants to increase its impact and use only one operating method it is recommended to use a method that combines advice and loan.

The second hypothesis we tested was that philanthropic help will cause businesses to move from the stage they are on the life cycle curve to the next stage. This hypothesis was found to be incorrect. It was not found that there was a significant change in the location of the business on the life cycle curve before and after receiving the help. Of course, businesses that were set up with the help of philanthropic help went from the stage of non-existent to existent but beyond that, no effect of the loan was found and no difference was found between the various funds.

The recommendation from the study is that philanthropic organizations that help small businesses and want to increase their impact should preferably incorporate a certain level of advice in their method of activity.

Further studies need to be conducted to define the amount and type of guidance that will give the greatest impact, as well as the proper mechanism of operation of the combined method.

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## References

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- Adizes, I., 2000. *Managing corporate Lifecycle*, Israel.
- Bremner, R.H., 2017. *Giving: Charity and philanthropy in history*. Routledge.
- Dinu, M., 2021. *Facerea economiei - Îndreptar epistemic*, Editura Economică, București.
- Fitch, 2006. Recommendation no. 2003/361/CE, World Bank definition, Organization for Economic Cooperation and Development (OECD) definition, Fitch.
- IFC (International Finance Corporation), World Bank, "How Do economies Define Micro, Small and Medium Enterprises (MSMEs)?", Companion Note for the MSME Country Indicators, by Kushnir K. (2010).
- Lester, D.L., Parnell, J.A. and Carraher, S., 2003. Organizational life cycle: A five-stage empirical scale. *The international journal of organizational analysis*.
- Lewis, V.L. and Churchill, N.C., 1983. The five stages of small business growth. *University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship*.
- Perenyi, A., Selvarajah, C. and Muthaly, S., 2011. Investigating the firm life-cycle theory on Australian SMEs in the ICT sector. *Journal of Asia Entrepreneurship and Sustainability*, 7(2), p. 13.
- Scott, M. and Bruce, R., 1987. Five stages of growth in small business. *Long range planning*, 20(3), pp. 45-52.
- SME and Entrepreneurship Policy in Israel, OECD, 2016.
- Social Impact Investment Taskforce, 2014. Measuring impact. Subject paper of the Impact Measurement Working Group, September.
- Uesugi, I., Sakai, K. and Yamashiro, G.M., 2010. The effectiveness of public credit guarantees in the Japanese loan market. *Journal of the Japanese and International Economies*, 24(4), pp. 457-480.

## Appendix A

### The Questionnaire and the meaning of the questions in terms of the model.

#### General questions regarding the business at the time of application for help:

- a. The name of the philanthropic foundation from which the help was received:  
 .....
- b. How many years before the application for help were submitted was the business established?
- 0-1
- 1-2
- 2 -
- c. Number of employs at the time of getting the loan: **A**

#### Questions related to the stage in the business life cycle.

- a. At the time of application for help; sales of the business were:
- In a constant state compared to year before?
- In slow growth compared to year before?
- In fast growth compared to year before?
- In retreat compared to year before?
- b. At the time of the application for help:
- \* Were there other low-level managers in the business?
- Yes  **C**
- No  **D**
- \* Were there other high-level managers in the business?
- Yes  **G**
- No  **H**
- \* Did the company have a developed product or service?
- Yes  **L**
- No
- c. The main purpose of the help was:
- Establishment of a new business?
- Investment in creating new products?
- Repayment of loans?
- Working capital?

**Questions regarding the business activity two year after getting the loan.**

- a. Number of employs: ..... **B**                    **B/A in percentage represent the help**
- b. Comparing to time of getting the loan, sales of the business were:
- The same.    **The loan did not help the business**
  - Higher.    **The loan helped the business**
  - Lower.     **The loan harmed the business**
- c. Were there other low-level managers in the business?
- Yes.     **E**                    **If  $E \neq C$  The loan helped the business**
  - No.    **F**                    **If  $F = C$  The loan harmed the business**
- d. Were there other high-level managers in the business?
- Yes.     **I**                    **If  $I \neq G$  The loan helped the business**
  - No.    **J**                    **If  $J \neq G$  The loan harmed the business**
- e. Did the company have a developed product or service?
- Yes.     **M**                    **If  $M \neq L$  The loan helped the business**
  - No.    **N**                    **If  $N \neq L$  The loan harmed the business**

## Appendix B

### 1. Data regarding the sending and receiving of questionnaires

**Table 4.** *Sending and receiving of questionnaires*

Fund	Questionnaires sent	Questionnaires received	Stage on the life cycle	Questionnaires received
The Galilee fund	135	67+5	1	24
			2	28
			3	15
Total				67
Israel Free Loan Association	610	91+1	1	46
			2	31
			3	14
Total				91
Jewish Agency	478	61+1	1	25
			2	28
			3	8
Total				61
Total	1,223	219+7		

Details of the number and percentage of employees added at each stage on the business life cycle curve in each of the funds, as well as data regarding the total for each fund, i.e. changes in sales and number of managers is presented in the tables below.

### 2. Data regarding the change in number of employees.

**Table 5.** *Change in number of employees*

Fund	Stage on the life cycle	Employees		
		Change in number	% Increase	Standard deviation
The Galilee fund	1	110	239	7.98
	2	156	89	10.96
	3	32	84	3.29
Total		298	124%	
Israel Free Loan Association	1	14	15	2.04
	2	41	63	2.81
	3	18	69	1.07
Total		73	40%	
Jewish Agency	1	181	75	10.40
	2	60	25	5.00
	3	25	35	5.44
Total		266	48%	

### 3. Data regarding the change in sales

**Table 6.** *Change in sales*

Fund	Stage on the life cycle	sales			
		Increase	% Increase	No change	Decrease
The Galilee fund	1	23	96%	1	0
	2	22	79%	6	0
	3	15	100%	0	0
Total			90%		
Israel Free Loan Association	1	31	67%	14	1
	2	28	90%	2	1
	3	13	93%	1	0
Total			79%		
Jewish Agency	1	25	100%	0	0
	2	24	86%	4	0
	3	8	100%	0	0
Total			93%		

### 4. Data regarding the change in Low-level managers

**Table 7.** *Change in low-level managers*

Fund	Stage on the life cycle	Low level-managers change			
		Increase	% Increase	No change	Decrease
The Galilee fund	1	8	33%	15	1
	2	5	18%	23	0
	3	12	80%	12	1
Total			37%		3%
Israel Free Loan Association	1	5	11%	39	2
	2	3	10%	27	1
	3	1	7%	13	0
Total			10%		3%
Jewish Agency	1	3	12%	18	4
	2	2	7%	25	1
	3	1	13%	7	0
Total			10%		8%

### 5. Data regarding the change in high-level managers

**Table 8.** *Change in high-level managers*

Fund	Stage on the life cycle	High level-managers change			
		Increase	% Increase	No change	Decrease
The Galilee fund	1	2	8%	22	0
	2	1	4%	23	4
	3	0	0%	15	0
Total			4%		
Israel Free Loan Association	1	2	4%	44	0
	2	3	10%	28	0
	3	0	0%	14	0
Total			5%		
Jewish Agency	1	1	4%	24	0
	2	2	7%	26	0
	3	3	38%	5	0
Total			10%		

Details of the number of businesses in each fund and at each stage that reported adding a unique product or service at the end of the test period.

## 6. Data regarding the change in unique product or service

**Table 9.** *Change in unique product or service*

Fund	Stage in the life cycle	Unique Product or service		
		Increase	No change	Decrease
The Galilee fund	1	0	23	1
	2	2	23	3
	3	1	14	0
Total				
Israel Free Loan Association	1	8	31	7
	2	1	20	10
	3	2	11	1
Total				
Jewish Agency	1	1	21	3
	2	2	19	3
	3	0	7	1
Total				



## Whether high frequency intraday data behave randomly: Evidence from NIFTY 50

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**Abstract.** *Keeping in mind the notion of random walk and market efficiency, the present study gives importance on the sense of the above issues by considering high frequency logarithmic intraday time series data of the popular Indian stock market index NIFTY 50 during the global Covid-19 pandemic. Thus, to realize the above notion deeply, the study uses parametric and non-parametric statistical approaches. The study reports that the null hypothesis of random walk is rejected based on various measures and the NIFTY 50 is inefficient in its weak form during the pandemic period. However, there is a little hope also because runs test accepts the null hypothesis that means NIFTY 50 follows random walk and informationally efficient in its weak form during the global pandemic. It may also be opined that testing of random walk and market efficiency largely depends on methodological innovation.*

**Keywords:** NIFTY 50, India, Covid, RWH, EMH.

**JEL Classification:** G00, G01, G02.

## 1. Introduction

Random walk and market efficiency are the most important topics of research in finance. A lot of studies are conducted on this area by the researchers around the globe. Generally, there are two sets of opinions that theoretically and empirically support the RWH (see Fama, 1965a, 1965b) under the efficient market hypothesis (EMH) and the second one is uncertainty regarding RWH (Lo and Mackinlay, 1988 etc.). An efficient market always discloses all the information on the stock prices and thus making of abnormal profit is impossible to the investors. But, dissemination of improper information on stock prices may generate manipulation and irrationality. According to Fama (1970, 1991), the market efficiency is divided into three forms particularly weak form, semi-strong form and strong form. Thus, the market is said to be efficient when the stock prices reflect all the information where insider information is of no use. RWH assumes that stock price movement don't follow any pattern and therefore it is tricky to guess the upcoming price movement based on past movement. Thus, market efficiency can be judged by observing the random walk pattern of the stock prices. It is observed that stock markets are badly affected during the Covid-19 pandemic around the globe. With this notion in mind, the present study tries to examine the random walk and market efficiency of the Indian stock market during the pandemic period.

After brief introduction in section I, the literature survey is given in section II. Section III describes about data and study period. Section IV deals with methodological aspect. Section V explains about analysis of result and finally, section VI ends with conclusion and recommendation.

## 2. Literature review

The efficient market hypothesis is associated with the random walk behaviour. Bachelier introduces the concept of random walk in 1900. Fama in 1991 describes about three forms of market efficiency specifically weak, semi-strong and strong forms. In 1973 Conrad and Juttner claim that random walk hypothesis is inappropriate to explain the behaviour of price changes. On the other hand, Shiller and Perron (1985) walk in a different path and try to investigate an assertion about power functions of a statistical test about random walk hypothesis. Random walk model says about prices of speculative assets which uses many observations. Sometimes data may arise with a short period of time with many observations then power of a test may be very high. To evaluate this, power functions for an important class of alternatives is tabulated with fixed span of data and the number of observations is varied by changing the frequency of observations. They observe that for  $t$  test and normalized beta test for short spans there is absence of much power but it rises in intermediate spans with the increase of observations. So over a substantial range, power depends on span of the data than the number of observations. They also opine that it is wrong to presume that power of tests of random walk hypothesis is high just because of many observations. There are lot of studies where models of economic fluctuations are examined in a context where economic growth is either assumed away or triggered by independent factors. In 1987, Ching considers an approach that the nature of aggregate

fluctuations cannot be abstracted from the process of economic development. He assumes that business cycle can be better understood by considering growth dynamics. He tries to develop an economic model where population is endogenously determined rather than exogenously specified and the novelty of this model is that diminishing returns to factors of production don't constrain the growth of the economy. The model forecasts that aggregate capital shocks, output, consumption and labour follow random walk with drift and the temporary real shocks which occur at a particular point in time is shifted permanently into the future and shift the entire equilibrium path and this process is not trend stationary and doesn't process stationary distributions. He opines that random walk process identifies the specific form of non-stationarity as suggested by Nelson and Plosser (1982). Although, Frennberg and Hansson (1993) argue that stock price doesn't follow random walk. However, Cooper's (1982) study supports in favour of random walk and efficient market hypothesis (See Sharma and Kennedy 1977). Similarly, Panas (1990) observes stock market is efficient in its strong form. Chan, Gup and Pan (1992) observe that the stock prices in the Asian markets as well as USA are efficient at their weak forms. Similar evidences are observed by Dickinson and Muragu (1994) at Nairobi stock market. Barnes (1986) shows that there is a high degree of efficiency in Kuala Lumpur market. Correspondingly, Groenewold and Kang (1993) observe semi strong form of market efficiency in Australian market. On the other hand, evidence of inefficient market efficiency is observed in the Kuwait market (Butler and Malaikah, 1992), Nairobi market (see Barnes, 1986), Istanbul stock market (Zychowicz et. al., 1995) and the Sri Lanka stock market (Abeysekera, 2001). Gradojevic, Djakovic and Andjelic (2010) investigate the soundness of the RWH by employing Lo and MacKinlay's (1988) VR test. Their study doesn't support RWH. But, Gu's (2004) study shows evidence of weak form of market efficiency in NASDAQ composite index. Dragotă et al. (2009) tries to examine the information efficiency of the Romanian capital market by considering two issues namely (i) can the capital market provides return to the normal mechanisms which make them work after a long silence and (ii) how long is it going to take the capital markets to return to the mechanism of the market economy? Thus, they consider daily data for those securities which are traded on Bursa stock exchange and applied various statistical tests like Cowles-Jones test, runs test and multiple variance ratio test. The study reports that the daily and weekly returns don't follow normality and there are evidences of information asymmetry in the Romanian capital markets. They also report that there is a very limited evidence of random walk based on runs test but this evidence is rejected by sequences and reversals ratio. Finally, they opine that Romanian capital market follows random walk and efficient in its weak form after long silence. Similarly, Ikram and Mehtab (2011) seek to examine the market efficiency of Indian equity market by considering daily closing time series data over a period from 2000 to 2010. Thus, they apply non parametric runs test and observe that the Indian equity markets don't follow random walk and inefficient at their weak forms. It is assumed that asset prices incorporate all available information instantaneously and behave accordingly where there is no place of abnormal gains. Thus taking this notion in mind, Oprean (2012) tries to examine the market efficiency by considering the emerging capital markets over a long period of time. Therefore, the study considers various statistical and econometrical tools and techniques to examine the pricing behaviour under random walk framework. The study reports mixed results about random walk and market efficiency

in emerging capital markets. Similarly, in 2014, Yadirichukwu tries to examine the weak form of market efficiency in Nigerian stock market indices over a period from 1984 to 2012 by considering monthly time series data. Their study reports evidence regarding presence of random walk with absence of market efficiency in Nigerian stock market when annual data is considered. The evidence is quite opposite when monthly data is considered with presence of market efficiency with absence of random walk. In 2015, Hodrea conducts a new study with a motto to examine the association between market efficiency and market liquidity of an emerging market like Romanian capital market. The author explains that liquidity of the market is closely associated with market efficiency based on the views of various studies. So, to establish the above relationship the study considers 13 companies which are traded in Bucharest stock exchange with daily intraday data and then the observations are arranged in a panel data framework. The study reports that there is a significant association between market efficiency and liquidity with presence of random walk. The study also claims that market liquidity plays a positive role to make the Romanian financial market efficient. Similarly, in 2015, Titan seeks to examine few previous studies which are conducted to examine efficient market hypothesis. It is accepted that market efficiency is a central problem in finance literature. He claims that various studies are conducted to realize the concept of efficient capital markets. There are many theoretical as well as empirical studies which focus on this problem. There are many arguments also. Some studies reject efficient market hypothesis and many studies accept this. There are few studies that support RWH and many of them reject it. In the same fashion, Kalsie et al. (2015) seeks to examine the weak form of market efficiency of NIFTY and six major sectoral indices over a period from 2001 to 2011 by considering daily data. They observe that NIFTY and its allied six sectoral indices are not efficient at their weak forms. In 2018, Gramatovici et al., tries to examine random walk hypothesis of two market indices of Bucharest stock market namely BET and BET plus by considering daily data with short time span. The study applies ARCH test, Naïve Bayes Classifier algorithm, K Nearest Neighbors algorithm, Monte Carlo simulation method, ARIMA modelling and support vector machine. The study reports that the markets follow random walk and efficient at their weak forms. Abkah et al., in 2018, tries to re-examine the weak form of market efficiency by considering 5 African stock markets particularly South Africa, Nigeria, Egypt, Ghana and Mauritius by taking into account weekly data over a period from 2000 to 2013. The study uses Fourier unit root test and augmented regression model to examine the stated objective. They report that three stock markets follow random walk and efficient at their weak forms based on non-linear Fourier unit root test and also opine that stock market efficiency depends on methodological application. Similarly, in 2020, Dias et al., tries to examine the weak form of market efficiency of BEL20 CAC40, DAX30, Dow Jones, FTSE Athex 20, IBEX3, ISEQ, PSI20 and SSE indices which are considered from various countries during the Covid-19 pandemic. Here, the study applies panel unit root test, structural break test and variance ratio test to fulfil the stated objectives. The study reports a mixed result about EMH and almost all the indices don't follow random walk and the prices don't reflect the available information in stock prices. Again in 2020, Dias et al., seeks to establish weak form of market efficiency by considering various stock markets around the globe during the pandemic time by considering daily time series data. They observe that the market indices don't follow random walk and the indices are inefficient at

their weak forms and the information doesn't reflect in stock prices and there is a strong possibility to earn abnormal profit. In 2020, Cepai tries to examine the stock market reaction during Covid-19 news by taking into consideration the most effected nations particularly USA, UK, Germany, France, Spain and Italy over a period from 3<sup>rd</sup> February 2020 to 17<sup>th</sup> April 2020. Therefore, the study considers six indices of those countries by considering daily time series data. Here, the study uses panel quantile regression framework which is recognised as more powerful tool for controlling extreme values throughout the asset distributions (Plooly, 2019). The study reports presence of asymmetric dependencies with various types of data related to Covid-19 of all the countries. In 2021, Evangelos tries to examine the efficient market hypothesis of US stock market particularly S&P 500 index by using daily time series data during the Covid-19 pandemic. The study reports that the US stock market doesn't react randomly and the market is not informationally efficient during the study period of the Covid-19 pandemic. Pillai et al. in 2021 also tries to examine the nature of market efficiency of the Indian stock market particularly NIFTY 50 during the pandemic time. In this study they seek to examine the behaviour of NIFTY 50 after the announcement of Covid-19 as a public health emergency of international concern and the announcement of lock down in India. The study uses event study approach to determine the efficiency. The study reports that the market is inefficient during this pandemic period and there is a lot of opportunity to make abnormal profits. They also observe that various sectors are affected by the information circulating in the market. In 2021, Budiharto tries to examine stock market forecasting by proposing a data science model by considering Indonesian stock exchange. The data science model is based on statistics and performed on R language and long short term memory (LSTM). The study reports that during Covid-19 pandemic, the composite stock price index is decreased by 28% and most affected industries are cigarette producers and banking sectors. The study also shows that EPOCH method is the best method for stock market prediction and its offers 94.59% accuracy based on data.

Accordingly, random walk and market efficiency obtain serious attention to the researchers. As discussed above that lot of studies are conducted to test randomness and market efficiency of stock prices around the globe by using various tools and techniques but till now there also exist a plenty of conflicts. This study tries to examine the same issue during the time of Covid-19 global pandemic by considering high frequency intraday data and the number of observation is very high and it is assumed that this study surely adds value to the existing domain of knowledge.

### 3. Data and study period

The present study is based on the perspective of recent Covid-19 pandemic. Therefore, NIFTY 50 which is considered as the popular stock market index in India and well recognised in the world is considered because many researchers use this index for their studies around the globe. Here, intraday data is collected per minute. Finally, 93529 observations are obtained per minute over a period from 1<sup>st</sup> April 2020 to 31<sup>st</sup> March 2021 in 249 trading days during Covid-19 pandemic. It is well known that Indian market is opened for trading at 9.15 a.m. and ended at 3.30 p.m. every day in general. So, during this

time interval the data is collected per minute through a computer system in every trading day and crossed checked with the intraday technical chart of NSE every day. Here, the time series observation is very large not ever been used by the researchers in recent time and this study surely add value to the existing literature.

#### 4. Methodology

Generally, logarithm time series is more realistic than normal time series because it provides various statistical characteristics that make the analysis simple. Generally, NIFTY 50 contains large value and after log conversion it becomes small and easy to manage and therefore, stationarity features are appropriately visible which is impossible in normal time series. The NSE prices series are converted in logarithm form by using the following mathematical formula:

$$R_{NSE,t} = \text{Ln}\left(\frac{NSE_t}{NSE_{t-1}}\right) \quad (1)$$

where:

$R_{NSE,t}$  is the per minute logarithm return of NIFTY 50 at time t,

$NSE_t$  is the current per minute index price and

$NSE_{t-1}$  denotes per minute index price of the previous respectively.

The study begins with the following regression equation with drift parameter:

$$\text{Ln}R_{NSE,t} = \text{Ln}R_{NSE,t-1} + \alpha + e_t \quad (2)$$

where:

$\text{Ln}R_{NSE,t}$  denotes logarithmic return of the current minute and  $\text{Ln}R_{NSE,t-1}$  is the logarithmic return of the immediately previous minute respectively,

$\alpha$  indicates subjective drift parameter,

$e_t$  denotes regression error with usual assumptions  $E(e_t) = 0$ ,  $E(e_t e_{t-i}) = \sigma_e^2$  for  $i = 0$  and  $E(e_t e_{t-i}) = 0$  for  $i \neq 0$ .

Commonly, the error term captures the differences of index price i.e.  $(\text{Ln}R_{NSE,t} - \text{Ln}R_{NSE,t-1})$  which is unpredictable white noise.

The following expression is applied to test random walk of NIFTY 50:

$$\Delta \text{Ln}R_{NSE,t} = (\text{Ln}R_{NSE,t} - \text{Ln}R_{NSE,t-1}) = \alpha + e_t \quad (3)$$

Random walk model supports that  $\text{Ln}R_{NSE,t}$  is  $I(1)$  ( $\Rightarrow \Delta \text{Ln}R_{NSE,t} \sim I(0)$ ),  $\alpha$  is different from 0 insignificantly and  $e_t$  is independently identically distributed.

A lot of statistical test is available to test random walk and market efficiency. The study considers both parametric and non-parametric techniques. Here, serial correlation test like Q statistic and Breusch-Godfrey LM test is applied under parametric approach and runs test is used for examining serial dependence of high frequency time series data under non-parametric framework. Along with these, the study applies ADF and PP unit root tests to

explore randomness of the time series data. At last, variance ratio test is used for examining randomness under the assumptions of homoskedasticity and heteroskedasticity conditions.

### A. Parametric approach

#### (i) Serial correlation test

This test is applied to check the relation between the current logarithmic return and immediately the previous. It helps to measure whether the serial correlation ( $\rho_k$ ) of the successive logarithm return is significantly diverse from 0 and if the association between the present and immediately previous periods is significantly positive then it may be said that the time series follows certain trends meaning that non-randomness. Here, equation 3 is used to examine the serial correlation between the two periods (current and previous) by taking into consideration the high frequency time series data and Ljung and Box's (1978) portmanteau Q-statistic is applied to test the significance of the autocorrelation (null: absence of autocorrelation) that can be shown below:

$$QLB = n(n+2) \sum_{k=1}^m \left( \frac{\hat{\rho}_k^2}{n-k} \right) \quad (4)$$

where:

$n$  denotes number of observation.

$m$  is the lag length and the test follows Chi square ( $\chi^2$ ) distribution.

The second parametric approach is applied to check the autocorrelation is Breusch-Godfrey LM test. The test is conducted by taking into account the disturbances of a regression equation. Here, the relationship between disturbances ( $e_t$ ) and its lagged values at the same time period is tested and this test is extensively applied for testing autocorrelation of the lags up to  $n^{\text{th}}$  order and this can be shown as below:

$$e_t = \rho_1 e_{t-1} + \rho_2 e_{t-2} + \rho_3 e_{t-3} + \dots + \rho_n e_{t-n} + \omega_t \quad (5)$$

where:

$$n \approx N(0, \sigma^2 \omega)$$

Here, the coefficients are the autocorrelation coefficients which are to be estimated. It is assumed that if the autocorrelation function dies out at a geometric rate and the partial autocorrelations become zero after one lag then application of first order autoregressive (AR) function is suitable. Otherwise, first-order moving average model is appropriate when autocorrelations become zero after one lag and the partial autocorrelations come down as a geometric rate.

The autocorrelation of a series of H at lag M can be estimated as below:

$$\Psi_m = \frac{\sum_{t=m+1}^T (h_t - \bar{h})(h_{t-1} - \bar{h})}{\sum_{t=1}^T (h_t - \bar{h})^2} \quad (6)$$

$\bar{h}$  denotes sample average and the correlation coefficient for values of the series  $m$  periods apart. If  $\Psi_1$  is non-zero that indicates that the series is serially correlated with order one if  $\Psi_m$  dies out more or less geometrically with increasing  $m$  lag then the series follows a low order AR process. On the other hand, if  $\Psi_1$  comes to 0 after a few lags then the series follows a low order MA process. Now, if the autocorrelation pattern is one which can be captured by an auto regressive function of order less than  $m$  then the partial auto correlation at lag  $m$  will be close to 0. Thus, the partial auto correlation at lag  $m$  can be recursively shown as under:

$$\Pi_m = \frac{\Psi_m^{\Psi_1} - \sum_{j=1}^{m-1} \Pi_{m-1, j} \Psi_{m-j}}{1 - \sum_{j=1}^{m-1} \Pi_{m, j} \Psi_{m-j}} \quad (7)$$

$M = 1$  for  $M > 1$ ; where  $\Psi_m$  is the estimated auto correlation at lag  $m$  and  $\Pi_{m, j} = \Pi_{m-1, j} - \Pi_m \Psi_{m-1, m-j}$  which can be tested by using Q statistics for checking white noise as already shown in equation 5.

## B. Non-parametric approach

### (i) Runs test

The runs test is a nonparametric statistical approach that allows identifying the independences of successive changes of logarithmic rate of return. It is a sequence of successive alteration of logarithmic rate of returns with positive or negative sign (+ or -) and a state of affairs when the change is zero. The return is categorized based on its position in respect of average return. The expected runs are the change in returns required if the data is generated by a random process. If the actual runs are close to expected number of runs then it is assumed that returns are generated by random process. The expected number of runs is distributed as normal with the subsequent mean as under:

$$e = \frac{S(S+1) - \sum_{i=1}^3 s_i^2}{S} \quad (8)$$

The standard deviation can be written as below:

$$\sigma_e = \left[ \frac{\sum_{i=1}^3 \left[ \sum_{i=1}^3 s_i^2 + S(S+1) \right] - 2S \left( \sum_{i=1}^3 s_i^3 - S^2 \right)}{S^2(S-1)} \right]^{\frac{1}{2}} \quad (9)$$



Where  $s_i$  is the number of runs of each category of  $i$ . The study uses  $Z$  statistic to conduct runs test that can be written as below:

$$z = \frac{N - p \pm 0.5}{\sigma p} \sim S(0,1) \quad (10)$$

$N$  denotes actual number of runs. If the actual number of runs higher (lower) than the expected runs then positive (negative)  $Z$  values can be obtained that means positive  $Z$  values associated with negative serial correlation and vice-versa.

### (ii) Unit root test

Modelling of time series data for economic relationship encounters non-stationarity and thus OLS technique may produce spurious results and therefore, testing of non-stationarity is an important task before moving on. Here, the study applies Augmented Dickey-Fuller (1979, 1981) test and Phillips-Peron (1988) test to examine non-stationarity of high frequency time series logarithm data. Here, unit root test is used to examine the market efficiency because it demands randomness (non-stationary) in the stock prices. Thus, two regression equations are applied:

$$\Delta \ln R_{NSE,t} = \alpha_0 + \beta_{i,t-1} \sum_{i=1}^q \Delta \ln R_{NSE,t-1} + e_t \quad (11)$$

$$\Delta \ln R_{NSE,t} = \alpha_0 + \alpha_{1t} + \beta_0 \ln R_{NSE,t-1} + \lambda_i \sum_{i=1}^q \Delta \ln R_{NSE,t-1} + e_t \quad (12)$$

Here, equation 13 includes both an intercept and trend terms where, equation 12 includes only an intercept term.  $q$  is the number of lagged lengths which can be determined by using AIC and  $e$  is the white noise.

### (iii) Lo and MacKinlay Variance Ratio test

Lo and MacKinlay's (1988) variance ratio test statistic is obtained from the assumption of linear relations in observations interval regarding the variance of increments. If the logarithmic time series rate of return follows random walk then the  $q^{\text{th}}$  differenced variable is  $q$  times higher than the first-differenced variable and if the logarithmic rate of return series is divided into equally spaced distance and characterised by random walk then the  $q^{\text{th}}$  variance of  $(\ln R_{NSE,t} - \ln R_{NSE,t-q})$  is equal to the variance of  $(\ln R_{NSE,t} - \ln R_{NSE,t-1})$ :  $\text{Var}(\ln R_{NSE,t} - \ln R_{NSE,t-q}) = q \text{Var}(\ln R_{NSE,t} - \ln R_{NSE,t-1})$

Where,  $q$  is the positive integer and the variance ratio may be written as follows:

$$VR(q) = \frac{\frac{1}{q} \text{Var}(\ln R_{NSE,t} - \ln R_{NSE,t-q})}{\text{Var}(\ln R_{NSE,t} - \ln R_{NSE,t-1})} = \frac{\sigma^2(q)}{\sigma^2(1)} \quad (13)$$

Here,  $H_0$  is  $VR(q) = 1$

Lo and Mackinlay's (1988) unbiased estimates of  $\sigma^2(1)$  and  $\sigma^2(q)$  for a sample size of  $nq + 1$  observations  $(R_0, R_1, \dots, R_{nq})$  may be expressed as follows:

$$\hat{\sigma}^2(1) = \frac{\sum_{k=1}^{nq} (R_k - R_{k-1} - \hat{\mu})^2}{nq - 1} \quad (14)$$

and

$$\hat{\sigma}^2(q) = \frac{\sum_{k=q}^{nq} (R_k - R_{k-q} - q\hat{\mu})^2}{v} \quad (15)$$

where:

$\hat{\mu}$  = sample mean of  $(R_t - R_{t-1})$

Mackinley (1988) talks about two test statistics which are  $Z(q)$  and  $Z^*(q)$  under the null hypothesis of homoskedasticity and heteroskedastic increments random walk. If the null hypothesis is accepted then the associated test statistic follows asymptotic standard normal distribution. Under the null hypothesis of homoskedastic increments with a sample size of  $nq + 1$  observations  $(R_0, R_1, \dots, R_{nq})$ , the standard normal test statistic  $Z(q)$  may be written as follows:

$$Z(q) = \frac{V\hat{R}(q) - 1}{\hat{\sigma}_0(q)} \quad (16)$$

where:

$$\hat{\sigma}_0(q) = \left[ \frac{2(2q-1)(q-1)}{3q(nq)} \right]^{\frac{1}{2}} \quad (17)$$

Whereas, the random walk test statistic of heteroskedastic increments  $Z^*(q)$  may be expressed as follows:

$$Z^*(q) = \frac{V\hat{R}(q) - 1}{\hat{\sigma}_e(q)} \quad (18)$$

where:

$$\hat{\sigma}_e(q) = \left[ 4 \sum_{k=1}^{q-1} \left(1 - \frac{k}{q}\right)^2 \hat{\delta}_k \right]^{\frac{1}{2}} \quad (19)$$

and

$$\hat{\delta}_k = \frac{\sum_{j=(k+1)}^{nq} (R_j - R_{j-1} - \hat{\mu})^2 (R_{j-k} - R_{j-k-1} - \hat{\mu})^2}{\left[ \sum_{j=1}^{nq} (R_j - R_{j-1} - \hat{\mu})^2 \right]} \quad (20)$$

**(iv) Multiple Variance Ratio (MVR) Test**

Chow and Denning develops the multiple variance ratio test in 1993 that captures auto-correlation and heteroscedasticity in time series data. This corresponds to the test  $E(e_t e_{t-i}) = 0$  and  $\sigma^2(e_t e_{t-i})$  is constant or  $e_t \sim$  i.i.d. Lo and Mackinlay's (1988) procedure is designed to test individual variance ratio for a specific aggregation interval ( $q$ ) whereas the condition of RWH is  $VR(q) = 1$  for all  $q$ . But, multiple variance ratio (MVR) test helps to compare multiple variance ratio estimates with the unity. The condition of null hypothesis for a single variance ratio test is  $VR(q) = 1$  and for multiple variance ratio test is  $Mr(q) = VR(q) - 1 = 0$  and further the set of  $m$  variance ratio tests is  $\{Mr(q_i) / i = 1, 2, \dots, m\}$ . Under RWH, multiple and alternative hypotheses are as under:

$H_{0i}$ :  $Mr(q_i) = 0$  for  $i = 1, 2, \dots, m$ .

$H_{1i}$ :  $Mr(q_i) \neq 0$  for any  $i = 1, 2, \dots, m$ .

The null of random walk is rejected when any one or more of  $H_{0i}$  is rejected. The homoscedastic test statistic in Chow-Denning may be expressed as under:

$$CD_1 = \sqrt{T} \text{Max} / 1 \leq i \leq Z(q_i) / \quad (21)$$

Chow-Denning test follows standardized maximum modulus (SMM( $\alpha, m, T$ )) distribution with  $m$  parameters with  $T$  degrees of freedom. Similarly, heteroscedastic robust statistic of Chow-Denning may be expressed as under:

$$CD_2 = \sqrt{T} \text{Max} / 1 \leq i \leq Z^*(q_i) / \quad (22)$$

The RWH is rejected if the value of standardized test statistic  $CD_1/CD_2$  is greater than the SMM critical value at chosen level of significance.

## 5. Result and analysis

The descriptive statistics of high frequency per minute logarithmic return series of NIFTY 50 index is presented in Table 1. It is observed that NIFTY 50 index provides positive return to the investors during Covid-19 pandemic study period. However, the risk exposure of NIFTY 50 is slightly higher during pandemic time. The skewness is found to be negative that means data are skewed right (platykurtic) as compared to the left one and positive kurtosis denotes logarithmic return distribution of the index has flatter tails than a normal distribution. Furthermore, the computed JB statistic of the high frequency logarithmic return distribution of NIFTY 50 is very large and the probability of

obtaining such statistic under the normality assumption is approximately significantly zero that means rejection of null hypothesis ( $H_0$ : Normally distributed) and opined that that the high frequency logarithmic return series of NIFTY 50 is not normally distributed.

**Table 1.** *Descriptive statistics*

Index	OB	Mean	Max.	Min.	Standard Deviation	Skew.	Kurtosis	J-B	P-Value
LnNSE	93038	0.000005	0.0410	-0.0375	0.0007	4.0451	544.5439	1140000000	0.000*

\*Significant at 5% level.

**Source:** Authors' own calculation.

Table 2 presents the auto correlation and partial auto correlation functions of the high frequency logarithmic return series of NIFTY 50 along with Q statistic and B-G serial correlation LM statistic. It is observed that the Q statistics of high frequency logarithmic return series of NIFTY 50 is statistically significant that supports to reject the null hypothesis ( $H_0$ : weak-form of market efficiency) and also implies significant association between current period and its immediately preceding period which confirms about presence of serial dependence in NIFTY 50 returns during Covid-19 period which also claims about absence of weak form of market efficiency.

In the same light it is observed that the probability value of the  $\chi^2$  statistic ( $=\text{Obs} \times R^2$ ) is 0.000 which is statistically significant and thus reject the null hypothesis and also confirms about presence of serial correlation. Therefore, it may be opined that the NIFTY 50 index with high frequency time series data doesn't support random walk behaviour.

**Table 2.** *Test of Serial Independence*

Index	Lags	AC	PAC	Q Statistic	Prob.	B-G Serial Correlation LM Test			
						F-stat.	Prob.	Obs*R <sup>2</sup>	Prob.
LnNSE	1	-0.022	-0.022	44.716	0.000*	37.6041	0.0000*	75.1507	0.0000*
	2	-0.022	-0.022	88.485	0.000*				
	3	-0.007	-0.008	93.279	0.000*				
	4	-0.002	-0.003	93.808	0.000*				
	5	0.011	-0.010	104.57	0.000*				
	6	0.016	0.016	127.16	0.000*				
	7	-0.012	-0.011	140.53	0.000*				
	8	-0.005	-0.004	142.48	0.000*				
	9	-0.012	-0.012	154.96	0.000*				
	10	-0.000	-0.001	154.97	0.000*				

\*Significant at 5% level.

**Source:** Authors' own calculation.

Runs test is a non-parametric statistical test which is conducted to check the independency of consecutive price changes of a time series or in other words a test of randomness for the sequence of returns. It is opined that time series is not normally distributed and thus there is a possibility of structural breaks (outliers) in the time series returns which may influence the test results. So, keeping in mind such issues, the runs test is conducted by using mean and median as a base. However, considering median can provide better result in the presence of structural break in the series. The outcome of runs test is presented in table 3 and 4. It is found that the computed z statistic is negative and insignificant which is also lower than the critical value at 5% significance level (1.96) in absolute term in both the cases and thus the null hypothesis is accepted. Hence, it may be opined that the stock price movement with high frequency data in the pandemic period is random in nature and the

past movement is affected by the previous movement. Therefore, it may be said that the NIFTY 50 index during the sample pandemic period with high frequency data follows random walk and the index is efficient in its weak form.

**Table 3.** *Runs test (Mean as base)*

Var.	Test Value	Case<test value	Case>=test value	Total Cases	Number of runs	z-statistic	p-value
LnNSE	0.00000578	46900	46138	93038	46430	-0.570	0.569

**Source:** Authors' own calculation.

**Table 4.** *Runs test (Median as base)*

Var.	Test Value	Case<test value	Case>=test value	Total Cases	Number of runs	z-statistic	p-value
LnNSE	0.00000	46513	46525	93038	46402	-0.774	0.439

**Source:** Authors' own calculation.

Unit root testing is one of the important tests for examining market efficiency. Table 5 presents the result of unit root test. It is found that the test statistic based on two measures is negative and statistically significant at level form that means rejection of null hypothesis. Thus, it may be claimed that logarithmic return of the high frequency time series of NIFTY 50 is stationary and against random walk behaviour during the pandemic time and therefore it may be opined that NIFTY 50 is inefficient at its weak form.

**Table 5.** *Unit Root Tests*

Index	ADF Test		PP Test	
	Level		Level	
	t-stat.	Prob.	t-stat.	Prob.
lnNSE	-223.0731	0.0001*	-312.0410	0.0001*

\*Significant at 5% level.

**Source:** Authors' own calculation.

The absolute value of  $z(q)$  and  $z^*(q)$  statistics is examined (homoskedastic and heteroskedastic increments random walk) based on the outcome of MacKinlay's variance ratio test. It is observed from the table (Table 6) that the absolute values of homoskedastic-consistent statistics [ $z(q)$ ] as well as heteroskedasticity-consistent statistics [ $z^*(q)$ ] under the various sampling intervals [ $z(2)$ ,  $z(4)$ ,  $z(8)$  and  $z(16)$ ] are higher than the critical value (2.49) at 5% level of significance in high frequency logarithmic return series of NIFTY 50 that confirms about rejection of null hypothesis of random walk and thus, it may be opined that NIFTY 50 index is inefficient at its weak forms.

Similarly, the maximum homoskedastic and heteroskedastic robust test statistics proposed by Chow and Denning are also reported in the same table. It is observed that Chow-Denning MVR test statistics are higher than the critical value (2.49) at 5% level of significance that indicates rejection of null hypothesis of random walk and thus it may be opined that NIFTY 50 index is inefficient at its weak form during the pandemic period.

**Table 6.** *Variance Ratio Test*

Index	Lo-Mackinlay VR Test				Prob.	Chow-Denning MVR Test	
	q	VR(q)	Z(q)	Z*(q)		Homoskedastic Statistic	Heteroskedastic Statistic
lnNSE	2	0.499824	-152.5634	-11.76347	0.0000	152.5634	11.76347
	4	0.245196	-123.0632	-11.72670	0.0000	(0.0000)	(0.0000)
	8	0.122868	-90.44590	-11.54911	0.0000		
	16	0.060686	-65.09049	-11.34220	0.0000		

\*Significant at 5% level.

**Source:** Authors' own calculation.

## 6. Conclusion and recommendation

The present study tries to examine the RWH and market efficiency of the high frequency intraday time series logarithmic return data of the well-known stock market index NIFTY 50 in India during the period of Covid-19 pandemic. The logarithmic return series of NIFTY 50 is not normally distributed and return series doesn't support random walk theory and thus inefficient in its weak form during the pandemic period based on parametric as well as non-parametric test approaches. However, the return series of NIFTY 50 index supports random walk behaviour during this pandemic period and the market is also efficient in its weak form based on runs test. Finally, it may be recommended that this study is helpful to the financial planners, policy makers and the investors who can get advantage from the evidences when they plan for stock market trading and market forecasting during pandemic period. The researchers may also conduct further study by taking into consideration of others financial markets those are affected a lot during this pandemic period by considering high frequency time series data.

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## References

- Abeyssekera, S.P., 2001. Efficient markets hypothesis and the emerging capital market in Sri Lanka: Evidence from the Colombo Stock Exchange – A note. *Journal of Business Finance and Accounting*. 28, pp. 249-261.
- Abkahl, E.J.A., Alagidede, P., Mensah, L. and Asare, K.O., 2018. Non-linear approach to random walk test in selected African countries. *International Journal of Managerial Finance*, 14(3), pp. 362-376.
- Bachelier, L., 1900. Theroi de la speculation. *Annales Scientifiques de l'Ecole Normale Supérieure Ser. 3*(17), pp. 21-86.
- Barnes, P., 1986. Thin trading and stock market efficiency: The case study of the Kuala Lumpur Stock Exchange. *Journal of Business Finance and Accounting*. 13(4), Winter, pp. 609-617.
- Bulter, K. and Malaikah, K., 1992. Efficiency and inefficiency in thinly traded stock markets: Kuwait and Saudi Arabia. *Journal of Banking and Finance*. 16, pp. 197-210.
- Budiharto, W., 2021. Data science approach to stock prices forecasting in Indonesia during Covid-19 using long short-term memory (LSTM). *Journal of Big Data*, 8(47), pp. 1-9.
- Conrad, K. and Juttner, D.J., 1973. Recent Behaviour of Stock Market Prices in Germany and the Random Walk Hypothesis. *Kyklos*, 26, pp. 576-599.
- Chan, C.K., Gup, B.E. and Pan, M.S., 1992. An empirical analysis of stock prices in major Asian Markets and the U.S. *Financial Review*. 27(2), pp. 289-307.
- Cepoi, C.O., 2020. Asymmetric dependence between stock market returns and news during Covid-19 financial turmoil. *Finance Research Letters*, 36, 101658, pp. 1-4.
- Dickey, D.A. and Fuller, W.A., 1979. Distribution of the estimators for autoregressive time series with a unit root. *Journal of American Statistical association*, 74, pp. 427-431.
- Dickey, D.A. and Fuller, W.A., 1981. Likelihood ratio statistics for autoregressive time series with unit root. *Econometrica*, 49, pp. 1057-1072.

- Dickinson, J.P. and Muragu, K., 1994. Market efficiency in developing countries: A case study of the Nairobi Stock Exchange. *Journal of Business Finance and Accounting*, 21(1), pp. 133-150.
- Dragotă, V., Stoian, A., Pele, D.T., Mitrică, E. and Bensafta, M., 2009. The development of the Romanian capital market: Evidences on information efficiency. *Romanian Journal of Economic Forecasting*, 2, pp. 147-160.
- Dias, R., Heliodoro, P., Alexandre, P. and Silva, R., 2020. Testing the weak form of efficient market hypothesis: Empirical evidence in the context of the Covid-19 pandemic. <<https://www.researchgate.net/publication/346420700>>, pp. 1-14.
- Dias, R., Teixeira, N., Machova, V., Pardal, P., Horak, J. and Vochozka, M., 2020. Random walks and market efficiency tests: evidence on US, Chinese and European Capital markets within the context of the global Covid-19 pandemic. *Oeconomia Copernica*, 11(4), pp. 586-598.
- Evangelos, V., 2021. Efficient markets hypothesis in the time of Covid-19. *Review of Economic Analysis*, 13, pp. 45-62.
- Fama, E.F., 1965a. The behaviour of stock market prices. *Journal of Business*, 38, pp. 161-176.
- Fama, E.F., 1965b. Random walks in stock prices. *Financial Analyst Journal*, 21(5), pp. 55-59.
- Fama, E.F., 1970. Efficient capital markets: A review of theory and empirical work. *Journal of Finance*, 25(2), pp. 383-417.
- Fama, E.F., 1991. Efficient capital markets II. *Journal of Finance*, 46(5), pp. 1575-1618.
- Frennberg, P. and Hansson, B., 1993. Testing the Random Walk Hypothesis on Swedish Stock Prices 1919-1990. *Journal of Banking and Finance*, 17(1), pp. 175-191.
- Groenewold, N. and Kang, K.C., 1993. The semi-strong efficiency of the Australian share market. *Economic Record*, 69(207), pp. 405-410.
- Gu, A.Y., 2004. Increasing market efficiency: Evidence from the NASDAQ. *American Business Review*, 22(2), pp. 20-25.
- Gradojevic, N., Djakovic, V. and Andjelic, G., 2010. Random walk theory and exchange rate dynamics in transition economics. *Panoeconomicus*, 57(3), pp. 303-321.
- Gramafovici, S. and Mortici, C.M., 2018. Random walk hypothesis on Bucharest stock exchange. *Review of the Air Force Academy*, 2(37), pp. 59-74.
- Hodrea, R., 2015. An intraday analysis of the market efficiency-liquidity relationship: the case of BVB stock exchange. *Procedia Economics and Finance*, 32, pp. 1432-1441.
- Khan, A.Q., Ikram, A. and Mehtab, M., 2011. Testing weak form market efficiency of Indian capital market: A case of national stock exchange (NSE) and Bombay stock exchange (BSE). *African Journal of Marketing Management*, 3(6), pp. 115-127.
- Kalsie, A. and Kalra, J.K., 2015. An empirical study on efficient market hypothesis of Indian capital markets. *Journal of Management Research and Analysis*, 2(2), pp. 108-114.
- Ljung, G.M. and Box, G.E.P., 1978. On a measure of lack of fit in time series models. *Biometrika*, 65(2), pp. 297-303.
- Lo, A. and MacKinlay, C., 1988. Stock market prices do not follow random walks: evidence from a simple specification test. *Review of Financial Studies*, 1, pp. 41-66.
- Mao, C.S., 1987. Aggregate fluctuations and economic growth: A case of random walk hypothesis. *Working paper 87-6, Federal Reserve Bank of Richmond*, pp. 1-30.
- Nelson, C.R. and Plosser, C.R., 1982. Trends and random walks in macroeconomic time series: some evidence and implications. *Journal of Monetary Economics*, 10(2), pp. 139-162.
- Oprean, C., 2012. Testing the financial market informational efficiency in emerging states. *Review of applied Socio-Economic Research*, 4(2), pp. 181-190.

- Panas, E., 1990. The behaviour of Athens stock prices. *Applied Economics*, 22, pp. 1715-1727.
- Phillips, P. and Perron, P., 1988. Testing for a unit root in time series regression. *Biometrika*, 75, pp. 335-346.
- Pillai, G.P. and Pillai, A., 2021. Efficient market hypothesis during the time of Covid. *International Journal of recent Technology and Engineering*, 10(1), pp. 21-29.
- Du Plooy, S., 2019. On the financial interpretation of risk contributions: an analysis using quantile simulation. *Investment Analysts Journal*, 48(3), pp. 188-204.
- Sharma, J.L. and Kennedy, R.E., 1977. A Comparative Analysis of Stock Price Behaviour on the Bombay, London and New York Stock Exchanges. *Journal of Quantitative Analysis*, 12, pp. 391-413.
- Shiller, R.J. and Perron, P., 1985. Testing the random walk hypothesis: Power versus frequency of observation. *Economic Letters*, 18, pp. 381-386.
- Titan, G.A., 2015. The efficient market hypothesis: review of specialized literature and empirical Research. *Procedia Economics and Finance*, 32, pp. 442-449.
- Yadirichukwu, E. and Ogochukwu, O.J., 2014. Evaluation of the weak form of efficient market hypothesis: Empirical evidence from Nigeria, *International Journal of Development and Sustainability*, 3(5), pp. 1199-1244.



## Poverty in Romania: an analysis at regional level

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**Abstract.** *This paper proposes to analyze the poverty rate in the eight development regions of Romania (NUTS 2), in the period 2010-2019. To provide the most complex analysis possible, I examined the determinants of the poverty rate, and I concluded that the gross domestic product per capita and the gross value added of the ICT sector reduce the poverty rate, while the unemployment rates lead to poverty increases. However, at regional level, in general, the poverty rate decreased in 2019 compared to the 2010 levels.*

**Keywords:** poverty, regions, NUTS 2, GDP, ITC sector.

**JEL Classification:** I32, R11, O11.

## 1. Introduction

Poverty is defined as a social state in which an individual finds himself when the earned income could not ensure a decent standard of living or the minimum subsistence needs. The subsistence needs include covering the expenses necessary for a regular diet, clothing needs, heating, but also other necessities necessary for living. At the same time, poverty is directly related to the level of development of a country, because given that the more developed a state is, the lower is the level of poverty (Dinu, 2021).

Fighting against poverty is a global concern, and poverty reduction leads to a smart, sustainable and inclusive growth. Measures to eradicate the poverty include alleviating social inequalities, which can be achieved through an efficient education system adapted to current economic needs, qualification in the labour market, equal opportunities in the labour market, a fair wage system and taxation for work, respectively social protection and inclusion.

In 2019, Romania ranked second in the European Union in terms of poverty rate (Bulgaria registered the highest level of poverty). At the same time, Romania has three of the poorest regions in the European Union, namely North-East, South-East and South-West Oltenia. Although several measures have been taken in recent years to reduce poverty, these have not been sufficient.

The reason why I chose this topic consists in the intensification on the discussions on poverty related issues at the level of European Union and Romania, but also in the importance of finding solutions to generate social inclusion and convergence at Member States and regional level. The main objective of this paper is to analyse the factors that increase the level of poverty in some regions of Romania. This object can be reached by achieving specific objectives, respectively: identifying the impact of the determinants of the poverty rate, respectively validating the feasibility of the model.

## 2. Literature review

The poverty rate is calculated by the share of people who have a disposable income less than 60% of the median equivalent disposable income at the national level, in the total population (National Institute of Statistics), this being also one of the methodological approaches preferred by Eurostat, although there are other poverty lines taken into account. The United Nations states that poverty means more than a lack of income, it also referring to the socio-economic dimension, social protection measures, decent work and opportunities. In addition, the World Bank stated that the determinants of the poverty rate include regional characteristics, the specificities of communities and the individual characteristics of people.

Poverty concept has been analysed by many authors. Among them is Smith (2010), which stated that poverty is a multidimensional phenomenon, that can be influenced by social and economic factors, but also by age, sex and culture. Moreover, Atkinson (2013) argued that poverty is caused by national policies adopted by public institutions.

The relationship between GDP per capita and poverty rate was analysed by Cerra et al. (2021), which confirmed an inverse relationship between these variables. In addition, the authors emphasised that it is important to examine the sources of growth that underlie poverty reduction. Adams (2003) stated that the growth of GDP per capita leads to a reduction of the poverty rate. In addition, Muloc et al. (2012) showed that economic growth is necessary but not sufficient to reduce poverty in a region. On the other hand, Anser et al. (2020) showed that there is a "U"-shaped relationship between poverty rate and GDP per capita.

Another analysed relationship is that between poverty rate and technology. In this case, Liu (2021) indicated that the widespread use of technology has a significant impact on economic growth and human well-being. In addition, Deaton (2017) showed that investing in technology helps to eradicate poverty. On the other hand, Jaumotte et al. (2008) have shown that increasing inequality and poverty is a consequence of technological progress. Also, Mirsa et al. (2019) stated that technology can lead to increasing social inequalities, including increasing poverty.

Regarding the relationship between the poverty rate and the unemployment rate, Šileika and Bekerytė (2012) found that there is a direct link between these variables. In addition, the authors pointed out that poor countries do not always have a high unemployment rate. On the other hand, Nasar (2014) stated that a high unemployment rate generates poverty, while Duiella and Turrini (2014) and Caminada et al. (2011) showed that the poverty rate has a negative impact on the unemployment rate and on GDP per capita.

### 3. Methodology

In this section I have described the methods used to estimate the impact of poverty on GDP per capita and the gross value added of the ICT sector. The analysis is performed at the level of the eight development regions of Romania (NUTS2), namely: North-East, South-East, South-Muntenia, South-West Oltenia, West, North-West, Centre and Bucharest-Ilfov.

Therefore, to calculate the impact poverty selected determinants, I used panel data, with quarterly frequency, using the time period 2010-2019 (72 observations in total). The reason why I used this period is to capture the post-economic crisis period. Statistical data for the eight regions of Romania were extracted from the Eurostat database.

In this analysis I used the method Estimated Generalized Least Squares (EGLS), with fixed effects, this being weighted with the Cross-section SUR option (since the number of cross-sections is less than the number of observations per cross-section) to eliminate ex-ante issues related to heteroskedasticity and correlation. The adjustment of the model with the fixed effects method was based on the result obtained after using the Redundant Fixed Effects – Likelihood Ratio test, this being a technique used to address heterogeneity issues in panel series.

In order to process the statistical data, I have applied the EGLS method on the following equation:

$$poverty = \alpha + \beta_0 poverty_{(-1)} + \beta_1 gdp\_capita + \beta_2 gva\_itc + \beta_3 unemployment_{(-1)} + \varepsilon_t, \quad (1)$$

where *poverty* represents the rate of people at risk of poverty,  $poverty_{(-1)}$  shows the rate of people at risk of poverty lagged by one year, *gdp\_capita* is represented by the percentage change of the gross domestic product per capita, *gva\_itc* represents the percentage change of the gross value added of the ICT sector, and  $unemployment_{(-1)}$  shows the unemployment rate lagged by one year.

Finally, I tested the maximum likelihood of the estimators by examining the following hypotheses:

- The significance of the parameters.
- Statistical validity of the model – Fisher test.
- Absence of multicollinearity – variance inflation factors.
- Absence of heteroskedasticity – Breusch-Pagan-Godfrey test.
- Absence of serial autocorrelation – Breusch-Pagan test.
- Absence of cross-section dependence – Breusch Pagan LM, Pesaran scaled LM, Pesaran CD and Bias-corrected scaled LM tests.
- Normal distribution of the residuals – Jarque-Bera test.

#### 4. Results and interpretations

In this paper, as mentioned above, I analysed the impact of poverty rate determinants, in the period 2010-2019. In this case, according to Figure 1, all estimators are statistically significant at 5%. In addition, the validity of the model is confirmed by the null probability of the F-statistical test. Moreover, the value of R-squared (98.67%) supports that the regressors have been properly selected.

**Figure 1. Estimation results**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POVERTY(-1)	0.341239	0.037513	9.096628	0.0000
GDP_CAPITA	-0.026690	0.012794	-2.086089	0.0412
GVA_ITC	-0.016641	0.003168	-5.252351	0.0000
UNEMPLOYMENT(-1)	0.165455	0.063796	2.593524	0.0119
C	14.68547	0.960362	15.29159	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
Weighted Statistics				
R-squared	0.986763	Mean dependent var	27.32945	
Adjusted R-squared	0.984336	S.D. dependent var	66.22089	
S.E. of regression	1.077471	Sum squared resid	69.65658	
F-statistic	406.6083	Durbin-Watson stat	2.310209	
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.939288	Mean dependent var	23.27083	
Sum squared resid	386.9834	Durbin-Watson stat	2.002384	

**Source:** Own calculations in Eviews 10.0 using Eurostat data.

Next, I have presented the impact of the selected poverty rate determinants. According to the results obtained, the increase by one percentage point of the rate of persons at risk of poverty lagged by one year, leads to the increase of the poverty rate by 0.341 percentage points, in the current year. Poverty is a challenge that the population faces in the short, medium and long term, and the process of overcoming it – is very difficult. In this case, individuals who fall into the category of people at risk of poverty will not be able to leave this category without earning higher incomes, and these high wages can be obtained mainly through better paid jobs. Also, people cannot get better paid job if they do not have a higher qualification. In addition, people may not be able to afford high qualifications due to their financial situation.

On the other hand, when the percentage change of the GDP per capita increases by one percentage point, the poverty rate decreases by 0.026 percentage points. GDP growth can be achieved in two ways: by increasing demand or increasing supply, both channels leading to better living conditions for the population, better health system, a better education system, and a social system that can help individuals to escape from the circle of poverty. In Romania, three out of eight regions have a high GDP per capita (Bucharest-Ilfov, West and Centre), the remaining regions facing major social problems, including a high level of poverty rate. In order to help the development of all regions, investments in infrastructure and human capital are needed, which promote social prosperity.

**Table 1.** Tests performed

Test	Test results (prob.)	Hypothesis accepted
<i>Compatibility with fixed effects model</i>		
Redundant Fixed Effects Test	0.000 (p<.05)	Fixed effects model is better than the random effects model
<i>Autocorrelation test (Breusch-Pagan)</i>		
R-squared (dependent variable: resid01)	0.020	There is no serial correlation between residuals
Observations (n)	72	
n*R-squared	1.440	
Degrees of freedom	1	
Prob. Breusch-Pagan	0.230	
<i>Heteroskedasticity test (Breusch-Pagan-Godfrey)</i>		
R-squared (dependent variable: resid01 <sup>2</sup> )	0.135	Homoskedasticity
Observations (n)	72	
n*R-squared	9.735	
Degrees of freedom	4	
Prob. Breusch-Pagan-Godfrey	0.045	
<i>Cross-section dependence (CD) test</i>		
Breusch-Pagan LM	1.000 (p>.05)	No CD
Pesaran scaled LM	0.000 (p<.05)	CD
Bias-corrected scaled LM	0.000 (p<.05)	CD
Pesaran CD	0.7721 (p>.05)	No CD
<i>Normality test</i>		
Prob. Jarque-Bera	0.278 (p>.05)	Normal distribution

**Source:** Own calculations using Eurostat database.

Further, I have found that the increase by one percentage point of the percentage change of the gross value added of ICT sector leads to a decrease in the poverty rate by 0.016 percentage points. Technology offers people the opportunity to have faster and easier access to information, which can generate opportunities at the individual level – especially related to jobs, qualifications and training programs, regardless of financial situation and

background. Therefore, technology can make a positive contribution to access to education, but on the other hand, it can limit access to the labour market as a result of the introduction of automation. Automation has begun to expand into many sectors, including in those where the minimum qualification is the secondary education cycle, which can lead to an increase in poverty if these people do not reorient themselves to other jobs on the labour market.

Regarding the effect of the unemployment rate lagged by one year, its increase by one percentage point lead to a hike in poverty rate of 0.165 percentage points. In this respect, a person falling into unemployment will suffer a significant reduction in income, and will be more likely to fall into the category of vulnerable people if fails to enter the labour market in a short period of time.

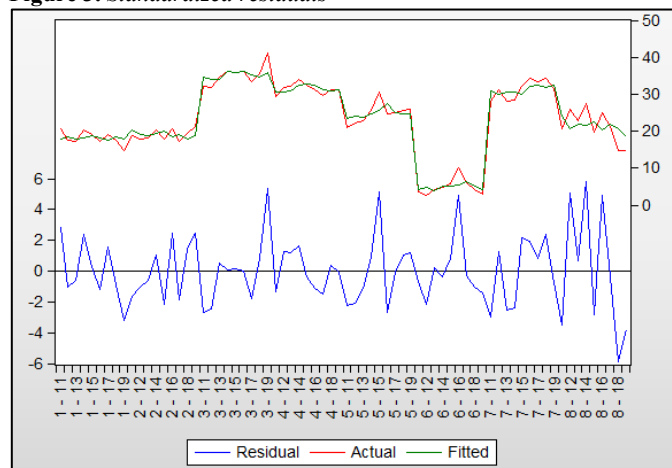
To verify the homoskedasticity of the model, I calculated the probability of the Breusch-Pagan-Godfrey test (Table 1). The value of the test confirmed that the model is homoskedastic. In addition, I used the Breusch-Pagan test to check the autocorrelation of the residuals, and the value obtained (0.230) confirmed the hypothesis of no serial correlation. The normality of the residuals has been verified using the Jarque-Bera test, which showed that the errors are normally distributed (the probability of the test was 0.278).

**Figure 2. Multicollinearity**

Variance Inflation Factors			
Date: 11/23/21 Time: 21:31			
Sample: 2010 2019			
Included observations: 72			
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
POVERTY(-1)	0.001407	267.2364	1.424457
GDP_CAPITA	0.000164	5.303481	1.973658
GVA_ITC	1.00E-05	1.980427	1.529435
UNEMPLOYMENT(-1)	0.004070	59.99942	1.078944
C	0.922295	323.8713	NA

**Source:** Own calculations in Eviews 10.0 using Eurostat data.

**Figure 3. Standardized residuals**



**Source:** Own calculations in Eviews 10.0 using Eurostat data.

As regards the cross-section dependence, I have confirmed its absence given that two of the four tests performed (Pesaran scaled LM and Bias-corrected scaled LM) supported this hypothesis. Multicollinearity has been verified using the Variance Inflation Factors test (Figure 2), which indicated that there is no multicollinearity at the level of the model. Next, according to Figure 3, it is observed that the residuals have a constant variation, their average being null, which is in line with the condition that a reliable model must meet.

## 5. Conclusions

This analysis showed that the poverty rate is influenced directly by the unemployment rate in the Romanian regions. The poverty rate is among the social indicators in which the Romanian regions are disadvantaged compared to other regions in the European Union, given the fact that in most regions about a quarter of the population falls into the category of people at risk of poverty. Unemployment rate is due to the lack of infrastructure, because the companies are not willing to open points in areas that do not have easy access to the distribution market, but in Romania, unemployment rate is, in some extent, undervalued.

On the other hand, GDP per capita and gross value added generated by the ICT sector lead to poverty reductions. However, the ICT sector is not developed at the level of all regions and there are not many people in the labour market in this sector (excepting Bucharest-Ilfov and Nord-Vest regions for which are reported a high value added by the ICT sector). In Romania there are several cities that are considered by investors as attractions in terms of labour, given the fact that many regions do not have skilled workers in this sector. In addition, the problem of attracting investors limits the regional GDP growth. In conclusion, policy makers need to make further steps forward to encourage companies to invest in disadvantaged areas, to create prosperity, and to support the efforts to reduce poverty and social inequality.

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## References

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- Adams, R.H., 2003. Economic Growth, Inequality, and Poverty: Findings from a New Data Set. Policy Research Working Paper No. 2972, World Bank, Washington, DC.
- Anser, M.K., Yousaf, Z., Nassani, A.A., Alotaibi, S.M., Kabbani, A. and Zaman, K., 2020. Dynamic linkages between poverty, inequality, crime, and social expenditures in a panel of 16 countries: two-step GMM estimates. *Journal of Economic Structures*, Vol. 9, No. 43.
- Atkinson, S., 2013. Beyond Components of Wellbeing: The Effects of Relational and Situated Assemblage. *Topoi*, Vol. 32, pp. 137-144.
- Caminada, K., Goudswaard, K. and Koster, F., 2011. Social income transfers and poverty: a cross-country analysis for OECD countries. *International Journal of Social Welfare*, Vol. 21, No. 2, pp. 1-12.
- Cerra, V., Lama, R. and Loayza, N., 2021. Links between Growth, Inequality, and Poverty: A Survey, International Monetary Fund.
- Deaton, A., 2017. *Marea evadare. Sănătate, bogăția și originile inegalității*, Litera, Bucharest.

- Dinu, M., 2021. *Facerea economiei - Îndreptar epistemic*, Editura Economică, București.
- Duiella, M. and Turrini, M., 2014. Poverty developments in the EU after the crisis: a look at main drivers. *ECFIN Economic Brief*, Issue 21, pp. 1-10.
- Jaumotte, F., Lall, S. and Papageorgiou, C., 2008. Rising income inequality: technology, or trade and financial globalization?, IMF Working Paper, WP/08/15.
- Liu, Z., Wei, Y., Li, Q. and Lan, J., 2021. The Mediating Role of Social Capital in Digital Information Technology Poverty Reduction an Empirical Study in Urban and Rural China. *Land 2021*, Vol. 10, No. 634.
- Mirza, M.U., Richter, A., Nes, E.H. and Scheffer, M., 2019. Technology driven inequality leads to poverty and resource depletion. *Ecological Economics*, Vol. 160, pp. 215-226.
- Mulok, D., Kogid, M., Asid, R. and Lily, J., 2021. Is economic growth sufficient for poverty alleviation? Empirical evidence from Malaysia. *Cuadernos de Economia*, Vol. 35, Issue 97, pp. 26-32.
- Nasar, S., 2014. *Geniul economic*. All, Bucharest.
- Šileika, A. and Bekerytė, J., 2013. The theoretical issues of unemployment, poverty and crime coherence in the terms of sustainable development. *Journal of Security and Sustainability*, Vol. 2(3), pp. 59-70.
- Smith, N., 2010. Economic inequality and poverty: where do we go from here? *International Journal of Sociology and Social Policy*, Vol. 30, pp. 127-139.
- Eurostat, <[www.ec.europa.eu/eurostat](http://www.ec.europa.eu/eurostat)>
- Institutul Național de Statistică, <[www.insse.ro](http://www.insse.ro)>
- United Nations – Global Compact, <[www.unglobalcompact.org](http://www.unglobalcompact.org)>
- World Bank, <[www.worldbank.org](http://www.worldbank.org)>



## The past, the present and the prospective future of efficient market hypothesis: a theoretical and empirical investigation of international stock markets

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**Abstract.** *This article discusses the documentary evidence on the Efficient Market Hypothesis (EMH) generated in the middle of 20th century and 21st century so far to have a crystal clear understanding of whether the destiny of EMH has met an end or it will continue to play a crucial role in the modern finance. The debate that is ongoing between the conflicting ideologies of EMH and the behavioral finance is presented here. Further, to have a comprehensive understanding of the concept, this article empirically tests the validity of the weak-form of market efficiency by implementing various tests such as unit root test (Augmented Dickey-Fuller, Phillips-Perron test), variance ratio test, runs test, serial correlation LM test, GARCH model, etc. We study the data of eleven indices pertaining to nine developed and emerging nations of the world. The study then concludes with a futuristic view that the concept of EMH will continue to be one of the most and widely accepted theories by academicians despite the availability of a pile of literature that discards or goes against the hypothesis, until and unless the behavioral theorists come up with a concrete theory guiding stock pricing and return behavior.*

**Keywords:** efficient market hypothesis, random walk, behavioral finance, market anomalies, stock market.

**JEL Classification:** G14, G15, G40.

## 1. Introduction

The capital market is one of the pillars on which the edifice of the economy stands. It provides funds for the smooth sailing of the economy. Thus, it is of utmost importance that stock markets be efficient in their operations and information processing. The capability of a capital market to absorb information has attracted the attention of academicians, scholars, traders, and regulatory bodies. However, there are two contrasting views. One view states that the market fully absorbs the information with immediate effect, whereas the other states quite the opposite suggesting only limited information efficiency. Informational efficiency of the stock market is of prime concern in this article. The notion of stock market efficiency states that the prices of the stock quickly and fully absorb any new information that comes into the market. It helps in understanding whether the stock market is capable enough to process the newly arrived information systematically as far as movements of stock prices are concerned. The Efficient Market Hypothesis (EMH) claims that the prices of the stocks absorb all the pieces of information quickly, thus, making it impossible for the investors to earn more than normal returns from the market consistently. EMH is understood in three forms: weak, semi-strong and strong forms that differ from each other based on the information they process. Each subsequent form engulfs within it the set of information of the previous form. Weak form efficiency states that historical data can't help in predicting the future course of prices as historical or past information has already been accounted for in the stock prices. Similarly, semi-strong and strong forms suggest that publicly available information and private information respectively can't be used to beat the market consistently. As a result, neither there is any undervalued security in the stock market nor is overvalued. The market, therefore, will always trade at fair prices, which behaves randomly.

Discussion on another branch of economics namely behavioral economics had taken momentum in early 1980s. Behavioral finance, a sub-branch of behavioral economics discards the rationality of the investors (one of the basic assumption of EMH) as investors do get swayed by psychological and emotional biases while taking investment decision. There are patterns in the stock returns that can be identified and be used to predict future returns. Parallel literature on market anomalies was also being produced. Market anomalies are the distortions that go against the accepted paradigm of EMH. These are the patterns that help investors earn above average returns which should not be the case as per theory of market efficiency. Faith in the theory of market efficiency has been shaken with the advent of market anomalies such as size effect, contrarian/reversal effect, day of the week effect, January effect, and momentum effect etc. While on one hand, literature on these anomalies started appearing and rigorous discussions were being made among academicians and practitioners regarding behavioral finance and on the other hand, parallelly, the theory of EMH was being subjected to several statistical tests.

EMH is indeed a widely discussed concept in the financial literature and has often been subjected to several empirical investigations by scholars and academicians worldwide. If a stock market possesses information efficiency, it implies that the return behavior of the stocks of that market manifest attributes of a random walk. Thus, one can infer that the markets where returns don't follow random walk cannot be considered weak-form

efficient. The objective of the article is to put forth the literature concerning the empirical and theoretical investigation of the weak form of EMH. The study then puts the hypothesis to the empirical analysis taking the stock market data of nine developed and emerging economies from 2005-2018. The article seeks out the answer of several questions such as:

- How the concept of EMH has evolved in the last few decades.
- What kind of supportive and challenging evidence has the literature provided to us?
- What does empirical investigation tells about the theory of market efficiency?
- Can EMH be entirely replaced by a new behavioristic finance theory, or will this new theory only be used to support EMH. What would be the future of EMH given continuously evolving literature on behavioral finance?

The organization of this article is as follows: Section 2 deals with the literature surveyed chronologically pertaining to different periods (20<sup>th</sup> and 21<sup>st</sup> century) to understand the evolvement of the concept of market efficiency. Section 3 discusses about the data taken and the methodology that has been applied in the article. Section 4 deals with the empirical investigation of the weak form efficiency of nine selected markets. Section 5 discusses how behavioral finance has challenged the existence of EMH. Section 6 finally concludes with a futuristic view of EMH.

## 2. Literature review

### 2.1. Understanding the soul of EMH through earlier studies (20<sup>th</sup> Century)

Bachelier (1900) speculated that stock prices move in “Brownian motion”, which is nothing but random erratic movements that imply that stock prices can’t be forecasted and are largely unpredictable. Kendall and Hill (1953) also specified that stock and commodity prices do follow a random walk. Fama (1965) asserted that there are mainly two approaches for studying if successive price changes are independent or not. The first approach uses essential statistical techniques such as coefficients of correlation or analysis of runs of same and opposite signs. In contrast, the second approach tests different trading rules and observes if they provide a return over and above a simple buy-hold strategy. Most of the empirical researches have heavily relied on the first approach. Fama (1965) stated that technical analysts are just like an astrologer and have no significant role in the analysis of the stock market. It also said that unless the fundamentalists have some new insights or new information, they also serve no purpose as stocks are already priced at their fair or intrinsic values. Until this time, there was no significant evidence against the three forms of market efficiency. Gradually, EMH was put to the test in stock market of several emerging, underdeveloped, and developed nations. Solnik (1973) tested the random walk model in European nations, where slight deviations from the random walk were observed. Sharma and Kennedy (1977) compared the theory of random walk in the markets USA, UK, and India, which were observed to be following the random walk. Ambrosio (1980) on the other hand, rejected the random walk hypothesis in the Singapore stock market. Lo and MacKinlay (1988) devised the new variance ratio test in order to test the weak level market efficiency. The study rejected the hypothesis as significant departures from a random walk were observed in the returns. Urrutia (1995) found the inefficiency in the four

emerging nations of Latin America, whereas on opposite Ojah and Karemera (1999) discovered the efficiency in emerging nations of Latin America. Inefficiencies were found by Poshakwale (1996), Loughani and Chappell (1997), and Mookerjee and Yu (1999) in the Indian, London, and Chinese stock markets, respectively. Chan et al. (1997) tested weak-form market efficiency in eighteen nations and found them efficient. Thus, the evidences which strongly favored EMH by the 1960s-1970s were gradually getting weaker.

Emerging of parallel literature on behavioral finance was also casting serious doubts on the future of EMH. Some evidences inconsistent with the well-established hypothesis of market efficiency started appearing in the literature, though these pieces of evidences were not being viewed together as they were vastly scattered and incoherent. These anomalous pieces of evidence in the form of momentum and contrarian effect, day of the week effect, small-firm effect, turn of the year effect, price-earnings ratio anomaly started emerging by the 1980s and 1990s. Results contrary to EMH were being discussed by various researchers, which raised a question as to how long the EMH will continue if it remained unrevised in light of new evidence being drawn. Cross (1973) analyzed the behavior of stock prices on Mondays and Fridays and observed that prices had shown rise more often on Fridays and least often on Mondays. Jensen (1978) pointed towards the inadequacies observed in asset pricing literature by several noted academicians and stated that one could not simply ignore this anomalous evidence. French (1980) examined behavior of stock returns on different week days to study weekend effect and observed that returns on Mondays were significantly negative while returns were observed to be positive on other days. Bondt and Thaler (1985) observed that the losers outperformed winners by 19.6 % after 36 months/3 years of portfolio formation, while the winners were earning 5% less than the market. Jegadeesh and Titman (1993) reported that buying winner stocks (stocks that performed well in past) and selling loser stocks (stocks that performed poor) would generate significantly positive returns in 3-12 months as markets display continuation pattern for at least 3-12 months. These anomalous evidences showed that markets provide more than normal return which goes against EMH. Several academicians put forth several other such pieces of evidence challenging the efficient market hypothesis.

## 2.2. Summary findings of literature on efficient market hypothesis in last 20 years (21<sup>st</sup> century)

In the past two decades, the hypothesis of market efficiency has been put on several tests in different stock markets to know if it is still valid in those markets or not. Cheung and Coutts (2001) confirmed the existence of weak form market efficiency hypothesis in the Hong Kong stock market as stock returns followed random walk model. Smith et al. (2002) investigated the random walk hypothesis in eight African nations, including South Africa. They found that seven markets reject random walk as these markets showed autocorrelation in stock returns, with the only exception of South Africa. Similarly, Abraham et al. (2002) and Buguk and Brorsen (2003) found mixed results for stock markets of gulf nations and Istanbul, respectively. Smith and Ryo (2003) tested weak form efficiency in five emerging countries of Europe and observed that four of the five markets rejected the random walk hypothesis. The study found liquidity to be an essential factor affecting market efficiency. Moustafa (2004) showed efficiency in the stock market of UAE, although their market was

newly developed at that time. Lima and Tabak (2004) found efficiency in the Hong Kong stock market and inefficiency in the Singapore market, while mixed evidence was reported for the market of China and asserted that market efficiency is largely affected by liquidity and market capitalization. Mollah (2007) and Balsara et al. (2007) found evidence of market inefficiency in Botswana and the Chinese stock market, respectively implying predictability of the stock prices. Awad and Daraghma (2009) reported market inefficiency in the Palestinian stock market, indicating that probability of earning excess returns exist in this market. Mishra (2009) found the Indian market to be having inefficiencies. Mehla and Goel (2012) analyzed the market efficiency of India. They found the presence of inefficiency implying predictability of returns and probability of earning more than what the market offers on average. Mobarek and Fiorante (2014) did sub-period analysis of weak-form efficiency of BRIC nations. They found inefficiencies in the earlier sub-period, while the markets were observed to approach the state of market efficiency in the later sub-period. Shiller and Radikoko (2014) found inefficiency in the Canadian stock market, and Hawaldar et al. (2017) presented mixed results relating to market efficiency in the Bahrain stock market. Lekovic (2018) reported that even after decades of continuous research, the literature is still not able to reach to a consensus about the validity of the efficient market hypothesis and the presence or absence of market anomalies. Awiagah and Choi (2018) reported inefficiency in the Ghana stock exchange, which was observed to be insensitive to return frequency. Kiran (2019) also rejected the random walk hypothesis in BRICS nations due to dependencies being found in the stock returns. Agwu et al. (2020) found inefficiency in the Nigerian stock exchange as prices were found to have a significant relationship with their lag values, which violates the basic assumption of the efficient market hypothesis.

It is clear from the above discussion that the literature has not reached a consensus as there are both supporting as well as conflicting evidence regarding the validity of the efficient market hypothesis. These contradictory observations reported in the literature, for one market or even for different markets, could probably arise due to various factors such as the techniques used, considered time window, or the data frequency. It is also argued that the inefficiencies are mostly reported in developing markets whereas developed markets display efficient behavior. To gain a clearer view of these conflicting observations, the present study analyses nine developed and developing nations for the period 2005-2018 for all the countries using unit root testing, run test, serial correlation test, variance ratio test, and GARCH model. The experiments allow us to arrive at precise results and drive us to understand the hypothesis better.

### 3. Data description and methodology

The details of the indices and methodology being used in the article for empirically investigating the weak form of market efficiency have been explained in this section.

#### 3.1. Sample data description

The article considers eleven global indices of nine countries for the empirical analysis. These indices were selected to include developing as well as developed nations. SP Global

100 has also been used in the study to capture the efficiency of the world stock market as this index is a barometer of the performance of 100 global companies selected from 29 stock markets. The selection of indices allows to investigate the efficacy and robustness of the methodology used extensively. Table 1 provides the list of the indices used for the purpose of analysis. We collected the data of daily closing prices from the Thomson Reuters EIKON data stream for the period January 2005 to November 2018 (3623 observations). The software used for the analysis includes E-Views, MS-Excel, and R.

**Table 1.** List of sample countries and their respective indices

No.	Country	Index used
1	Brazil	Bovespa
2	India	Nifty, Sensex
3	Germany	DAX 30
4	United States of America	Dow Jones
5	United Kingdom	FTSE 100
6	Greece	Athex
7	Hong Kong	Hang Seng
8	China	Shenzhen
9	Japan	Topix
10	World	SP Global 100

The article follows the convention of working with log returns in financial literature. The daily log returns have been calculated as follows:

$$R_t = \ln\left(\frac{S_t}{S_{t-1}}\right), t = 1, 2, 3, \dots, T$$

where:

$S_t$  and  $S_{t-1}$  represent the closing prices of the stock on  $t$ -th and  $(t-1)$ -th day respectively.

### 3.2. Methodology and techniques used

The tests undertaken in the study for purpose of empirical investigation are as follows-

- Unit Root Test – Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Test have been used to test the stationarity in the data as non-stationarity in the data implies random walk.
- Runs Test helps in detecting statistical dependencies in the time series data. When expected number of runs varies significantly from the observed number of runs, null hypothesis (no randomness) gets rejected.
- Lo and MacKinlay's Heteroskedasticity – robust standard error estimates have been used to calculate variance ratio. Variance ratio of  $q$ -period difference (returns) should be  $q$  times the variance of one period difference for the series to be called a random walk as according to random walk theory,  $VR(q)$  must approach unity.
- Breusch-Godfrey serial correlation LM Test has been applied in order to test the data for the presence of serial correlation. The presence of it implies violation of weak form efficiency hypothesis. Autocorrelation and Partial autocorrelation have also been calculated to see if returns have lagged relationship with itself.
- GARCH (1, 1) model has also been applied to test weak form of market efficiency. The model would capture the presence of volatility clustering in stock returns that implies market inefficiency.

## 4. Data analysis and empirical results

### 4.1. Descriptive statistics

Table 2 summarises the descriptive statistics of daily return of the indices studied.

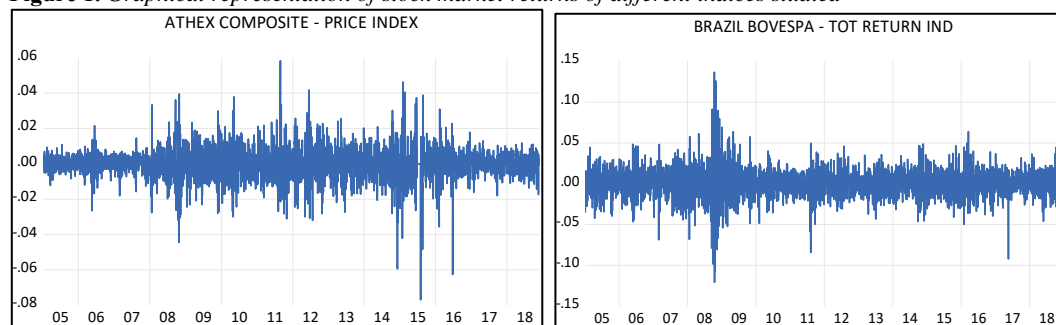
**Table 2.** Descriptive statistics

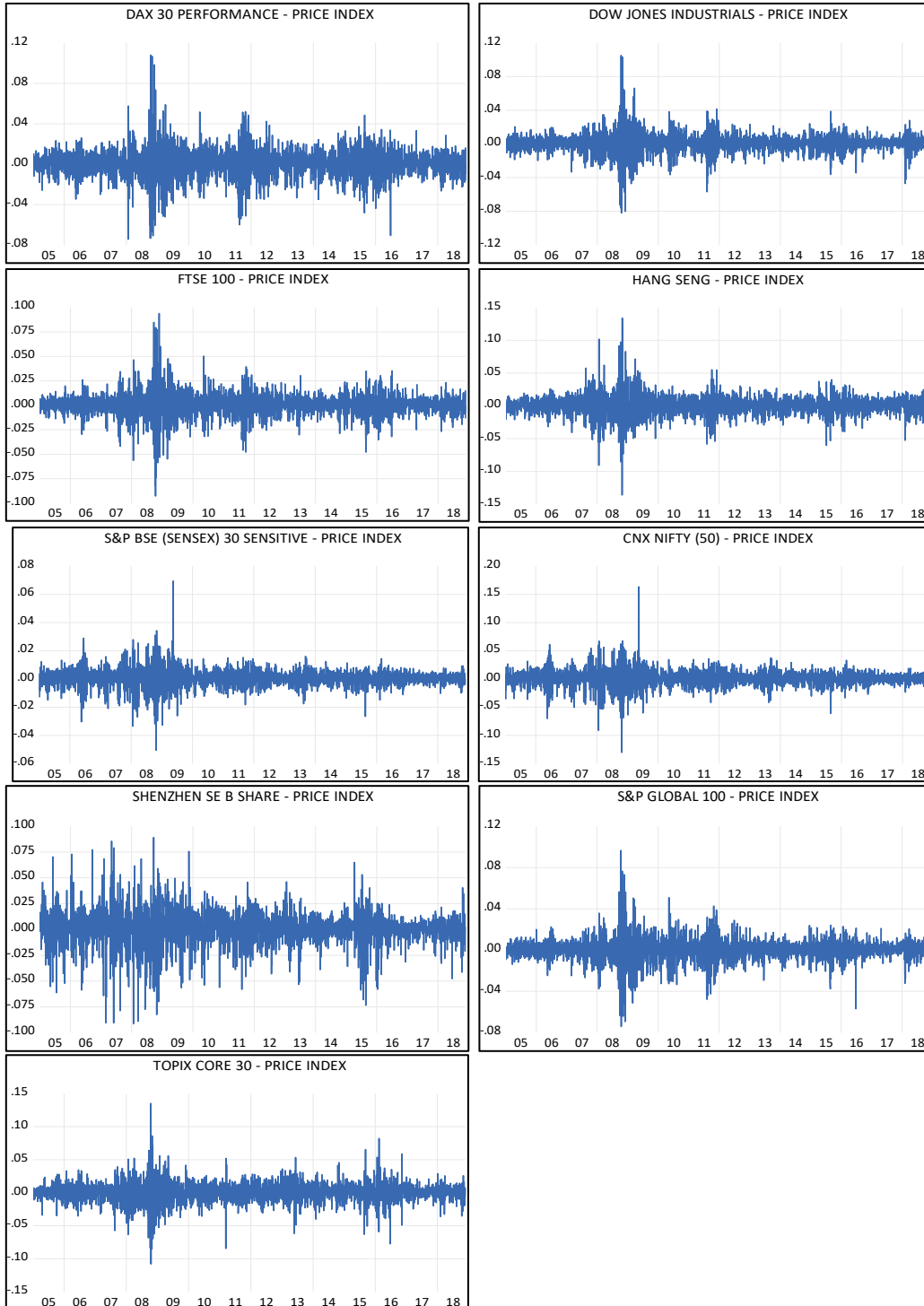
Index	Mean	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis	Jarque-Bera	JB p-value
Athex	-0.00018	0.0583	-0.0769	0.0083	-0.3764	9.8284	7124.3	0.00*
Bovespa	0.00033	0.1367	-0.1209	0.0167	-0.0490	8.9010	5258.2	0.00*
DAX 30	0.00026	0.1079	-0.0743	0.0131	-0.0364	9.7075	6792.6	0.00*
Dow Jones	0.00022	0.1050	-0.0820	0.0107	-0.1608	14.81704	21095.8	0.00*
FTSE 100	0.00010	0.0938	-0.0926	0.0111	-0.1529	11.89864	11967.87	0.00*
HangSeng	0.00016	0.1340	-0.1358	0.0144	-0.0079	13.32343	16088.14	0.00*
Nifty	0.00044	0.1633	-0.1301	0.0137	-0.0398	14.20090	18940.21	0.00*
Sensex	0.00019	0.0694	-0.0503	0.0059	0.0776	13.28948	15986.13	0.00*
Shenzhen	0.00038	0.0890	-0.0913	0.0156	-0.5036	8.218779	4264.5	0.00*
S&P Global 100	0.00010	0.0964	-0.0740	0.0103	-0.3055	12.63174	14060.8	0.00*
Topix	-0.000002	0.1352	-0.1078	0.0143	-0.2596	10.435	8388.4	0.00*

\*significant at 5% level.

As evident from Table 2, the mean return of all the indices except Athex and Topix is positive; the highest is for Nifty. Standard deviation tells about the volatility of the series. The highest volatility is present in the case of Bovespa whereas Sensex is the least volatile. Skewness and Kurtosis measure the symmetry and peakedness of the data respectively. The observed statistics of Skewness are negative for all the indices except Sensex. The observed value of kurtosis hints towards the non-normal distribution as all the values are significantly greater than zero (leptokurtic distribution), the highest being in the case of US and Indian stock market indices i.e. Dow Jones and Nifty. The results of the Jarque-Bera test for normality also confirm non-normal distribution as the p-value is less than 0.05, thereby rejecting the null hypothesis that states that distribution is normal. The highest value of Jarque-Bera statistics is again in the case of Dow Jones and Nifty.

**Figure 1.** Graphical representation of stock market returns of different indices studied





The returns of all the indices have been presented in the form of graphs.



## 4.2. Methodology and findings

### 4.2.1. Unit root test – ADF and PP test

To test whether the unit root is present in the data or not, the two most famous and widely used unit root tests, the Augmented Dickey-Fuller (ADF) test (1979) and Phillips-Perron (PP) test (1988), have been applied. The presence of unit root implies non-stationarity in the data, which further implies that the data does follow a random walk. A time series having a unit root is said to be non-stationary and thus follows a random walk (Ahmad et al., 2006, pp. 49-56). The results of the ADF test are obtained using intercept and no trend as well as using both intercept and trend, equations for which are presented below as equation 1 and 2 respectively.

$$\Delta y_t = \alpha_0 + \lambda y_{t-1} + \sum_{i=1}^p \gamma_i \Delta y_{t-i} + u_t \quad (1)$$

$$\Delta y_t = \alpha_0 + \beta_0 t + \lambda y_{t-1} + \sum_{i=1}^p \gamma_i \Delta y_{t-i} + u_t \quad (2)$$

The results of the ADF test are obtained using both intercept as well as intercept and trend equations. PP test is a non-parametric method that controls higher-order serial correlation present in series. The test is robust with respect to unspecified autocorrelation and heteroskedasticity, if present any, in error terms in the test equation. The results of the ADF test using both an intercept and a trend and with only an intercept are presented in Tables 3 and 4, respectively. Since the value of t-statistics is less than the Mackinnon critical values for all the indices at 1%, 5%, and 10% significance level, the null hypothesis (series contains unit root) gets rejected. Thus, the data of all the indices don't have a unit root, and that the data is stationary. Based on the results of the ADF test for both equations, we conclude that the selected markets are not following the random walk hypothesis and thus are weak-form inefficient.

**Table 3.** ADF results using trend and intercept

Index	T-statistics	p-value	Critical values		
			At 1% level	At 5% Level	At 10% Level
Athex	-56.11613	0.00*	-3.960573	-3.411046	-3.127341
Bovespa	-61.72224	0.00*	-3.960573	-3.411046	-3.127341
DAX 30	-60.07145	0.00*	-3.960573	-3.411046	-3.127341
Dow Jones	-47.26427	0.00*	-3.960574	-3.411047	-3.127341
FTSE 100	-28.81088	0.00*	-3.960576	-3.411048	-3.127342
Hang Seng	-61.8163	0.00*	-3.960573	-3.411046	-3.127341
NIFTY	-57.62205	0.00*	-3.960573	-3.411046	-3.127341
Sensex	-57.08752	0.00*	-3.960573	-3.411046	-3.127341
Shenzhen	-56.59314	0.00*	-3.960573	-3.411046	-3.127341
S&P Global 100	-44.35029	0.00*	-3.431974	-3.862147	-3.567141
Topix	-59.72579	0.00*	-3.960573	-3.411046	-3.127341

\*significant at 5% level.

**Table 4.** ADF results using intercept and no trend

Index	T-statistics	p-value	Critical values		
			At 1% level	At 5% Level	At 10% Level
Athex	-56.12267	0.00*	-3.431969	-2.862141	-2.567133
Bovespa	-61.72719	0.00*	-3.431969	-2.862141	-2.567133
DAX 30	-60.07668	0.00*	-3.431969	-2.862141	-2.567133
Dow Jones	-47.25676	0.00*	-3.431969	-2.862141	-2.567133
FTSE 100	-28.81384	0.00*	-3.431971	-2.862141	-2.567134

Index	T-statistics	p-value	Critical values		
			At 1% level	At 5% Level	At 10% Level
Hang Seng	-61.82185	0.00*	-3.431969	-2.862141	-2.567133
NIFTY	-57.62308	0.00*	-3.431969	-2.862141	-2.567133
Sensex	-57.08489	0.00*	-3.431969	-2.862141	-2.567133
Shenzhen	-56.57106	0.00*	-3.431969	-2.862141	-2.567133
S&P Global 100	-44.35373	0.00*	-3.431969	-2.862141	-2.567133
Topix	-59.73094	0.00*	-3.431969	-2.862141	-2.567133

\*significant at 5% level.

**Table 5.** PP test results using both trend and intercept

Index	T-statistics	p-value	Critical values		
			At 1% level	At 5% Level	At 10% Level
Athex	-55.99747	0.00*	-3.960573	-3.411046	-3.127341
Bovespa	-62.03045	0.00*	-3.960573	-3.411046	-3.127341
DAX 30	-60.19023	0.00*	-3.960573	-3.411046	-3.127341
Dow Jones	-66.66126	0.00*	-3.960573	-3.411046	-3.127341
FTSE 100	-62.65178	0.00*	-3.960573	-3.411046	-3.127341
Hang Seng	-61.81111	0.00*	-3.960573	-3.411046	-3.127341
NIFTY	-57.57739	0.00*	-3.960573	-3.411046	-3.127341
Sensex	-57.02539	0.00*	-3.960573	-3.411046	-3.127341
Shenzhen	-56.86381	0.00*	-3.960573	-3.411046	-3.127341
S&P Global 100	-56.10661	0.00*	-3.960573	-3.411046	-3.127341
Topix	-59.83460	0.00*	-3.960573	-3.411046	-3.127341

\*significant at 5% level.

**Table 6.** PP test results using intercept and no trend

Index	T-statistics	p-value	Critical values		
			At 1% level	At 5% Level	At 10% Level
Athex	-56.00441	0.00*	-3.960573	-3.411046	-3.127341
Bovespa	-62.03116	0.00*	-3.960573	-3.411046	-3.127341
DAX 30	-60.19461	0.00*	-3.960573	-3.411046	-3.127341
Dow Jones	-66.64450	0.00*	-3.960573	-3.411046	-3.127341
FTSE 100	-62.66005	0.00*	-3.960573	-3.411046	-3.127341
Hang Seng	-61.81659	0.00*	-3.960573	-3.411046	-3.127341
NIFTY	-57.57917	0.00*	-3.960573	-3.411046	-3.127341
Sensex	-57.02447	0.00*	-3.960573	-3.411046	-3.127341
Shenzhen	-56.86159	0.00*	-3.960573	-3.411046	-3.127341
S&P Global 100	-56.11209	0.00*	-3.960573	-3.411046	-3.127341
Topix	-59.83830	0.00*	-3.960573	-3.411046	-3.127341

\*significant at 5% level.

Next, we present the results of the Phillips-Perron test in Tables 5 and 6, respectively, with two different specifications, one with both trend and intercept and the other one with an intercept only. Results similar to that of ADF are observed for the Phillips-Perron test, which serves as confirmatory analysis. The test statistics computed are less than Mackinnon's critical values, thereby rejecting the null hypothesis (the data contains unit root) at all the three levels of significance, i.e., 1%, 5%, and 10%. Thus, all the indices undertaken in the study do not follow a random walk, and hence these stock markets are inefficient. In case of both the ADF and PP test, null hypothesis has been rejected for the SP Global 100, thus signifying the inefficiency in behavior of world market index.

#### 4.2.2. Runs Test

Runs test detects the statistical dependencies or randomness. The number of runs is calculated as a sequence of changes in prices with the same sign, and it rejects the null



Index		1	2	3	4	5	6	7	8	9	10
Bovespa	AC	-0.025	-0.012	-0.049	-0.017	0.005	-0.013	-0.033	0.008	-0.001	0.016
	PAC	-0.025	-0.013	-0.050	-0.020	0.002	-0.016	-0.036	0.006	-0.003	0.012
	Q-Stat	2.2670	2.7988	11.488	12.592	12.673	13.299	17.288	17.511	17.515	18.412
	Prob.	0.132	0.247	0.009*	0.013*	0.027*	0.039*	0.016*	0.025*	0.041*	0.048*
DAX30	AC	0.001	-0.032	-0.021	0.013	-0.047	0.022	-0.003	-0.012	-0.012	0.010
	PAC	0.001	-0.032	-0.021	0.012	-0.09	0.022	-0.005	-0.013	-0.010	0.006
	Q-Stat	0.0073	3.7995	5.3713	6.0154	14.112	15.806	15.830	16.345	16.835	17.219
	Prob.	0.932	0.150	0.147	0.198	0.015*	0.015*	0.027*	0.038*	0.051	0.070
DowJones	AC	-0.093	-0.051	0.038	-0.007	-0.039	-0.005	-0.030	0.041	-0.030	0.017
	PAC	-0.093	-0.060	0.028	-0.004	-0.037	-0.015	-0.036	0.037	-0.026	0.017
	Q-Stat	31.663	41.158	46.517	46.708	52.319	52.428	55.597	61.717	64.966	66.068
	Prob.	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*
FTSE100	AC	-0.034	-0.051	-0.047	0.053	-0.050	-0.021	0.020	0.008	-0.012	0.004
	PAC	-0.034	-0.052	-0.051	0.047	-0.052	-0.022	0.018	0.000	-0.007	0.005
	Q-Stat	4.1867	13.524	21.458	31.736	40.780	42.390	43.812	44.069	44.625	44.680
	Prob.	0.041*	0.001*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*
HangSeng	AC	-0.027	0.012	-0.025	-0.022	-0.013	-0.022	0.025	0.025	-0.006	-0.033
	PAC	-0.027	0.011	-0.025	-0.023	-0.014	-0.023	0.023	0.025	-0.007	-0.034
	Q-Stat	2.6458	3.1464	5.4852	7.2355	7.8549	9.6083	11.849	14.070	14.200	18.257
	Prob.	0.104	0.207	0.140	0.124	0.164	0.142	0.106	0.080	0.115	0.051
Nifty	AC	0.043	-0.006	-0.025	0.013	-0.008	-0.046	-0.019	0.031	0.061	0.042
	PAC	0.043	-0.008	-0.025	0.015	-0.009	-0.046	-0.014	0.031	0.056	0.038
	Q-Stat	6.7500	6.8667	9.1645	9.8058	10.017	17.691	18.987	22.426	35.768	42.263
	Prob.	0.009*	0.032*	0.027	0.044*	0.075	0.007*	0.008*	0.004*	0.00*	0.00*
Sensex	AC	0.053	-0.014	-0.023	0.004	-0.012	-0.043	-0.028	0.030	0.070	0.051
	PAC	0.053	-0.017	-0.022	0.006	-0.014	-0.042	-0.023	0.031	0.064	0.044
	Q-Stat	10.255	11.005	12.946	13.008	13.572	20.248	23.019	26.253	43.955	53.357
	Prob.	0.001*	0.004*	0.005*	0.011*	0.019*	0.003*	0.002*	0.001*	0.00*	0.00*
Shenzhen	AC	0.062	-0.014	0.024	0.022	0.008	0.002	0.031	0.023	-0.010	0.014
	PAC	0.062	-0.018	0.026	0.018	0.007	0.001	0.031	0.019	-0.012	0.015
	Q-Stat	13.767	14.512	16.601	18.320	18.566	18.578	22.130	24.078	24.433	25.168
	Prob.	0.00*	0.001*	0.001*	0.001*	0.002*	0.005*	0.002*	0.002*	0.004*	0.005*
SP Global 100	AC	0.068	-0.072	-0.008	0.019	-0.045	-0.018	0.002	0.007	-0.034	0.003
	PAC	0.068	-0.077	0.002	0.015	-0.048	-0.009	0.003	0.004	-0.034	0.007
	Q-Stat	16.729	35.424	35.677	37.055	44.381	45.573	45.595	45.773	49.943	49.981
	Prob.	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*	0.00*
Topix	AC	0.007	-0.014	-0.035	0.002	-0.002	-0.037	-0.009	-0.008	-0.017	0.009
	PAC	0.007	-0.014	-0.035	0.002	-0.003	-0.038	-0.008	-0.009	-0.019	0.008
	Q-Stat	0.1900	0.9035	5.4429	5.4523	5.4704	10.344	10.618	10.838	11.833	12.109
	Prob.	0.663	0.637	0.142	0.244	0.361	0.111	0.156	0.211	0.223	0.278

\*significant at 5% level.

The null hypothesis states that there is no autocorrelation. We reject the null hypothesis for Greece, USA, UK, India, China, and the global index (SP Global 100), which means that returns in these markets are autocorrelated with their previous returns, which further implies that information doesn't get reflected in the stock prices immediately. More specifically, there is a lag in the absorption of information. Thus, these markets are not weak-form efficient. The null hypothesis is accepted for the stock market of Brazil, Germany, Hong Kong, and Japan as the p-value is more than 0.05. Thus, these markets are weak-form efficient as far as autocorrelation and partial autocorrelation suggests.

The last two rows of the table report the Ljung-Box Q-statistics (null hypothesis of the test suggests no autocorrelation up to specified lags) and their p-values. From the Q-statistics values, results similar to that of auto-correlation can be observed. The null hypothesis is

rejected in the case of Greece, the USA, the UK, India, China, and the global index (SP Global 100), thereby suggesting that these markets display autocorrelation and are inefficient. On the other hand, Brazil, Germany, Hong Kong, and Japan have no autocorrelation and thus are weak-form efficient.

#### 4.2.4. Variance Ratio Test

This test helps in testing for random walk that assumes homoscedastic increments as well as the random walk where increments are assumed to be heteroskedastic (Campbell et al., 1998, pp. 559-562). If we assume that a series follows random walk, then it simply implies that the variance of q-period difference (returns) should be q times the variance of one period difference.

Suppose  $y_t$  is the return at any time t where t is equal to 1, ..., T. According to variance ratio test, VR (q) is the ratio of variance of q<sup>th</sup> difference to variance of first difference.

$$VR(q) = \frac{\sigma^2(q)}{\sigma^2(1)}$$

where:

$\sigma^2(q)$  denotes 1/q the variance of the q-differences and  $\sigma^2(1)$  is variance of the first differences.

According to random walk theory, VR (q) must approach unity. If it is less than 1 or more than 1, it indicates towards presence of negative serial correlation and positive serial correlation respectively (Borges, 2010, pp. 711-726). Since the data series of the selected indices are volatile as seen in the graphs (also confirmed by results of GARCH model), Lo and MacKinlay's heteroskedasticity-robust standard error estimates have been calculated in this study. Variance ratio test for the selected indices for sampling intervals of 2, 4, 8 and 16 days has been performed.

**Table 9.** Variance Ratio test: Heteroskedasticity robust standard error estimates

Index		q=2	q=4	q=8	q=16
Athex	VR (q)	0.5441	0.2808	0.1293	0.0674
	Z (q)	-13.91	-12.94	-11.06	-8.60
	p-value	0.00*	0.00*	0.00*	0.00*
Bovespa	VR (q)	0.4939	0.2484	0.1213	0.0601
	Z (q)	-15.42	-12.93	-10.25	-7.61
	p-value	0.00*	0.00*	0.00*	0.00*
DAX 30	VR (q)	0.5170	0.2472	0.1270	0.0603
	Z (q)	-14.54	-12.83	-9.97	-7.52
	p-value	0.00*	0.00*	0.00*	0.00*
DowJones	VR (q)	0.4809	0.2304	0.1098	0.0563
	Z (q)	-11.29	-9.436	-7.34	-5.39
	p-value	0.00*	0.00*	0.00*	0.00*
FTSE100	VR (q)	0.5082	0.2291	0.1202	0.0588
	Z (q)	-13.09	-11.27	-8.29	-6.19
	p-value	0.00*	0.00*	0.00*	0.00*
HangSeng	VR (q)	0.4812	0.2490	0.1190	0.0606
	Z (q)	-11.55	-9.258	-7.37	-5.70
	p-value	0.00*	0.00*	0.00*	0.00*
Nifty	VR (q)	0.5253	0.2578	0.1267	0.0657
	Z (q)	-28.58	-23.886	-17.77	-12.78
	p-value	0.00*	0.00*	0.00*	0.00*

Index		q=2	q=4	q=8	q=16
Sensex	VR (q)	0.5358	0.2632	0.1283	0.0667
	Z (q)	-12.71	-11.71	-9.42	-7.14
	p-value	0.00*	0.00*	0.00*	0.00*
Shenzhen	VR (q)	0.5406	0.2609	0.1305	0.0647
	Z (q)	-15.14	-14.10	-11.28	-8.72
	p-value	0.00*	0.00*	0.00*	0.00*
SP Global 100	VR (q)	0.5752	0.2632	0.1335	0.0537
	Z (q)	-10.90	-10.46	-8.19	-6.05
	p-value	0.00*	0.00*	0.00*	0.00*
Topix	VR (q)	0.5109	0.2517	0.1273	0.0608
	Z (q)	-13.90	-11.77	-8.99	-6.86
	p-value	0.00*	0.00*	0.00*	0.00*

\*significant at 5% level.

Variance ratio i.e. VR (q) and test statistic of heteroskedastic standard error estimates have been reported in the Table 9 along with their associated p-values. For all the indices, similar results were found. The null hypothesis that the data series follow random walk is rejected. Since it is suggested that variance ratio should be close to 1 in order to call a data series random walk, all the variance ratios in the table are significantly less than 1. This implies that the returns of all these markets are autocorrelated and there is reversion to the mean. The data series of all the selected indices are found to be having negative serial correlation as the observed values of variance ratio are less than 1 for all the values of q (Borges, 2010, pp. 711-726). It signifies that the investors have the tendency to overreact to the information (whether positive or negative) which eventually gets corrected in the days to come.

#### 4.2.5. Breusch-Godfrey Serial Correlation LM Test

This test tests for the presence of serial correlation in the residual series of the data by finding regression of the series with its lagged values. The null hypothesis states that there is no serial correlation up to specific lags taken while the alternate suggests the presence of serial correlation. The results presented in Table 10 show that with the exception of Bovespa, DAX, Hang Seng and Topix, null hypothesis is rejected in all other markets taken for the study as p-value is less than 5% significance level. Thus as per the results of this test, only markets of Brazil, Germany, Hong Kong and Japan are weak form efficient as their indices are not serially correlated. Rest of the markets possess significant serial correlation in their stock market data thus signifying inefficiency.

**Table 10.** Breusch-Godfrey Serial Correlation LM test results

Index	Athex	Bovespa	DAX 30	Dow Jones	FTSE 100	Hang Seng	Nifty	Sensex	Shenzhen	SP Global 100	Topix
LM test statistic	18.529	2.8529	3.7979	44.750	13.954	3.0837	6.9508	11.322	14.950	37.966	0.9080
p-value	0.000*	0.240	0.149	0.000*	0.000*	0.214	0.031*	0.003*	0.000*	0.000*	0.635

Null Hypothesis – No serial correlation up to 2 lags.

#### 4.2.6. Garch (1, 1) Model

The sum of ARCH and GARCH coefficient measures the persistence of volatility clustering. The persistence of volatility clustering means the inefficiency of the capital market (Mishra, 2011, pp. 26-34; Seth and Sharma, 2015, pp. 88-106). GARCH (1, 1) model has been used in the study to capture the existence of volatility clustering in the data

series. According to model, if sum of ARCH (1) and GARCH (1) coefficients is close to unity, it indicates the persistence of volatility clustering and thus signifies the inefficiency of the stock market. The results of GARCH (1, 1) model indicate that sum of ARCH (1) i.e.  $\alpha$  and GARCH (1) i.e.  $\beta$  is close to unity in case of all the selected indices and all the values are significant. It signifies the persistence of volatility indicating the inefficiency of the stock markets selected.

**Table 11.** GARCH (1, 1) model results

Index	$\alpha$			$\beta$			$\alpha+\beta$
	Coefficient	Z-statistics	p-value	Coefficient	Z-statistics	p-value	
Athex	0.0588	24.598	0.00*	0.9430	759.43	0.00*	1.0018
Bovespa	0.0665	11.181	0.00*	0.9086	117.34	0.00*	0.9752
DAX 30	0.0864	13.355	0.00*	0.8987	116.24	0.00*	0.9851
DowJones	0.1163	14.806	0.00*	0.8630	98.227	0.00*	0.9793
FTSE100	0.1077	13.335	0.00*	0.8773	100.17	0.00*	0.9851
HangSeng	0.0608	12.827	0.00*	0.9304	164.80	0.00*	0.9912
Nifty	0.0849	14.992	0.00*	0.9086	154.11	0.00*	0.9936
Sensex	0.0783	14.588	0.00*	0.9154	164.37	0.00*	0.9937
Shenzhen	0.0351	19.548	0.00*	0.9633	633.91	0.00*	0.9985
SP Global 100	0.0992	14.927	0.00*	0.8916	122.29	0.00*	0.9909
Topix	0.0975	15.964	0.00*	0.8893	125.57	0.00*	0.9868

\*significant at 5% level.

**Table 11.** Summary results of all the tests

	ADF Test	PP Test	Runs Test	AC, PAC and Q-statistics	Variance Ratio Test	B-G LM Test	GARCH
Athex	WFMI	WFMI	WFME	WFMI	WFMI	WFMI	WFMI
Bovespa	WFMI	WFMI	WFMI	WFME	WFMI	WFME	WFMI
DAX 30	WFMI	WFMI	WFMI	WFME	WFMI	WFME	WFMI
Dow Jones	WFMI	WFMI	WFME	WFMI	WFMI	WFMI	WFMI
FTSE 100	WFMI	WFMI	WFMI	WFMI	WFMI	WFMI	WFMI
Hang Seng	WFMI	WFMI	WFMI	WFME	WFMI	WFME	WFMI
Nifty	WFMI	WFMI	WFMI	WFMI	WFMI	WFMI	WFMI
Sensex	WFMI	WFMI	WFMI	WFMI	WFMI	WFMI	WFMI
Shenzhen	WFMI	WFMI	WFME	WFMI	WFMI	WFMI	WFMI
SP Global 100	WFMI	WFMI	WFMI	WFMI	WFMI	WFMI	WFMI
Topix	WFMI	WFMI	WFMI	WFME	WFMI	WFME	WFMI

Table 11 presents the summary of results derived from applying various tests and techniques of analysis. WFMI here represents weak-form market inefficiency whereas WFME represents weak-form market efficiency. Majority of the tests in majority of the markets have provided evidence that goes against the accepted paradigm of efficient market hypothesis and random walk theory.

## 5. Behavioral finance: a challenge to existence of EMH. An opinion

The recent empirical evidences (presented in section 2.2) have shown that the dominance of the theory of market efficiency has become far less acceptable than it was before. Academic finance has evolved a long way from the accepted paradigm of EMH to the behavioral finance. Where the EMH had strong evidences and literature that favoured the hypothesis, the evidences in support of behavioral finance are not much strong. The pieces of literature on behavioral finance, behavioral biases, market anomalies etc. are widely

scattered and are not viewed in unison. EMH assumed that investors are always rational which is not possible in the real world at all the times. The behavioral finance is indeed the new future of academic finance as it is based on realities of real world as it assumes that investors get swayed by emotions and biases of their own and that of the others. However, it is also the matter of fact that behavioral finance has not yet come up with any concrete theory guiding asset pricing or return behavior as the discipline is still in its infancy stage where lot of research is being done. Though the literature has also provided evidences of stock market anomalies that go against the accepted paradigm of EMH, debates on their persistency and causes are still going on. Thus, it can be asserted that behavioral finance is indeed emerging as the basis of future academic finance. However, lot of new research based on strong evidences favouring behavioral finance is required to challenge the traditional finance and EMH that has strong and wide acceptance among academicians.

## 6. Conclusion

The present study discussed how the Efficient Market Hypothesis has evolved since its origin. The literature in the early 20th century presented substantial evidence in favor of market efficiency. However, the recent literature showed strong evidence of market inefficiency when the hypothesis was examined through several statistical tests. The results in this study have shown strong evidence of market inefficiency in the majority of the markets except for the results from one or two tests which suggest efficiency in the case of Shenzhen, Bovespa, DAX 30, Topix, and Hang Seng. Thus these markets didn't show any substantial evidence of market efficiency. However, despite the vast amount of conflicting literature, the hypothesis is still regarded as one of the most accepted paradigms in financial literature. Most probably because even though behavioral economists have given some behavioral explanation of market inefficiency, they have not come out with any concrete theory explaining behavior or movements of stock prices yet. Thus, the efficient market hypothesis will continue to be accepted as one of the finest theories in the literature of finance till behavioral economists present any such concrete theory.

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## References

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- Abraham, A., Seyyed, F.J. and Alsakran, S.A., 2002. Testing the random walk behavior and efficiency of the Gulf stock markets. *Financial Review*, 37(3), pp. 469-480.
- Agwu, E.C., Godfrey, O.U. and Chigozie, O.G. (2020). Efficient Market Hypotheses Controversy and Nigerian Stock Exchange Relations. *American International Journal of Economics and Finance Research*, 2(1), pp. 1-13.
- Ahmad, K.M., Ashraf, S. and Ahmed, S., 2006. Testing weak form efficiency for Indian stock markets. *Economic and Political Weekly*, pp. 49-56.



- Al-Loughani, N. and Chappell, D., 1997. On the validity of the weak-form efficient markets hypothesis applied to the London stock exchange. *Applied Financial Economics*, 7(2), pp. 173-176.
- D'Ambrosio, C.A., 1980. Random walk and the stock exchange of Singapore. *Financial Review*, 15(2), pp. 1-12.
- Araújo Lima, E.J. and Tabak, B.M., 2004. Tests of the random walk hypothesis for equity markets: evidence from China, Hong Kong and Singapore. *Applied Economics Letters*, 11(4), pp. 255-258.
- Awad, I. and Daraghma, Z., 2009. Testing the weak-form efficiency of the Palestinian securities market. *International Research Journal of Finance and Economics*, 32(1), pp. 7-17.
- Awiagah, R. and Choi, S.S.B., 2018. Predictable or random?-A Test of the weak-form efficient market hypothesis on the Ghana stock exchange. *Journal of Finance and Economics*, 6(6), pp. 213-222.
- Bachelier, L., 1900. Théorie de la spéculation. *Annales scientifiques de l'École normale supérieure*, 17(1), pp. 21-86.
- Balsara, N.J., Chen, G. and Zheng, L., 2007. The Chinese stock market: An examination of the random walk model and technical trading rules. *Quarterly Journal of Business and Economics*, pp. 43-63.
- De Bondt, W.F. and Thaler, R., 1985. Does the stock market overreact? *The Journal of Finance*, 40(3), pp. 793-805.
- Borges, M.R., 2010. Efficient market hypothesis in European stock markets. *The European Journal of Finance*, 16(7), pp. 711-726.
- Buguk, C. and Brorsen, B.W., 2003. Testing weak-form market efficiency: Evidence from the Istanbul Stock Exchange. *International review of Financial Analysis*, 12(5), pp. 579-590.
- Campbell, J.Y., Lo, A.W., MacKinlay, A.C. and Whitelaw, R.F., 1998. The econometrics of financial markets. *Macroeconomic Dynamics*, 2(4), pp. 559-562.
- Chan, K.C., Gup, B.E. and Pan, M.S., 1997. International stock market efficiency and integration: A study of eighteen nations. *Journal of Business Finance & Accounting*, 24(6), pp. 803-813.
- Cheung, K.C. and Andrew Coutts, J., 2001. A note on weak form market efficiency in security prices: Evidence from the Hong Kong stock exchange. *Applied Economics Letters*, 8(6), pp. 407-410.
- Cross, F., 1973. The behavior of stock prices on Fridays and Mondays. *Financial Analysts Journal*, 29(6), pp. 67-69.
- Fama, E.F., 1965. The behavior of stock-market prices. *The Journal of Business*, 38(1), pp. 34-105.
- French, K.R., 1980. Stock returns and the weekend effect. *Journal of Financial Economics*, 8(1), pp. 55-69.
- Hawaldar, I.T., Rohith, B. and Pinto, P., 2017. Testing of weak form of efficient market hypothesis: evidence from the Bahrain Bourse. *Investment Management and Financial Innovations*, 14(2), pp. 376-385.
- Jegadeesh, N. and Titman, S., 1993. Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of Finance*, 48(1), pp. 65-91.
- Jensen, M.C., 1978. Some anomalous evidence regarding market efficiency. *Journal of Financial Economics*, 6(2/3), pp. 95-101.
- Kendall, M.G. and Hill, A.B., 1953. The analysis of economic time-series – Part I: Prices. *Journal of the Royal Statistical Society. Series A (General)*, 116(1), pp. 11-34.

- Kiran, S., 2019. Analysis of Stock Market Efficiency in Emerging Markets: Evidence from BRICS. *Romanian Economic Journal*, pp. 60-77
- Leković, M., 2018. Evidence for and against the validity of efficient market hypothesis. *Economic Themes*, 56(3), pp. 369-387.
- Lo, A.W. and MacKinlay, A.C., 1988. Stock market prices do not follow random walks: Evidence from a simple specification test. *The Review of Financial Studies*, 1(1), pp. 41-66.
- Mehla, S. and Goyal, S.K., 2012. Empirical evidence on weak form of efficiency in Indian stock market. *Asia-Pacific Journal of Management Research and Innovation*, 8(1), pp. 59-68.
- Mishra, P.K., 2009. Indian capital market-Revisiting market efficiency. *Indian Journal of Capital Markets*, 2(5), pp. 30-34.
- Mishra, P.K., 2011. Weak form market efficiency: Evidence from emerging and developed world. *The Journal of Commerce*, 3(2), pp. 26-34.
- Mobarek, A. and Fiorante, A., 2014. The prospects of BRIC countries: Testing weak-form market efficiency. *Research in international Business and Finance*, 30(1), pp. 217-232.
- Mollah, A.S., 2007. Testing weak-form market efficiency in emerging market: evidence from Botswana Stock Exchange. *International Journal of Theoretical and Applied Finance*, 10(06), pp. 1077-1094.
- Mookerjee, R. and Yu, Q., 1999. An empirical analysis of the equity markets in China. *Review of Financial Economics*, 8(1), pp. 41-60.
- Moustafa, M.A., 2004. Testing the weak-form efficiency of the United Arab Emirates stock market. *International Journal of Business*, 9(3), pp. 309-325.
- Ojah, K. and Karemera, D., 1999. Random walks and market efficiency tests of Latin American emerging equity markets: a revisit. *Financial Review*, 34(2), pp. 57-72.
- Poshakwale, S., 1996. Evidence on weak form efficiency and day of the week effect in the Indian stock market. *Finance India*, 10(3), pp. 605-616.
- Seth, N. and Sharma, A.K., 2015. International stock market efficiency and integration: evidences from Asian and US markets. *Journal of Advances in Management Research*, 12(2), pp. 88-106.
- Sharma, J.L. and Kennedy, R.E., 1977. A comparative analysis of stock price behavior on the Bombay, London, and New York stock exchanges. *Journal of Financial and Quantitative Analysis*, 12(3), pp. 391-413.
- Shiller, I. and Radikoko, I., 2014. Testing weak-form market efficiency on the TSX. *Journal of Applied Business Research*, 30(3), pp. 647-658.
- Smith, G. and Ryoo, H.J., 2003. Variance ratio tests of the random walk hypothesis for European emerging stock markets. *The European Journal of Finance*, 9(3), pp. 290-300.
- Smith, G., Jefferis, K. and Ryoo, H.J., 2002. African stock markets: multiple variance ratio tests of random walks. *Applied Financial Economics*, 12(7), pp. 475-484.
- Solnik, B.H., 1973. Note on the validity of the random walk for European stock prices. *The Journal of Finance*, 28(5), pp. 1151-1159.

## Causal nexus between economic growth, FDI and employment: An inquiry into BRICS and ASEAN

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**Abstract.** *This article discusses the documentary evidence on the Efficient Market Hypothesis (EMH) This study examines the nexus between economic growth, FDI and employment. We employ panel data for BRICS and ASEAN nations for the period 1993 to 2019. We have used FGLS considering the cross-section dependence and slope heterogeneity. Moreover, we apply the Pairwise Dumitrescu-Hurlin panel non-causality tests to confirm the direction of causality. The study finds that overall impact of FDI and employment on economic growth is ambiguous. However, in HIE, FDI positively impact economic growth. We observed bidirectional causality between FDI and economic growth. Human capital and globalization have positive impact on economic growth. The relation between FDI and employment is ambiguous. However, it may increase employment in high income economies. To receive the intended benefit of FDI, authorities should focus on the local development of the region. The positive sign of openness suggests restrictive trade policies should not be encouraged. However, the sophisticated policy is required to maintain the high economic growth and low unemployment.*

**Keywords:** ASEAN, BRICS, feasible generalized least square, foreign direct investment, panel non causality.

**JEL Classification:** C40, E24, F16, F43, O47.

## 1. Introduction

Over the last few decades, countries particularly developing countries have experienced large inflow of foreign direct investment (FDI) and high economic growth, despite this labour market did not experience improvement (Das and Ray, 2020). In theory, relation between economic growth and FDI can run in either direction. On one hand FDI increases economic growth and support the FDI 'growth led hypotheses. The 'market led hypothesis' which presuppose that economic growth attract more FDI (Rodrik, 1999; Mah and Yoon, 2010) FDI with capital brings technology to target firms, countries. So, it affects labour force composition, productivity and wages (Hale and Xu, 2016). FDI like private and public investment generate employment and sound employment in turn brings more FDI as high employment bring social and political tranquillity and thus smooth governance (Das and Ray, 2020). It increases per capita income, generate employment maintain healthy BOP (Kumari and Sharma, 2017). FDI have multi-impact on economic growth in terms of introducing technology, managerial capabilities, and making the economy more globalized (Rizvi and Nishat, 2009). It creates job for the host country by establishing local manufacturing plant or by acquisition of local plant. However, the picture is not clear whether FDI increase growth and help in employment creation.

FDI as an important determinant of growth intend to stabilize the labour market. The results are equally ambiguous whether FDI increases employment/unemployment. FDI seeks stability and cheap labour. This implies that surplus labour is the possible determinant of FDI. The impact of FDI on employment depends upon several factors such as, type of investment (brownfield or greenfield), type of sector or industry (FDI in labour intensive industry or capital), and whether it substitute domestic production by crowding out domestic investment. For instance, (Mucuk and Demirsel, 2013) point out that FDI and unemployment are cointegrated while in Tunisia and Turkey FDI positively impact unemployment. Jenkins (2006) for Vietnam shows that by the introduction of labour-saving technique the employment creation potential of FDI has reduced. Nevertheless, it depends upon the level of development of an economy. FDI is a source of rapid development only for certain developed countries (Blomstrom et al., 1992) (Kumar et al., 2010; Pheang et al., 2017) found positive impact on economic growth and employment or negative impact on unemployment. However, some studies find positive impact on employment but no impact on economic growth. Albassam (2015) indicate that FDI do not impact economic growth while it positively impacts employment. The ambiguity varies from region and development of the economy. As (Blomstrom et al., 1992) noted that development of the economy affects the intended benefit of foreign capital. So, this necessitates to analyse the nexus among the FDI, employment and economic growth. To the best of our knowledge, this study is the first of its kind to analyse this relationship simultaneously.

The contributions of the study to the debate is manifold. Firstly, we outline the lack of empirical work on the linkages between economic growth, employment and FDI, even the fact of high economic growth, rise in flow of FDI and stagnant employment. To the best of our knowledge no study has examined simultaneously the nexus between economic

growth, FDI and employment in case of BRICS and ASEAN. However extensive literature is available on the impact of FDI on unemployment and economic growth, casual relation between FDI and economic growth, FDI and unemployment (Hussain et al., 2021).

Second, we employ the so-called second-generation econometric model. For instance, FGLS (feasible generalized least square) which is applicable in presence of cross section dependence and slope heterogeneity, and it has been ignored by previous studies. Third we make use of other indicators like KOFGI (to measure openness), HC to measure human capital based on Penn world Table 10.0.

So, in this backdrop we estimate the nexus among the economic growth, FDI and employment by employing second generation econometric technique namely FGLS. Section two present the overview of literature which is divided into two strands. The data collection and model specification are in section three whereas section four is about econometrics techniques. Sections five and six deals with the empirical results and discussion respectively, whereas section seven devoted for conclusion and policy implications.

## 2. Review of literature

As we examine the relationship between economic growth, employment and FDI. The existing literature present the ambiguous picture whether FDI negatively or positively impact the economic growth and employment/unemployment. Theoretically the direction of causality between FDI and economic growth can be in either direction. And there is no consensus among the researcher whether FDI causes employment/unemployment and whether FDI increases employment in host nation or not. Thus, in order to elaborate further we divide the literature review into two, namely FDI-economic growth nexus and FDI-employment nexus.

### 2.1. FDI-economic growth nexus

Theoretically, FDI like other investment increases economic growth of the host nation. FDI is considered as best alternative to fuel the economic growth in developing countries, source of management skill, improved product and quality services and increases export potential of the host nation (Strat et al., 2015). Certain threshold level of development is required to effectively absorb technology from foreign investor (Blomstrom et al., 1992) (Borensztein et al., 1995) analyse the impact of FDI on growth for 69 developing countries for the period 1970-1989. The result indicates that FDI positively impact economic growth through technology and knowledge spill over. Similar study by (de Mello, 1999) analyse the impact of FDI on economic growth for the period 1970-1990 for OECD and non-OECD countries. The study finds the long run positive impact of FDI on growth in OECD economies. They find that the positive growth effect is on account of technology and knowledge spill overs. Moreover study find no causality in the short run in OECD economies and negative short run impact of FDI on GDP in non-OECD economies. This indicates that growth effect of FDI is limited to OECD. Narayanamoorthy et al. (2009) for BRICS during the period 1992-2007 analyse the casual link between FDI and economic

growth. The study reports bidirectional causality for Brazil, Russia and South Africa and unidirectional causality for India and China running from FDI to economic growth (Zhang, 2001) based on cointegration technique and error correction model for 11 East Asian and Latin American countries concludes positive impact of FDI on economic growth. However, the extent of positive impact on growth depends on the individual characteristic of economies such as level of education and human capital, macro-economic condition, economic freedom. Mehrara et al. (2012) for 57 developing countries during 1980-2007 find bidirectional causality between FDI and economic growth. Pegkas (2015) for Eurozone counties based on FMOLS and DOLS for the period 2002-12 find positive long run relationship between FDI stock and economic growth. (Hansen and Rand, 2006) also find a positive long run relation for 31 developing economies. Similarly, (Samad, 2009) examine the link between FDI and economic growth for 19 developing countries and found a positive significant long run relation.

On the other hand, some studies find negative effect of FDI on economic growth, and some found no significant relationship. Saltz (1992) for developing economies for the period 1970-80 find inverse relationship between FDI and economic growth. Mencinger (2003) for eight European Union countries finds negative effect of FDI on economic growth. Anyanwu and Yameogo (2015) employ GMM and OLS technique for West African countries between the period 1970-2010 and the study finds the negative relation between FDI and economic growth. Alfaro et al. (2004) for a panel of 71 developing countries found negative relation between FDI and economic growth. However authors argued that it is due to the less developed financial market.

Likewise, Levine and Carkovic (2002) for 72 countries for the period 1960-1995 find a weak link between FDI and economic growth. Sarkar (2007) for a panel of 51 less developed countries based on ARDL report no significant effect of FDI. Herzer et al. (2008) for 28 developing countries during 1970-2003; (Nath, 2009) for 13 transition economies of Central and Eastern Europe, and the Baltic region during the period 1991-2005, Louzi and Abadi (2011) for Jordan for the period 1997-2006; Tekin (2012) for the case of least-developed countries during the period 1970-2009; Belloumi (2014) for the case of Tunisia during the period 1970-2008; Mahembe and Odhiambo (2016) for the case of low-income SADC countries during the period 1980-2012; and more recently, Golitsis et al. (2018) for Albania during the period 1996-2014 report a weak or no significant impact of FDI on economic growth.

## 2.2. FDI – Employment nexus

This section outlines the review of previous studies on relation between FDI and employment. There is no consensus regarding the causality between economic growth and FDI as pointed out in previous section. FDI as an important determinant of growth intend to stabilize the labour market. The studies examine the employment elasticity in the Okun law framework pointed out ambiguous result. However general conclusion is that over the period employment elasticity is declining. The impact of production on employment creation depends on several factors. According to UNCTAD 1994, employment creation through FDI depend on several factors. First, the type of investment (greenfield or brownfield investment). For instance, Mucuk and Demirsel (2013) point out that FDI and

unemployment are cointegrated while in Tunisia and Turkey FDI positively impact unemployment. Secondly the type of sector or industry, whether FDI and so the growth is taking place in labour intensive sector or not. Third whether it substitutes or replace domestic production.

The studies like (Kumar et al., 2010; Pheang et al., 2017) indicate that FDI positively impact the economic growth and help in reducing unemployment. Albassam (2015) contended that FDI do not impact economic growth while it positively impacts employment. Sharma and Cardenas (2018) conclude that FDI reduces overall unemployment in Mexico and offer more working hours and possibly increases hour wage rate. Poumie and Claude (2021) examine the impact of foreign capital on employment in 29 African countries. Based on DOLS, AMG and CCEMG study concludes that FDI positively impact employment in the region. Balcerzak and Żurek (2011) for Poland and (Chang, 2007) for Taiwan based on VAR conclude that impulse in FDI inflows have adverse impact on unemployment, thus beneficial for employment. Chaudhuri and Mukhopadhyay (2014) argue that FDI has the potential to reduce unemployment among both skilled and unskilled labour in developing countries.

Contrary to the above studies, large stream of literature concludes negative effect of FDI on employment or support the neutrality hypothesis. Zdravkovic et al. (2017) find no relation between FDI and employment creation in the 17 transition countries and hence support the general conclusion that the FDI remains neutral to employment generation. Hisarciklilar et al. (2014) opine that FDI negatively influence employment in Turkey. However the study attribute such phenomenon to Merger and acquisition. The study by (Rizvi and Nishat, 2009) support the neutral hypothesis that FDI do not influence the employment and growth to employment elasticity is very less. Mucuk and Demirsel (2013) find that FDI and unemployment are cointegrated while in Tunisia and Turkey FDI positively impact unemployment. They argue that it is due to the concentration of brownfield investment and merger and acquisition. Aktar et al. (2009) examine that FDI does not reduce unemployment in Turkey and even economic growth does not cure unemployment. Strat et al. (2015) examine the causal relation between FDI and unemployment in 13 EU states based on TY procedure. The study concluded that there is causality running from FDI to unemployment in four and for three states it run from unemployment to FDI. Onaran (2008) indicates overall impact of FDI on employment is not significant in CEEC. Additionally, contrary to traditional view, she finds that labour demand is not sensitive to wage dynamic. Jenkins (2006) for Vietnam shown that by the introduction of labour-saving technique, the employment creation potential of FDI has reduced.

**Table 1.** Variable description and sources

Variables	Variable definition	Sources
GDP	GDP per capita (\$) at 2010 prices	World Development Indicators (WDI) 2021
FDI	FDI in stock % of GDP	United Nations Conference on Trade and Development (UNCTAD) 2021
Openness	Economic, social and political globalization with a weightage of 33.3 each	(KOFGI) KOF Swiss Economic Institute 2020
HC	Average year of schooling and return to education	Penn World Table 10.0
Emp	Total Employment	Penn World Table 10.0
Wage	GDP per person employed (constant 2017 PPP \$)	World Development Indicators (WDI) 2021

### 3. Data collection and model specification

The study investigates the connection between economic growth, FDI, employment, human capital and openness using data from different sources for the period 1993 to 2019. We convert the sample data to form the panel for 9 ASEAN and 5 BRICS nations for the period 1993 to 2019. Myanmar is not included in the panel owing to unavailability of data for chosen variables. We take GDP per capita at constant 2010 prices in dollar as a proxy for economic growth. Employment is measured as total employment and it is retrieved from Penn World Table 10.0. It covers all the working age population. FDI stock as proxy for FDI which is taken from UNCTAD (2020), human capital is proxied by human capital index which is based on average year of schooling and return to education and is retrieved from Penn World Table 10.0. Openness is proxied by KOFGI (KOF globalization index) (Gygli et al., 2019). KOFGI considers economic, social, and political dimension of globalization. So, it overrides the other measure of globalization such as trade openness measured by percentage share of trade to GDP. By linear imputation we make balance dataset as for the year 2019 KOFGI data point is not available. We take GDP per person employed as proxy for wage. The study employs wage in employment equation to correct for omitted variable bias. It is derived by dividing GDP by total employment in the economy. It is converted to constant international 2017 dollar using PPP rate to compare across the cross sections.

#### 3.1. Empirical model

The literature review present in the above section revealed that the connection among the variables is ambiguous. Our core variables are economic growth, FDI and employment. The study estimates two models, first consider economic growth as dependent variable and in second equation employment is dependent variable. Additionally, we control for the human capital and globalization as proxy for openness in the first model as these two indicators gain importance in recent years. FDI is an aspect of globalization and consider as important determinant of economic growth and employment creation in the host nation. However, it depends on the nature of investment whether it crowds out the domestic investment or is mere merger and acquisition. In employment equation we control for human capital and wage (GDP per person employed) to avoid the model misspecification due to omitted variable bias. We posit the Cobb Douglas type of function and thus we transform the variables into their natural log form. Our baseline equation is.

$$Y_{it} = \alpha_{it} + \beta_1 FDI_{it} + \beta_2 Openness_{it} + \beta_3 HC_{it} + \beta_4 EMP_{it} + U_{it} \quad (1)$$

where:

$i = 1, \dots, N$  for each cross section,  $t = 1, \dots, N$  refers to time period of the study,  $\alpha$  = intercept,  $\beta$ s and  $U$  refer to elasticities and error term respectively.

The second equation is

$$Emp_{it} = \alpha_{it} + \beta_1 FDI_{it} + \beta_2 wage + \beta_3 HC_{it} + \beta_4 GDP_{it} + U_{it} \quad (2)$$

where:

$i = 1, \dots, N$  for each country,  $t = 1, \dots, N$  refers to time.  $\alpha$  = intercept,  $\beta$ s and  $U$  refer to elasticities and error term respectively and  $Emp$  refers to total employment.



#### 4. Econometrics techniques

The study is based on panel data covering the variety of economies of BRICS and ASEAN. As the panel data comes with its own merits, for in instance, it reduces the collinearity problems, improve the efficiency of the result and increases the degree of freedom and sample variation (Hsiao, 2007; 2012) However, there are certain caveats also while analysing panel data. As it is the combination of different cross sections, so it suffers from the problem of cross section dependence and slope heterogeneity. So, it is important to check for cross section dependence. Because conventional unit root (the so-called first-generation unit root test) are based on the assumption of cross section independence. Disregarding these steps may result wrong selection of econometric method. So we implement the (Pesaran, 2004) for cross section dependence and technique developed by (Pesaran, 2007; Pesaran and Yamagata, 2008) for slope heterogeneity so that the suitable method could be applied. So, we start with the cross-section dependence test. It is likely that the panel data like ours would exhibit cross section dependence due to existence of common shocks with heterogeneous impact as economies are integrated with each other. Disregarding the cross-section dependency may have detrimental impact on the regression output. When it exists in the data the OLS become inefficient and produce bias estimated standard error for the model (Moscone and Tosetti, 2009). We therefore test the cross-section dependency of the series (Pesaran, 2004) CD test. This test is also valid for dynamic heterogeneous panel and for small sample. Pesaran (2004) test is computed as:

$$\sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N \sqrt{\rho_{jn}} \quad (3)$$

Where T is time, N is individual observation and  $\rho_{jn}$  is the sample for which correlation coefficient was computed. Pesaran (2007) test is robust to non-stationarity and parameter heterogeneity. We then estimate the slope heterogeneity using (Pesaran and Yamagata, 2008) test. The model estimated in presence of heterogeneous slope yield inconsistent and biased result. As result indicates that there is cross sectional dependence and slope heterogeneity in the data. So, the conventional unit root test become invalid as they assume the cross-sectional independence in the model. We perform CADF (Pesaran, 2007) test (so-called second-generation unit root test) to check the level of integration of the variables. In presence of cross-sectional dependence and heterogeneous slope parameters CADF yield efficient and reliable result. CADF is based on the mean of the individual augmented Dickey Fuller t-statistics of each unit. The null hypothesis assumes the series are non-stationary.

##### 4.1. Long run estimate

In this section we proposed the model based on the cross-section dependence, slope heterogeneity parameters and unit root test. We estimate the feasible generalized least square (FGLS). One of the prerequisites for FGLS is time period should be greater than cross section (Bai et al., 2021). The time period of the study is large than number of cross sections, so we use FGLS. FGLS is best to deal with cross section dependence, serial correlation, and slope heterogeneity. However, FGLS comes with some shortcomings as it underestimates the standard error in finite sample, or it inflates confidence. Secondly it demonstrates poor analytical performance when error variance covariance matrix is unknown. So, we apply PCSE (panel corrected standard error) to cross validate the estimate. We apply standard PCSE to cross check the result. Our analysis and discussion are based on FGLS.

#### 4.2. Pairwise Dumitrescu-Hurlin panel causality tests

After succeeding FGLS estimation we estimate panel causality test. Engle and Granger (1987) and Granger (1988) contended that the two  $I(0)$  and  $I(1)$  series may have either bidirectional or unidirectional causality between at least the  $I(0)$  series. We apply (Dumitrescu and Hurlin, 2012) panel non causality test. The (Dumitrescu and Hurlin, 2012) test produce strong output in presence of cross-sectional dependence and slope heterogeneity. It considers two facets of heterogeneity in addition to considering fixed effect, one heterogeneity of regression model, second heterogeneity of casual relationship. After long run estimation, it is important to conform the direction of causality among the variables. We use (Dumitrescu and Hurlin, 2012) panel non causality test to compute the direction of causality. The bootstrap procedure is useful when data exhibit cross section dependence.

### 5. Empirical results

The first step is to test the properties of the data used in the study. Disregarding of the properties may yield misleading results and conclusion. We confirm the cross-section dependence or independence using (Pesaran, 2004). Table 2 report the cross-section dependence test result. The null hypothesis is cross section independence. We conform the cross-section dependence using before estimation command for each series. We find cross section dependence in all the series except employment, as we reject the null of cross section independence at 5 % level since p-value is less than 0.05. CD tests conform that the shock in the economies can be transferred easily to other economies. We then proceed to test slope homogeneity using (Pesaran and Yamagata, 2008) test. The null is slope coefficient are homogeneous. We report the result for homogeneity test in Table 2. We reject the null of slope coefficient are homogeneous based on delta and adjusted delta value. The result indicates the slope parameter are not homogeneous.

#### 5.1. Result for cross section dependence and homogeneity test

**Table 2.** Cross section dependency (H0: There is no cross-sectional dependency)

Variable	CD-test	P-value
GDP	35.27	0.000***
Employment	46.51	0.972
FDI	27.45	0.000***
KOFGI	46.77	0.000***
HC	47.38	0.000***
Wage	33.50	0.000***
Slope heterogeneity test for growth equation (H0: slope coefficients are homogenous)		
Economic growth Equation		
Test	Statistics	p-value
Delta	24.14	0.000***
Adjusted Delta	27.38	0.000***
Employment equation		
Test	Statistics	p-value
Delta	19.088	0.000***
Adjusted Delta	21.644	0.000***

**Note:** \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ .

**Source:** Authors' estimates.

**Table 3.** Unit root test result

		Variables					
		GDP	FDI	KOFGI	HC	Emp	Wage
I(0)	Without trend	-1.89 (0.31)	-2.370 (0.01) ***	-2.06 0.127	-1.87 0.34	-1.83 (0.40)	-1.93 (0.26)
	With trend	-2.44 (0.30)	-1.99 0.90	-2.22 0.653	2.86 (0.01)**	-2.34 (0.45)	-1.90 (0.95)
I(1)	Without trend	-2.557 (0.001) ***	-2.67 (0.00)***	-2.716 (0.00)***	-2.487 (0.00)***	-2.12 (0.08)*	2.39 (0.0)***
	With trend	-2.77 (0.035) **	-2.98 (0.00)***	-3.24 (0.00)***	-3.41 (0.0)***	-2.48 (0.25)	-2.66 (0.08)*

**Note:** \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ . We report t-statistics, p-value are in parentheses. Two lags for each variable except HC and GDP, for GDP and HC four lag length have been chosen.

**Source:** Authors' estimates.

We conduct CADF test to level of integration of the variables. Table 3 above reports the result for CADF test. FDI and HC are stationary at level as the null that the series contain unit root is rejected. GDP, Openness and Emp are integrated of order one. So, we conclude that GDP, Openness, and Emp are static after first difference.

**Table 4.** Result for FGLS and PCSE. Economic growth is dependent variable

	Model 1		Model 2		Model 3	
	Baseline Equation		Focus on FDI		Focus on Employment	
	FGLS	PCSE	FGLS	PCSE	FGLS	PCSE
Variables						
Openness	0.584*** (-0.035)	0.429*** (-0.164)	0.447*** (-0.041)	0.787*** (-0.136)	0.300*** (-0.027)	0.537*** (-0.109)
HC	3.877*** (-0.077)	4.116*** (-0.371)	2.181*** (-0.05)	1.848*** (-0.195)	1.980*** (-0.043)	1.796*** (-0.172)
Employment	-0.021*** (-0.004)	-0.049*** (-0.007)	-0.110*** (-0.003)	-0.152*** (-0.008)		
FDI	-0.054*** (-0.004)	-0.075*** (-0.012)			-0.003 (-0.003)	-0.034*** (-0.01)
FDI as interaction						
FDI_hie			0.058*** (-0.011)	0.026 (-0.02)		
FDI_lmie			-0.188*** (-0.006)	-0.126*** (-0.028)		
FDI_umie			-0.115*** (-0.004)	-0.002 (-0.017)		
Employment as interaction						
Emp_hie					0.036*** (-0.005)	0.170*** (-0.023)
Emp_lmie					-0.043*** (-0.003)	0.042*** (-0.015)
Emp_umie					-0.012*** (-0.003)	0.077*** (-0.015)
Constant	1.606*** (-0.055)	2.303*** (-0.2)	4.069*** (-0.083)	4.131*** (-0.197)	2.670*** (-0.064)	0.841** (-0.338)
R-squared		0.984		0.997		0.996

**Note:** \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ . Standard error are in parentheses. We estimate the FGLS model using panel specific AR 1 auto correlation structure. We assume heteroscedasticity across the panel and autocorrelation within the panel. For PCSE, standard PCSE is estimated. So the reported standard error is panel corrected standard error.

**Source:** Authors' estimates.

## 5.2. Long run estimate (FGLS)

Based on analysis provided above we now estimate our model using second generation estimator like FGLS. FGLS and PCSE can be validly applied in presence of cross section dependence and slope heterogeneity. The result of both the estimator shows that human capital, Openness, FDI and employment are significant. Human capital and Openness have significant positive impact on economic growth, whereas employment and FDI negatively influence economic growth in overall sample of the study. The high elasticity coefficient of human capital and significance level indicates the importance of human capital to economic growth in BRICS and ASEAN economies. Result indicates that one percent increase in globalization and human capital causes an increase of 0.34% and 3.78% in economic growth respectively. This implies BRICS and ASIAN economies need to invest more on human capital and should focus on the encouraging aspect of globalization. The negative influence of FDI could be due to the lack of infrastructure, underdeveloped financial market. The PCSE estimation also provide similar output.

**Table 5.** Result for FGLS and PCSE. Employment is dependent variable

Variable	Model 1		Model 2	
	Baseline Equation		Focus on FDI	
	FGLS	PCSE	FGLS	PCSE
HC	1.437*** (-0.13)	1.015** (-0.473)	2.013*** (-0.073)	0.33 (-0.359)
GDP	0.651*** (-0.027)	0.603*** (-0.119)	0.547*** (-0.026)	0.643*** (-0.12)
Wage	-0.975*** (-0.027)	-1.125*** (-0.097)	0.150*** (-0.026)	-1.23*** (-0.157)
FDI	-0.049*** (-0.006)	0.070*** (-0.02)		
<b>FDI as interaction</b>				
FDI_hie			-0.002 (-0.012)	0.048** (-0.024)
FDI_lmie			-0.148*** (-0.01)	0.083 (-0.062)
FDI_umie			-0.123*** (-0.006)	0.123*** (-0.026)
Constant	17.626*** (-0.115)	18.827*** (-0.504)	12.522*** (-0.087)	19.491*** (-0.718)
R-squared		0.999		0.999

**Note:** \*\*\*  $p < .01$ , \*\*  $p < .05$ , \*  $p < .1$ . Standard error are in parentheses. FGLS model is estimated using panel specific AR 1 auto correlation structure. We assume heteroscedasticity across the panel and autocorrelation within the panel. For PCSE, standard PCSE is estimated. So, the reported standard error is panel corrected standard error.

**Source:** Authors' estimates.

Additionally, we take dummy for two reasons, first our sample constitute varieties of economies, so we take the three dummies on the basis of income classification made by World Bank secondly, the negatively impact of FDI on economic growth that whether the impact of FDI depend upon the development of economy or not. These dummies are high income economies (HIE), upper middle-income economies (UMIE) and low middle-income economies (LMIE). We estimate two separate model one with interaction of FDI with dummy and second the interaction of employment with dummy. The study finds the positive significant impact of FDI and employment on economic growth in high income

economies. Whereas it is negative and significant for upper middle income and low middle-income economies. In the baseline model FDI is negatively impacting economic growth. This is probably due to a smaller number of high-income economies in the panel. However, the coefficient of FDI is significant for HIE. This implies that certain level of development is necessary to achieve the growth objective of FDI.

Results for FGLS indicate that human capital and economic growth have positive impact on employment. Whereas FDI and wage negatively influence employment. However, result for PCSE indicates positive impact of FDI on employment in both models.

**Table 6.** Pairwise Dumitrescu-Hurlin panel non causality tests results

Null hypothesis	W statistics	Z-bar statistics	Z-bar tilde	P-Value
GDP FDI	11.19	9.52	5.85	0.03
FDI GDP	13.20	12.17	7.65	0.00
GDP EMP	7.49	4.62	2.53	0.20
EMP GDP	9.75	7.61	4.56	0.05
HC GDP	16.46	16.49	10.57	0.01
GDP HC	19.71	20.79	13.49	0.00
Openness GDP	10.04	8.00	4.82	0.03
GDP Openness	9.04	6.67	3.92	0.07
EMP FDI	6.49	3.29	1.63	0.50
FDI EMP	6.33	3.08	1.49	0.35
EMP HC	9.21	6.89	4.07	0.15
HC EMP	7.70	4.90	2.72	0.52
Wage EMP	7.50	4.63	2.54	0.22
EMP Wage	12.31	11.00	6.85	0.01
FDI HC	21.33	22.92	14.93	0.00
HC FDI	8.79	6.33	3.69	0.22

**Note:** Null hypothesis is that the dependent variable does not Granger cause independent variable and the alternate is it does Granger cause for at least one panel var. P-value is computed using bootstrap replication which is useful in presence of cross section dependence.

**Source:** Authors' estimates.

## 6. Discussions

The section is dedicated to in-depth discussion on the empirical findings. Our estimation of growth equation suggests FDI negatively impact economic growth. However in HIE, FDI positively impact economic growth. The conformation of negative effect of FDI on economic growth is in congruent with (Saltz, 1992) in context of developing economies, (de Mello, 1999) for 32 developed and developing countries, (Mencinger, 2003) for eight transition countries. Alfaro et al. (2004) for a panel of 71 developing countries find the same result. However author attributed this to the less developed financial market. Wang (2009) for the 12 Asian Economies found FDI inflows in non-manufacturing sectors do not enhance growth. Anyanwu and Yameogo (2015) for West African nations revealed negative impact of FDI on economic growth. Bagli and Adhikary (2014) concludes the similar result. However some studies revealed weak or insignificant impact of FDI on economic growth. For instance, Levine and Carkovic (2002) for 72 countries for the period 1960-1995 find a weak link between FDI and economic growth. Sarkar (2007) for a panel of 51 less developed countries based on ARDL report no significant effect of FDI. Herzer et al. (2008) for 28 developing countries during 1970-2003, (Nath, 2009) for 13 transition

economies of Central and Eastern Europe, and the Baltic region during the period 1991-2005 (Louzi and Abadi, 2011) for Jordan for the period 1997-2006; (Tekin, 2012) for the case of least- developed countries during the period 1970-2009; (Belloumi, 2014) for the case of Tunisia during the period 1970-2008; (Mahembe and Odhiambo, 2016) for the case of low-income SADC countries during the period 1980-2012; and recently, (Golitsis et al., 2018) for Albania during the period 1996-2014 report a weak or no significant impact of FDI on economic growth. Most of the studies attributed that the negative effect is owing to the transferring of benefits by the MNC to the country of origin. Secondly the developed financial market, high human capital is the determining factor. This implies that certain level of development is required to affectively absorb technology from foreign investor (Blomstrom et al., 1992) However our findings are in contradiction with (Borensztein et al., 1995; Zhang, 2001) etc. these studies suggested that FDI exhibit significant positive relationship with economic growth. We observed bidirectional causality between economic growth and FDI. Our findings are consistent with (Samad, 2009; Mehrara et al., 2012) (Hansen and Rand, 2006) for developing economies. Pegkas (2015) for Eurozone countries. This is not surprising as researcher hypothesized 'FDI led growth hypothesis' and 'market led hypotheses based on direction of causality.

The result suggest that employment negatively impact economic growth. As in the case of FDI in HIE dummy for employment indicates employment increases economic growth. However, this is not staggering. As most of the emerging economies are agrarian in nature. In these economies, agriculture is associated with low productivity. Additionally, large share of the economy is informal in nature, labour is low skilled. This implies encouraging the labour-intensive activities instead of capital intensive (growth enhancing in nature) causes decline in economic growth. Probably this may be the reason that FDI is failed to promote economic growth. As per the causality test, we observed bidirectional causality between employment and economic growth.

Human capital in each model suggests high elasticity with respect to economic growth. This shows the importance of human capital to stimulate the growth. The results are in congruent with the previous research. Further there is bidirectional causality between human capital and economic growth. This supports the feedback hypothesis.

The result suggest that globalization positively impact economic growth. So, the result is in consistent with the previous studies. This make stronger the hypothesis of export led growth, and the results suggest that openness is the best alternative to boost the growth for emerging economies.

The second equation assume employment as dependent. FDI and wage negatively impact employment. The negative coefficient with 0.049 implies weak negative compared to economic growth and human capital. However the result are consistent with (Hisarciklilar et al., 2014; Zdravkovic et al., 2017) and other. However these results are in in contrast with (Albassam, 2015; Kumar et al., 2010; Pheang et al., 2017; Sharma and Cardenas, 2018). This could be due to the inflow to FDI to capital intensive sector, lack of skilled labour, rigid labour market, raised in productivity less developed financial market. However (Nickell, 1997; Kapsos, 2006) indicate impact of labour market regulation is ambiguous. Economic growth and human capital have positive impact on employment. Our

results are consistent with theoretical expectation. HC likewise in previous model indicates high coefficient which is not surprising. Economic growth positively impacts employment with the highly significant coefficient of 0.65. This invalidates the common jargon of 'jobless growth'. However, in previous model employment negatively impact economic growth. This implies merely investing in labour intensive sectors could not be the cure. Authorities should adopt more sophisticated policy so that reasonable economic growth as well as low unemployment could be maintained. Our causality test conforms this ambiguity as there is absence of causality in either direction.

Additionally, we estimate the Pairwise Dumitrescu-Hurlin panel non causality tests for globalization and FDI, FDI and employment, HC and FDI, globalization and employment and HC and FDI to examine the direction of causality. Table 6 report the result for Dumitrescu-Hurlin panel non causality test. We observed the one-way causality between globalization and FDI running from globalization to FDI. This is in consistent with the previous studies. This suggest that globalization increases FDI inflow. KOFGI takes weightage of FDI in composite index. FDI and employment and globalization and FDI does not cause each other in any direction. This imply that globalization in broader context and FDI in particular are independent to employment generation. So, the study supports the hypothesis that globalization or openness and FDI does not increase employment in ASEAN and BRICS nations. Probably this may be one such reason that economic growth and employment generation do not move side by side. That is why the phrase Jobless growth gaining importance particularly in Indian context. We find one way causality running from FDI to HC. This indicates that FDI increases competitiveness and probably creates demand for skilled labour.

## 7. Conclusion and policy implication

This study examines the casual nexus among FDI, employment and economic growth using the panel data for BRICS and ASEAN nations. The study period spans from 1993 to 2019. The earlier studies report mixed result with regard to FDI and economic growth and FDI and employment. However, this study covers variety of economies for instance high income, upper and lower middle-income economies. The study finds that in high income economies, FDI has positive impact on economic growth. Overall impact of FDI on economic growth is not clear. We observed bidirectional causality between economic growth and FDI. This is not surprising as researcher hypothesized 'FDI led growth hypothesis' and 'market led hypotheses based on direction of causality. Human capital and globalization have positive impact on economic growth. The impact of employment on economic growth is not clear for full panel. However, it is positive in high income economies.

In second model human capital and economic growth have positive impact on employment. FDI overall negatively affect employment in the ASEAN and BRICS nations in FGLS model, whereas PCSE shows opposite sign. However, the negative sign for high income economies is not significant in FGLS and it is positive in PCSE model. In case of low middle-income economies each model shows negative sign. So we conclude that impact of

FDI on employment creation is ambivalent. However human capital and economic growth are essential to reduce unemployment. The coefficient of wage suggest that high wage may increase employment.

The study has several important implications. As Blomstrom et al. (1992), FDI is a source of rapid development only for certain developed countries. The study confirmed from the very fact that FDI has positive impact on economic growth only in high income economies (HIE). So emerging economies must focus on development in their region to reap the benefit from FDI. The negative affect of FDI does not mean to stop or discourage the FDI or globalization. Because openness has positive impact on economic growth which takes the weightage of FDI with other indicators. However, there is need of more sophisticated policy. More focus should be on human capital to boost the economic growth and employment. Moreover, employment negatively impact economic growth whereas economic growth has positive impact on employment. This implies that mere focus on employment creation by investing on labour intensive sector could not be the cure for the problem. However, two-pronged policy is required so that high economic growth as well as high employment rate could be maintained.

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## References

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- Aktar, İ., Demirci, N. and Öztürk, L., 2009. Can Unemployment be cured by Economic Growth and Foreign Direct Investment? *Sosyal Ekonomik Araştırmalar Dergisi*, 9(17), pp. 425-467.
- Albassam, B.A., 2015. Does Saudi Arabia's economy benefit from foreign investments? *Benchmarking*, 22(7), pp. 1214-1228. <<https://doi.org/10.1108/BIJ-05-2014-0039>>
- Alfaro, L., Chanda, A., Kalemli-Ozcan, S. and Sayek, S., 2004. FDI and economic growth: The role of local financial markets. *Journal of International Economics*, 64(1), pp. 89-112. <[https://doi.org/10.1016/S0022-1996\(03\)00081-3](https://doi.org/10.1016/S0022-1996(03)00081-3)>
- Anyanwu, J.C. and Yameogo, N.D., 2015. What Drives Foreign Direct Investments into West Africa? An Empirical Investigation. *African Development Review*, 27(3), pp. 199-215.
- Bagli, S. and Adhikary, M., 2014. FDI inflow and Economic Growth in India an Empirical Analysis. *Economic Affairs*, 59(1), p. 23. <<https://doi.org/10.5958/j.0976-4666.59.1.003>>
- Bai, J., Choi, S.H. and Liao, Y., 2021. Feasible generalized least squares for panel data with cross-sectional and serial correlations. *Empirical Economics*, 60(1), pp. 309-326. <<https://doi.org/10.1007/s00181-020-01977-2>>
- Balcerzak, A.P. and Żurek, M., 2011. Foreign Direct Investment and Unemployment: VAR Analysis for Poland in the Years. *European Research Studies*, XIV(1), pp. 1-12.
- Belloumi, M., 2014. The relationship between trade, FDI and economic growth in Tunisia: An application of the autoregressive distributed lag model. *Economic Systems*, 38(2), pp. 269-287. <<https://doi.org/10.1016/j.ecosys.2013.09.002>>
- Blomstrom, M., Lipsey, R.E. and Zejan, M., 1992. *What Explain Developing Country Growth*. <<https://doi.org/10.3386/w4132>>



- Borensztein, E., Gregoria, J. de and Lee, J.-W., 1995. *How Does Foreign Direct Investment Affect Economic Growth?* NBER Working Paper Series.
- Chang, S.C., 2007. The interactions among foreign direct investment, economic growth, degree of openness and unemployment in Taiwan. *Applied Economics*, 39(13), pp. 1647-1661. <<https://doi.org/10.1080/00036840600675612>>
- Chaudhuri, S. and Mukhopadhyay, U., 2014. FDI and Unemployment. In: *Foreign Direct Investment in Developing Countries: A Theoretical Evaluation*. [online] Springer, New Delhi. pp. 161-209. <[https://doi.org/10.1007/978-81-322-1898-2\\_7](https://doi.org/10.1007/978-81-322-1898-2_7)>
- Das, R.C. and Ray, K., 2020. Linkages between Employment and Net FDI Inflow: Insights from Individual as Well as Panel Data for Emerging South Asian Labour Market. *Global Business Review*, pp. 1-19. <<https://doi.org/10.1177/0972150919873501>>
- Dumitrescu, E.I. and Hurlin, C., 2012. Testing for Granger non-causality in heterogeneous panels. *Economic Modelling*, 29(4), pp. 1450-1460. <<https://doi.org/10.1016/J.ECONMOD.2012.02.014>>
- Engle, R.F. and Granger, C.W.J., 1987. Co-Integration and Error Correction: Representation, Estimation, and Testing. *Econometrica*, [online] 55(2), pp. 251-276. <<https://about.jstor.org/terms>>
- Golitsis, P., Avdiu, K. and Szamosi, L.T., 2018. Remittances and FDI Effects on Economic Growth: A VECM and GIRFs for the Case of Albania. *Journal of East-West Business*, 24(3), pp. 188-211. <<https://doi.org/10.1080/10669868.2018.1435432>>
- Granger, C.W.J., 1988. Some recent development in a concept of causality. *Journal of Econometrics*, 39(1-2), pp. 199-211. <[https://doi.org/10.1016/0304-4076\(88\)90045-0](https://doi.org/10.1016/0304-4076(88)90045-0)>
- Gygli, S., Haelg, F., Potrafke, N. and Sturm, J.E., 2019. The KOF Globalisation Index – revisited. *Review of International Organizations*, 14(3), pp. 543-574. <<https://doi.org/10.1007/s11558-019-09344-2>>
- Hale, G. and Xu, M., 2016. *FDI effects on the labor market of host countries*. [online] San Francisco. <<http://www.frbsf.org/economic-research/publications/working-papers/wp2016-25.pdf>> [Accessed 17 May 2022].
- Hansen, H. and Rand, J., 2006. On the Causal Links between FDI and Growth in Developing Countries. *World Economy*, [online] 29(1), pp. 21-41. <<https://doi.org/10.1111/J.1467-9701.2006.00756.X>>
- Herzer, D., Klasen, S. and Nowak-Lehmann D.F., 2008. In search of FDI-led growth in developing countries: The way forward. *Economic Modelling*, 25(5), pp. 793-810. <<https://doi.org/10.1016/j.econmod.2007.11.005>>
- Hisarciklilar, M., Gultekin-Karakas, D. and Ahmet Atil, A., 2014. Can FDI Be a Panacea for Unemployment?: The Turkish Case. In: T. Dereli, Y. Pinar Soykut-Sarıca and A. Sen-Taşbas, (eds.), *Labor and Employment Relations in a Globalized World New Perspectives on Work, Social Policy and Labor Market*. [online] Springer. pp. 43-70. <<http://www.springer.com/series/1262>>
- Hsiao, C., 2007. Panel data analysis – advantages and challenges. *TEST 2007 16:1*, [online] 16(1), pp. 1-22. <<https://doi.org/10.1007/S11749-007-0046-X>>
- Hsiao, C., 2012. WHY PANEL DATA? *The Singapore Economic Review*, 50(2), pp. 143-154. <<https://doi.org/10.1142/S0217590805001937>>
- Hussain, M., Bashir, M.F. and Shahzad, U., 2021. Do foreign direct investments help to bolster economic growth? New insights from Asian and Middle East economies. *World Journal of*

- Entrepreneurship, Management and Sustainable Development*, 17(1), pp. 62-84. <<https://doi.org/10.1108/WJEMSD-10-2019-0085/FULL/XML>>
- Jenkins, R., 2006. Globalization, FDI and employment in Viet Nam. *Transnational Corporation*, 15(1), pp. 115-132.
- Kapsos, S., 2006. The Employment Intensity of Growth: Trends and Macroeconomic Determinants. *Labor Markets in Asia*, [online] pp. 143-201. <[https://doi.org/10.1057/9780230627383\\_4](https://doi.org/10.1057/9780230627383_4)>
- Kumar Tiwari, A. and Mutascu, M., 2010. Economic growth and FDI in ASIA: A panel data approach. *Economic analysis and policy*, 41(2), pp. 173-187.
- Kumari, R. and Sharma, A.K., 2017. Determinants of foreign direct investment in developing countries: a panel data study. *International Journal of Emerging Markets*, 12(4), pp. 658-682. <<https://doi.org/10.1108/IJoEM-10-2014-0169>>
- Levine, R. and Carkovic, M., 2002. Does foreign direct investment accelerate economic growth? In: *Does foreign direct investment promote development?* pp. 195-220.
- Louzi, B.M. and Abadi, A., 2011. The Impact of Foreign Direct Investment on Economic Growth in Jordan. *IJRRAS*, [online] 8(2). <[www.arpapress.com/Volumes/Vol8Issue2/IJRRAS\\_8\\_2\\_16.pdf](http://www.arpapress.com/Volumes/Vol8Issue2/IJRRAS_8_2_16.pdf)> [Accessed 17 May 2022].
- Mah, J.S. and Yoon, S.-C., 2010. *Determinants of FDI Flows into Indonesia and Singapore. International Area Review*.
- Mahembe, E.E. and Odhiambo, N.M., 2016. Does foreign direct investment cause economic growth? A dynamic panel data analysis for SADC countries. *International Journal of Emerging Markets*, 11(3), pp. 316-332. <<https://doi.org/10.1108/IJOEM-06-2014-0084>>
- Mehrara, M., Haghnejad, A., Dehnavi, J. and Meybodi, F.J., 2012. Dynamic Causal Relationships among GDP, Exports, and Foreign Direct Investment (FDI) in the Developing Countries. *International Letters of Social and Humanistic Sciences*, 14, pp. 1-19. <<https://doi.org/10.18052/www.scipress.com/ilshs.14.1>>
- De Mello, L.R., 1999. *Foreign Direct Investment-Led Growth: Evidence from Time Series and Panel Data. Source: Oxford Economic Papers*.
- Mencinger, J., 2003. Does Foreign Direct Investment Always Enhance Economic Growth? *KYKLOS*, 56(4), pp. 491-508.
- Moscone, F. and Tosetti, E., 2009. A Review and Comparison of Tests of Cross-Section Independence in Panel. *Journal of Economic Surveys*, [online] 23(3), pp. 528-561. <<https://doi.org/10.1111/J.1467-6419.2008.00571.X>>
- Mucuk, M. and Demirsel, M.T., 2013. The Effect of Foreign Direct Investments on Unemployment: Evidence from Panel Data for Seven Developing Countries. *Journal of Business, Economics & Finance*, 2(3).
- Narayanamoorthy, V., Sridharan, P. and K, C.S.R., 2009. Causal Relationship between Foreign Direct Investment and Growth: Evidence from BRICS Countries. *International Business Research*, 2(4), pp. 198-203. <<https://doi.org/10.5539/ibr.v2n4p198>>
- Nath, H.K., 2009. Trade, foreign direct investment, and growth: Evidence from transition economies. *Comparative Economic Studies*, 51(1), pp. 20-50. <<https://doi.org/10.1057/ces.2008.20>>
- Nickell, S., 1997. Unemployment and Labor Market Rigidities: Europe versus North America. *Journal of Economic Perspectives*, 11(3), pp. 55-74.

- Onaran, O., 2008. Jobless growth in the central and east European countries: A country-specific panel data analysis of the manufacturing industry. *Eastern European Economics*, 46(4), pp. 90-115. <<https://doi.org/10.2753/EEE0012-8775460405>>
- Pegkas, P., 2015. The impact of FDI on economic growth in Eurozone countries. *Journal of Economic Asymmetries*, 12(2), pp.124-132. <<https://doi.org/10.1016/j.jeca.2015.05.001>>
- Pesaran, M.H., 2004. *General Diagnostic Tests for Cross Section Dependence in Panels*. Discussion Paper Series. Bonn, Germany.
- Pesaran, M.H., 2007. A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, 22(2), pp. 265-312. <<https://doi.org/10.1002/jae.951>>
- Pesaran, M.H. and Yamagata, T., 2008. Testing slope homogeneity in large panels. *Journal of Econometrics*, 142(1), pp. 50-93. <<https://doi.org/10.1016/j.jeconom.2007.05.010>>
- Pheang, P., Liu, J., Sirisrisakulchai, J., Chaiboonsri, C. and Sriboonchitta, S., 2017. Foreign Direct Investment, Exports and Economic Growth in ASEAN Region: Empirical Analysis from Panel Data. *Studies in Computational Intelligence*, [online] 692, pp. 691-705. <[https://doi.org/10.1007/978-3-319-50742-2\\_43](https://doi.org/10.1007/978-3-319-50742-2_43)>
- Rizvi, S.Z.A. and Nishat, M., 2009. The Impact of Foreign Direct Investment on Employment Opportunities: Panel Data Analysis: Empirical Evidence from Pakistan, India and China. *The Pakistan Development Review*, 48(4), pp. 841-851.
- Rodrik, D., 1999. Making Openness Work: The New Global Economy and the Developing Countries. *Washington, DC: Overseas Development Council*.
- Saltz, I.S., 1992. The negative correlation between foreign direct investment and economic growth in the Third World: theory and evidence. *Rivista internazionale di scienze economiche e commerciali : RiSEC ; pubblicazione trimestrale*, 39(7).
- Samad, A., 2009. *Does FDI Cause Economic Growth? Evidence from South-East Asia and Latin America*. [online] 8000 W. University PKY Orem USA. <<http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.521.6145>> [Accessed 17 May 2022].
- Sarkar, P., 2007. *Does Foreign Direct Investment Promote Growth? Panel Data and Time Series Evidence from Less Developed Countries, 1970-2002*. Munich.
- Sharma, A. and Cardenas, O., 2018. The Labor Market Effects of FDI: A Panel Data Evidence from Mexico. *International Economic Journal*, 32(4), pp. 572-588. <<https://doi.org/10.1080/10168737.2018.1547322>>
- Strat, V.A., Davidescu (Alexandru), A. and Paul (Vass), A.M., 2015. FDI and the Unemployment - A Causality Analysis for the Latest EU Members. *Procedia Economics and Finance*, 23, pp.635-643. <[https://doi.org/10.1016/s2212-5671\(15\)00448-7](https://doi.org/10.1016/s2212-5671(15)00448-7)>
- Tekin, R.B., 2012. Economic growth, exports and foreign direct investment in Least Developed Countries: A panel Granger causality analysis. *Economic Modelling*, 29(3), pp. 868-878. <<https://doi.org/10.1016/j.econmod.2011.10.013>>
- Wang, M., 2009. Manufacturing FDI and economic growth: Evidence from Asian economies. *Applied Economics*, 41(8), pp. 991-1002. <<https://doi.org/10.1080/00036840601019059>>
- Zdravkovic, A., Djukic, M. and Bradic-Martinovic, A., 2017. Impact of FDI on unemployment in transition countries: Panel cointegration approach. *Industrija*, 45(1), pp. 161-174. <<https://doi.org/10.5937/industrija45-13548>>
- Zhang, K.H., 2001. Does Foreign Direct Investment Promote Economic Growth? Evidence from East Asia and Latin America. *Contemporary Economic Policy*.

## Appendices

### Appendix A.1

#### List of countries selected for the study

ASEAN	BRICS
Brunei	Brazil
Cambodia	Russia
Indonesia	India
Lao PDR	China
Malaysia	South Africa
Philippines	
Singapore	
Thailand	
Vietnam	

### Appendix A.2

#### Correlation matrix

	GDP	Openness	HC	FDI	Employment	wage
GDP	1.0					
Openness	0.67* (0.00)	1.0				
HC	0.76* (0.0)	0.81* (0.00)	1.0			
FDI	0.04 (0.38)	0.28* (0.0)	0.24* (0.0)	1.0		
Employment	-0.13* (0.007)	0.35* (0.0)	0.07 (0.15)	0.40* (0.0)	1.0	
Wage	0.3861* (0.0)	0.15* (0.00)	0.21* (0.0)	-0.26* (0.0)	-0.46* (0.0)	1.0

Source: Authors' estimates.

## A comparative analysis of export-led and domestic demand-led growth hypotheses in BRICS economies

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**Abstract.** *The elevation of economic growth and development of an economy has always been a prime concern for nations. In this context, exports and domestic demand are the two economic growth components that promote and accelerate economic growth. While exports are given more emphasis whereas domestic demand is underestimated. Moreover, the present study argues the superiority of domestic demand-led growth over export-led growth. As a novel contribution, the study compares export-led growth (ELG) and domestic demand-led growth (DDLG) hypotheses by employing a newly developed methodology for BRICS for the period 1991-2019. The data in the study is found to be heterogeneous and cross-sectionally dependent. Therefore, the study further employs Dumitrescu-Hurlin causality test, common correlated effects (CCE) mean group estimator which considers cross-sectional dependence and heterogeneity between the variables. Our findings support both hypotheses and also report that DDLG contributes more towards the economic growth of an economy than ELG. Based on the results, the study claims that ELG and DDLG are complementary to each other rather than competitive.*

**Keywords:** Export, Economic Growth, BRICS, Cross-section Dependence, CCE Mean Group Estimator.

**JEL Classification:** F1, O4, C1.

## 1. Introduction

Every economy has an objective to achieve more balanced growth in the economy. To pursue this objective, various economies follow several strategies depending on the country-specific characteristics. Export-led growth (ELG) is one such strategy among all. ELG strategy is one where a country opens itself to international trade to develop its economy. New growth theories also suggest that open economies grow faster than closed economies as it leads to the adoption of new technologies and more efficiency in production (Jalil and Rauf, 2021). While this strategy worked for many nations it comes with significant risks such as dependency on foreign demand, ignorance of domestic priorities, and wage suppression. Moreover, many economists hypothesized that after the East Asian crisis export-led growth strategy that was earlier followed by East Asian economies as an optimal growth strategy ultimately abandon and even harmed the prospects of growth in developing economies (Palley, 2002; Felipe and Lim, 2005; Sgro, 2009; Mohanty, 2012). Krueger (1980) also recommends that the biasness of foreign demand in trade strategies is not sustainable in the long term because these policies are associated with higher costs. ELG is not a sufficient strategy to revamp the performance of the external sector and tweak the domestic growth of any economy. Such a type of trade policy is highly elastic to exogenous shocks. Moreover, many empirical studies realised the need of an alternative strategy that can promote economic growth (Tang et al., 2015; Venkatraja, 2015; Abosedra and Tang, 2019; Odhiambo, 2021). Therefore, to achieve the goal of balanced growth many developing economies started shifting focus from export-led growth (ELG) to domestic demand-led growth (DDLG). A high growth path should be achieved only through a long-term development policy. Within this frame of reference, DDLG emphasizes that the economic fundamentals of the emerging economies are eroded by over-depending on foreign demand and foreign capital. Therefore, the focus of the policies should be more on private consumption to enhance the domestic manufacturing sector strategy (Mohanty, 2012; Venkatraja, 2015; Saglam and Egeli, 2017).

As per the macroeconomic accounting identity, there are numerous factors that affect the economic growth of an economy. Economic growth or GDP of an economy is composed of private consumption, government consumption, gross domestic investment, and net exports. Private consumption, government consumption, gross domestic investment or gross domestic capital formation (GDCF) are the components of domestic demand while net export (exports – imports) is the other component of GDP that is a foreign component. Therefore, any change in these components will bring a change in economic growth (Felipe and Lim, 2005; Mishra and Nancharaiyah, 2016; Saglam and Egeli, 2018). Thus, four possibilities may arise: First when domestic demand is increasing and net exports are decreasing, if the resulting GDP growth is positive then this will be the result of rising domestic demand and this refers to domestic demand-led growth. Second, when domestic demand is falling and net exports are rising, if the growth is positive then growth must be net export-led. Third when domestic demand and net exports are deteriorating then the resulting negative growth would be the result of both domestic demand and net exports. Fourth and last when domestic demand and net exports are rising then this growth is due to both domestic demand and net exports. The share of which component is more in accelerating economic growth is not known and is part of empirical analysis.

The present study is different from the previous studies and contributes to the existing literature in a way as first there are plenty of studies (see section 3) which explore the export-led growth policy but the author realized that there are limited studies on domestic demand-led growth strategy. Second, a comparison between ELG and DDLG has been done for many countries but the study for BRICS nations is left untouched. Third, the present study is using a newly developed methodology for panel data. Therefore, this study aims to explore and compare the export-led growth and demand-led growth strategy using panel data for BRICS during 1991-2019.

Hence, keeping in view the above background and the importance of such hypotheses, this study proposes to address the following research objectives:

- First, to examine the existence of a long-run relationship between net exports, domestic demand and economic growth in BRICS for 1991-2019.
- Second, to assess the direction of causality between the variables.
- Third, to assess to what extent net exports and domestic demand impact the economic growth in BRICS.

The rest of the article is organized as follows. The second section presents the institutional background of the BRICS organization. Section third extensively reviews the literature on the topic. The fourth section describes the data and its sources. Empirical analysis and results are reported in the fifth section, and the sixth section presents the conclusion of the study.

## 2. BRICS: Institutional background

The BRICS is an association of five emerging economies (Brazil, Russia, India, China and South Africa) that are critical players in international trade. Climbing economic integration has been observed worldwide over the past three decades. International trade is one of the factors that play an important role in a modern economy. Knowing the pros and cons of export-oriented growth policy is a matter of research for every economy. Over the last decades, most of them have experienced rapid growth in trade with China and India on top. Moreover, BRICS alliance is a vital institution having a large share in global growth. Despite the adverse effects of the global crisis of 2008 in the world, the average GDP per capita for the BRICS countries was higher than worldwide (Larionova, 2020). Table 1 reports the GNP per capita for the different groups of countries and for the World during the last three consecutive ten-year periods. The period 2008-2017 defines the repercussions of the global economic crisis of 2008. As it is clear from Table 1 that the world was growing at 1.4% at the earliest period (1988-1997) and the growth rate rose to 2.8% from 1998 to 2007. BRICS was leading the board, averaging 6.7% during this period which was only 2.1% in 1988-1997. This highlights the BRICS standing out and emerging as a major global economic alliance.

Afterward, the global economy was suddenly hit by the financial crisis of 2008. This had adversely affected worldwide and the effects are persisted till now. Growth rates were slowed down and the economy stagnated. But BRICS was one of the few institutions which were least affected and are the major engine of economic growth. Their joint growth rate

has been 5.4% with the most noteworthy countries China and India. Further, economists predicted that the growth rate of BRICS which is higher than the global growth rate will lead to a further rise in share in the global trade and it will surpass the USA and European countries combined by 2030 (Larionova, 2020; Rani and Kumar, 2018).

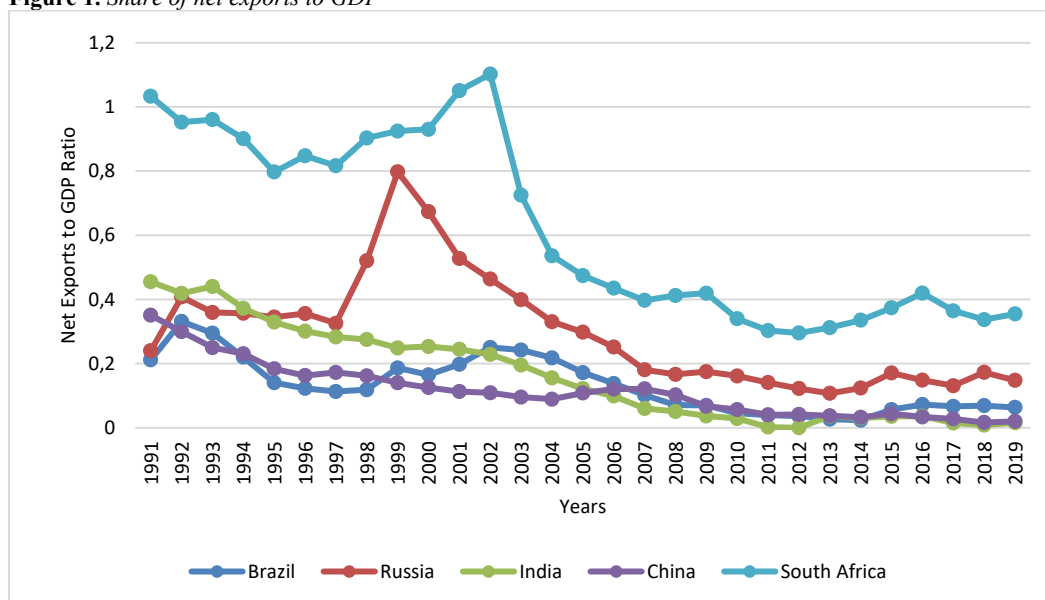
**Table 1.** Annual growth rates of GNP per capita (%) (2005 \$PPP)

	1988-1997	1998-2007	2008-2017
World	1.4	2.8	1.7
USA	2.0	2.0	0.7
Europe	1.8	2.3	0.6
Other Developed countries	2.5	1.8	0.8
BRICS	2.1	6.7	5.4
Other emerging countries	1.5	3.2	1.1
Developing countries	0.3	2.5	2.7

Source: CAM World Databank (WD).

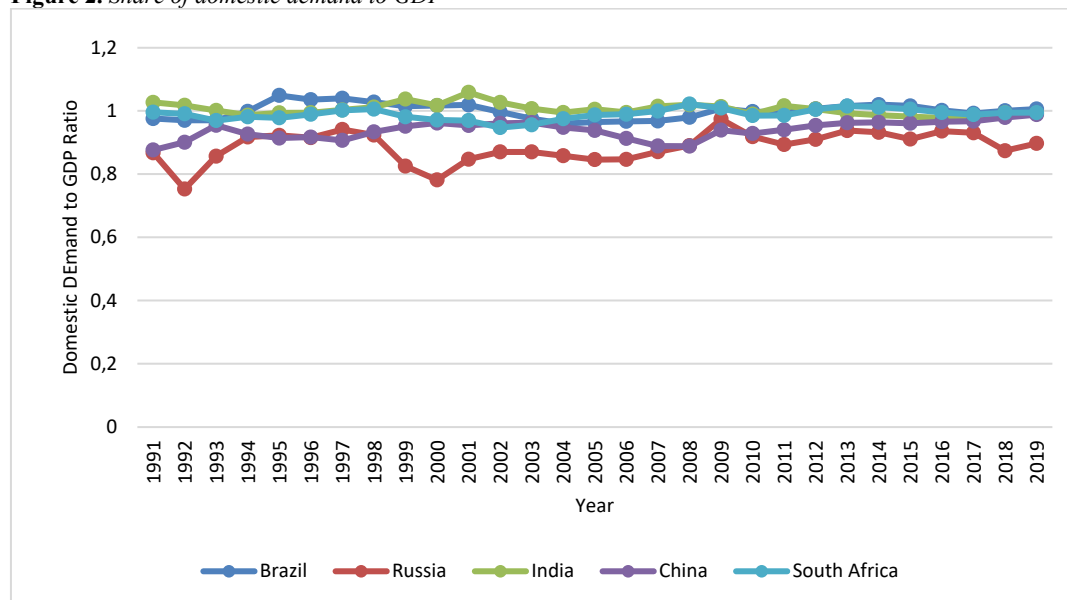
Many factors lead to the higher growth of the BRICS organization as a whole such as exports, and domestic demand. Figure 1 and 2 compares the share of net exports and domestic demand to the growth of BRICS during 1991-2019. It is clear from the figures that share of domestic demand is higher for BRICS as a whole since it ranges between 0.75 to 1.05 whereas the share of net exports is lower for all BRICS countries except South Africa which was 1.10 in 2002. However, the trend of share of net exports to GDP is dropping whereas the trend of domestic demand to GDP remains almost constant throughout all five countries. Conclusively, both domestic demand and net exports play a vital role in the economic growth of BRICS countries. This study explores the nexus between these three using cointegration analysis. Moreover, it is further complemented by CCE mean group estimator to know the share of both domestic demand and net exports in the growth of BRICS.

**Figure 1.** Share of net exports to GDP



Source: Authors' own computation using WDI, World Bank database.



**Figure 2.** *Share of domestic demand to GDP*

**Source:** Authors' own computation using WDI, World Bank database.

### 3. Literature review

Exports and domestic demand are the two components that boost the economic growth of an economy. Most countries gave importance to the exports but after the East Asian crisis, the focus shifted from foreign demand to domestic demand. In the literature also exports have been given more importance. There are numerous studies that study the export growth nexus or export-led growth hypothesis. The empirical results vary depending on the country-specific characteristics, data and methodology used. Based on their results, there are two groups of studies: The first found a positive association and the second group of studies found a negative association between exports and growth. Most of the studies found a positive relationship between export and growth and conclude that exports promote growth (Parida and Sahoo, 2007; Amiri and Gerdtham, 2011; Hye, 2012; Korhan et al., 2015; Al-Assaf and Al-Abdulrazag, 2015; Ee, 2016; Raghutla and Chittedi, 2020). However, some recent studies based on time series analysis raised some doubts and fail to support the positive long-run relationship between exports and economic growth using cointegration analysis (Cuadros et al., 2004; Bajo-Rubio and Diaz-Roldan, 2012). Therefore, it is necessary to find other complementary means by which economic growth drives. Domestic demand is one such component. Here we briefly provide a critical appraisal of existing studies comparing ELG and DDLG hypotheses.

Medina-Smith (2001) analyzed the ELG hypothesis for the period 1950-1997 in case of Costa-Rica. The results find a positive relationship between exports and economic growth but their impact is relatively small. The study suggests that the ELG is beneficial only for limited developing countries and only to a certain extent.

Yew Wah (2004) examined the role of domestic demand in economic growth in Malaysia using cointegration analysis. He found that both ELG and DDLG hypothesis is valid in the short run but in the long run results did not support the ELG hypothesis. Despite there being a positive effect of domestic demand on economic growth which implies that domestic demand is important for Malaysian Growth.

Tsen (2007) examines the relationship between exports, domestic demand and economic growth in the Middle East countries using the granger causality test and Geweke decomposition of causality. He found that consumption is more important than investment in contributing to economic growth. The result of the study suggested that both exports and domestic demand should be promoted for sustainable economic growth. Venkatraja (2015) estimated the relative influence of domestic demand and export demand on economic growth in China and India by using the linear regression model. The results show that China's economic growth is driven by export demand and further analysis indicates that such growth is not sustainable whereas India's growth is driven by domestic demand and is sustainable.

Tang, Lai and Ozturk (2015) and Abodesra and Tang (2019) both empirically investigated the export-led growth hypothesis for Asia's four little dragons and five countries in MENA region respectively. Both the studies find the long-run positive relationship between exports and economic growth but they are not in the favor of ELG hypothesis as it is not stable over time. They suggest that policymakers should opt for other alternatives instead of export to accelerate the growth of the economies. Abodesra and Tang (2019) analyzed the period from 1980-2012 using the time-varying TYDL Granger causality test. Additionally, it also suggests that government should target domestic and foreign investment in key sectors to improve the macroeconomic fundamentals. While Tang, Lai and Ozturk (2015) employed cointegration and rolling causality test on both bivariate and trivariate models.

Saglam and Egeli (2017) employed the dynamic panel data analysis to compare the export-led growth and domestic demand-led growth hypothesis in East Asian countries during 1983-2015. The findings of the causality test show that there is two-way causality between net exports, domestic demand and economic growth. The dominance of a hypothesis depends on the country as DDLG is dominant in South Korea and ELG is dominant in Hongkong. It is recommended that a good combination of both ELG and DDLG is necessary for persistent economic growth. Saglam and Egeli (2018) comparatively analyzed the export-led and domestic demand-led growth hypothesis for European transition economies over the period 1990-2015 using dynamic panel data techniques. The results of the analysis found that DDLG is accepted and the contribution of domestic demand to economic growth is seven times more than the net exports. Odhiambo (2021) employed panel cointegration and the Granger causality test to examine the link between export and economic growth in sub-Saharan African countries for 1980-2017. The study found the existence of a long-run association between the variables but the study suggests that the strategy has limited scope and is not desirable for low-income and middle-income countries.

Further, the paper figures out some studies which are done for the BRICS alliance. Mishra and Nancharaiyah (2016) examined the role of domestic demand and external demand in BRICS countries for the period 1991-2012. Though domestic demand plays an important role in enhancing growth, external demand cannot be neglected. Both the policies should be complementary rather than competitive to accelerate the pace of development. Rani and Kumar (2018) and Raghutla and Chittedi (2020) examined the association between export, import and economic growth in the case of BRICS countries. Raghutla and Chittedi (2020) applied the Johansen cointegration test and Granger causality test for 1979-2018. Whereas, Rani and Kumar (2018) employed FMOLS, dynamic OLS and VECM using panel data from 1967-2014. Both the studies find a positive association between export, import and growth and support the ELG hypothesis. Mishra (2020) examined the role of external and domestic demand in the growth of BRICS countries using vector autoregression analysis. The results are mixed depending on the individual countries of BRICS.

From the above empirical literature, it is observed that if the export-led growth hypothesis is complemented by an alternative strategy it can boost economic growth. There are plenty of studies that explore the export-led growth policy for various countries but a lacuna of studies on domestic demand-led growth strategy for BRICS nations. Additionally, the present study is using a newly developed methodology for panel data. Therefore, this study aims to explore and compare the export-led growth and demand-led growth strategy using panel data for BRICS during 1991-2019.

#### 4. Methodology and data

This section deals with the discussion of the methodology and data used in the study. The empirical estimation done in the study passes through five steps. First, the study tests the characteristics of the data such as homogeneity and cross-section dependence. Towards this, the study employs the Delta test for homogeneity and Pesaran's test for cross-section dependence. Second, based on the data characteristics Pesaran's panel unit root test is applied to test the stationarity of data. Third, to test the long-run relationship (cointegration) between variables Westerlund cointegration test is used. Fourth, Dumitrescu-Hurlin causality test is employed to examine the direction of causality between variables. Fifth, common correlated effect (CCE) mean group estimator is employed which accounts for heterogeneity and cross-section dependence among variables to estimate the coefficients of the explanatory variables.

Moreover, the paper employs panel data for BRICS (Brazil, Russia, India, China and South Africa) for the period 1991-2019. As we know from the theory that economic growth is a function of domestic demand and net exports. It can be expressed as:

$$Y = f(DD, NE) \quad (1)$$

The econometric form of the regressors and dependent variable can be written in the following form:

$$Y_{ti} = \alpha + \beta_1 DD_{ti} + \beta_2 NE_{ti} + \mu_{ti} \quad (2)$$

The present study uses the following model specification:

$$LY_{ti} = \alpha + \beta_1 LDD_{ti} + \beta_2 LNE_{ti} + \mu_{ti} \quad (3)$$

Y is the GDP at the current US\$ which is used as a proxy for economic growth, DD is domestic demand which is the summation of consumption expenditure, investment expenditure and government expenditure. The study used the aggregation of household final consumption expenditure, general government final consumption expenditure and gross fixed capital formation at the current US\$. NE is net exports that are equal to the subtraction of exports of goods and services and imports of goods and services at current US\$. The prefix ‘L’ before each variable in equation 3 represents the natural logarithmic transformation of the variables. The secondary data for the above variables have been collected from WDI, World Bank for BRICS (Brazil, Russia, India, China and South Africa) countries for the period 1991-2019.

## 5. Empirical analysis

In this section, we represent the empirical analysis and its results using STATA software. First of all, the paper tested for the homogeneity of the data using the delta test given by Pesaran and Yamagata (2008). This test is the standardized version of Swamy’s test of slope homogeneity for panel data models that is suitable for large samples. The test is generally denoted by delta ( $\Delta$ ) (Pesaran and Yamagata 2008).

The Null hypothesis of the test claims that the slope coefficients are homogeneous. The results of the test are shown in Table 2. Here p-value is smaller than 0.05 therefore we reject the null hypothesis. This implies that slope coefficients are heterogeneous.

**Table 2.** Slope homogeneity test

Delta	Statistics	p-value
$\Delta$ performing	10.596	0.000
$\Delta$ adj.	23.693	0.000

**Source:** Author’s own computation using Stata15.

Cross-section dependence is one of the most important diagnostics that a researcher should investigate before a panel data analysis. Traditional tests unrealistically assume cross-section independence which leads to inadequate results. In real life, cross-section dependence can arise due to spatial or spillover, or unobservable effects (Baltagi and Pesaran, 2007). Therefore, the present paper uses Pesaran’s CD test which is developed by Pesaran in 2004.

The null hypothesis claims that there is no cross-section dependence. According to Table 3, we reject the null hypothesis and there is cross-section dependence in the data.

**Table 3.** Pesaran’s test of cross-section dependence

CD test	Test Statistics	p-value
Pesaran (2004)	4.582	0.0000

**Source:** Author’s own computation using Stata15.

Pesaran (2007) panel unit root test is a second-generation panel unit root test and takes into account both the heterogeneity and cross-sectional dependency. The Pesaran (2007) test states that all series are non-stationary under the null hypothesis while the series is stationary under the alternative hypothesis. Table 4 shows the findings of the test and indicates that the null hypothesis can be rejected for all variables at 0.05 significance level. Thus, the variable LNE is stationary at trend and LDD and LY are stationary at both constant and trend.

**Table 4.** Pesaran (2007) panel unit root test

Variable	t-bar	z(t-bar)	p-value	Result
LNE	-2.314	-1.276	0.101	Non-stationary
ΔLNE	-3.020	-1.707	0.044	Stationary
LDD	-2.687	-2.136	0.016	Stationary
ΔLDD	-3.334	-2.462	0.007	Stationary
LY	-3.007	-2.874	0.002	Stationary
ΔLY	-3.614	-3.135	0.001	stationary

**Source:** Author’s own computation using Stata15.

Table 5 illustrates the cointegration test using Westerlund's (2007) cointegration test. This test assumes that all variables are stationary at first difference. The null hypothesis claims no cointegration between variables against the alternative that some panels are cointegrated.

The p-value of 0.0517 shows that we reject the null hypothesis at 5% level of significance and states that there is cointegration between variables.

**Table 5.** Westerlund cointegration test

	Statistics	P-value
Variance Ratio	-1.6284	0.0517

**Source:** Author’s own computation using Stata15.

Dumitrescu and Hurlin (2012) introduced a test to detect granger causality in panel dataset. The test estimates three statistics that are  $\bar{W}$ ,  $\bar{Z}$  and  $\tilde{Z}$ . The null and alternative hypotheses are described as follows:

$$H_0: \beta_{i1} = \dots = \beta_{iK} = 0 \quad \forall i = 1, \dots, N \tag{1}$$

$$H_1: \beta_{i1} = \dots = \beta_{iK} = 0 \quad \forall i = 1, \dots, N1$$

$$\beta_{i1} \neq 0 \text{ or } \dots \text{ or } \beta_{iK} \neq 0 \quad \forall i = N1 + 1, \dots, N$$

Null hypothesis implies the absence of causality for some individuals in the panel. Table 6 illustrates the result of the DH test for net exports and GDP.

The p-value rejects the null hypothesis and states that there is a two-way causal relationship between net exports and GDP relationship during 1991-2019 for BRICS countries.

**Table 6.** *Dumitrescu-Hurlin causality test*

Null Hypothesis		Statistics	P-value
LNE does not granger cause LY.	W bar	3.5326	
	Z bar	4.0044	0.0001
	Z bar tilde	3.3278	0.0009
LY does not granger cause LNE.	W bar	2.4223	
	Z bar	2.2489	0.0245
	Z bar tilde	1.8170	0.0692

**Source:** Author's own computation using Stata15.

On the other hand, Table 7 shows the findings of the DH test for domestic demand and GDP. The results show that domestic demand and GDP have a two-way causal relationship during 1991-2019 for BRICS countries.

**Table 7.** *Dumitrescu-Hurlin causality test*

Null Hypothesis		Statistics	P-value
LDD does not granger cause LY.	W bar	2.8539	
	Z bar	2.9313	0.0034
	Z bar tilde	2.4043	0.0162
LY does not granger cause LDD.	W bar	4.8746	
	Z bar	6.1263	0.0000
	Z bar tilde	5.1538	0.0000

**Source:** Author's own computation using Stata15.

The DH test only determines the causality between variables. However, it is not known which variables are contributing more to economic growth in the long term. Therefore, the value of coefficients should be estimated. Common Correlated Effects (CCE) model has been developed by Pesaran (2006). Many unobserved common factors are present in the panel dataset because of the large no. of observations. CCE approach estimates both mean group and pooled estimators depending on the assumption of slope homogeneity. CCE mean group estimator is more suitable in the case of data heterogeneity. The CCE mean group estimator is a simple average of the estimators of the individual slope coefficients (Pesaran, 2006). The study estimated the CCE mean group estimator model since the data in our study is heterogeneous. Table 8 represents the results of CCE mean group estimates. It is seen that there is a positive association between economic growth, net exports and domestic demand. It is also seen that all the coefficients are individually statistically highly significant as their p-values are very low.

**Table 8.** *CCE mean group estimates*

LY	Coefficient	Standard Error	P-value
LNE	0.1351	0.5159	0.009
LDD	0.9716	0.0211	0.000

**Source:** Author's own computation using Stata15.

The value of coefficients suggests that when the net exports increase by 1 percent, on average, the GDP or economic growth will increase by 0.13 percent holding the domestic demand constant. Similarly, if domestic demand increases by 1 percent, on average, the GDP goes up by 0.97 percent holding the net exports constant. This implies that a percentage increase in domestic demand contributes more toward economic growth than the percentage increase in net exports. The results of the present study are in line with Yew Wah (2004), Felipe and Lim (2005), Mishra and Nancharaiyah (2016), Saglam and Egeli (2018), and Mishra (2020).

## 6. Conclusion

The study primarily compares the export-led growth hypothesis and domestic demand-led growth hypothesis for BRICS (Brazil, Russia, India, China and South Africa) alliance during 1991-2019. The preliminary analysis shows that variables are heterogeneous and cross-sectionally dependent. Therefore, further tests are chosen while considering the above characteristics of the variables. The results of the Pesaran unit root test and Westerlund cointegration test indicate that net exports, domestic demand and economic growth are stationary at trend and have long-run relationships among the variables. On the basis of the Dumitrescu-Hurlin causality test, there is two-way causality between net exports – economic growth and domestic demand – economic growth. Further, the study employs CCE mean group estimates for the panel data from 1991-2018. The findings of the study show that there is a significant positive relationship between net exports – economic growth and domestic demand – economic growth. This implies that both the hypotheses (ELG and DDLG) are accepted in the BRICS organization for 1991-2019. Moreover, a comparison between ELG and DDLG indicates that a percentage increase in domestic demand contributes more toward economic growth than the percentage increase in net exports.

The findings of the paper are straightforward and useful for policymakers. They provide a clear message to policymakers that domestic demand should be given first importance rather than foreign demand. In spite of this BRICS should not totally discard the export-led growth strategy. To sum up, the policy mix of both the strategies would be more meaningful in accelerating the growth of an economy and that growth would be stable and sustainable. Further, a country should be careful in choosing the appropriate strategy for its economy as the effect of exports and domestic demand on economic growth varies with the country's stage of development. Odhiambo (2021) suggests that low-income countries should pursue a domestic demand-led growth strategy to expand the real sector of the economy and middle-income countries should pursue a mix of both export-led and domestic demand-led growth strategies. One can extend the work by including disaggregated analysis. By this, we mean that one can include the various components of domestic demand and analyze them individually. Moreover, the long-term coefficient for each cross-section unit of BRICS can also be individually estimated.

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## References

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- Abosedra, S. and Chor F.T., 2019. Are Exports a Reliable Source of Economic Growth in MENA Countries? New Evidence from the Rolling Granger Causality Method. *Empirical Economics* 56(3), pp. 831-841.
- Agrawal, P., 2015. The Role of Exports in India's Economic Growth. *Journal of International Trade and Economic Development* 24(6), pp. 835-859.
- Al-Assaf, G. and Bashier, Al-A., 2015. The Validity of Export-Led Growth Hypothesis for Jordan: A Bounds Testing Approach. *International Journal of Economics and Financial Issues* 5(1), pp. 199-211.

- Amiri, A. and Ulf-g Gerdtham, 2011. Relationship between exports, imports, and economic growth in France: Evidence from cointegration analysis and Granger causality with using geostatistical models. *MPRA Paper*, no. 34190. <<http://mpra.ub.uni-muenchen.de/34190/>>
- Bajo-R., O. and Díaz-Roldán, C., 2012. Do Exports Cause Growth? Some Evidence for the New EU Members. *Post-Communist Economies* 24(1), pp. 125-131.
- Baltagi, B.H. and Pesaran, M.H., 2007. Heterogeneity and cross section dependence in panel data models: theory and applications introduction. *Journal of Applied Econometrics* 22(2), pp. 229-232.
- Barbieri, L. and Parmense, V.E., 2016. Panel Unit Root Tests under Cross-Sectional Dependence: An Overview. *Journal of Statistics: Advances in Theory and Applications* 1(2), pp. 117-158.
- Basevi, G., 1970. Domestic Demand and Ability to Export. *Journal of Political Economy* 78(2), pp. 330-337.
- Chandra, P.P. and Sahoo, P., 2007. Export-Led Growth in South Asia: A Panel Cointegration Analysis. *International Economic Journal* 21(2), pp. 155-75.
- Cuadros, A., Orts, V. and Alguacil, M., 2004. Openness and Growth: Re-Examining Foreign Direct Investment, Trade and Output Linkages in Latin America. *Journal of Development Studies* 40 (4), pp. 167-192.
- Dumitrescu, E.-I. and Hurlin, C., 2012. Testing for Granger non-causality in heterogeneous panels. *Economic modelling* 29 (4), pp. 1450-1460.
- Eberhardt, M., 2011. Panel Time-Series Modeling: New Tools for Analyzing Xt Data. *United Kingdom Stata Users' Group Meetings 2011*, September, pp. 1-42. <[http://repec.org/usug2011/UK11\\_eberhardt.pdf](http://repec.org/usug2011/UK11_eberhardt.pdf)>
- Ee, C.Y., 2016. Export-Led Growth Hypothesis: Empirical Evidence from Selected Sub-Saharan African Countries. *Procedia Economics and Finance* 35 (October 2015), pp. 232-40.
- Felipe, J. and Lim, J., 2005. Export or domestic-led growth in Asia?. No. 69. ERD working paper series.
- Gokmenoglu, K.K., Sehnaz, Z. and Taspinar, N., 2015. The Export-Led Growth: A Case Study of Costa Rica. *Procedia Economics and Finance* 25 (May), pp. 471-77.
- Hye, Q.M.A., 2012. Exports, Imports and Economic Growth in China: An ARDL Analysis. *Journal of Chinese Economics and Trade Studies* 5 (1), pp. 42-55.
- Islam, Md.M., 2020. Testing Export-Led Growth Hypothesis: Evidence from BCIM Countries. *SSRN Electronic Journal*, pp. 1-15.
- Jalil, A. and Rauf, A., 2021. Revisiting the Link between Trade Openness and Economic Growth Using Panel Methods. *Journal of International Trade and Economic Development*, pp. 1-20.
- Krueger, A.O., 1980. Trade policy as an input to development. *The American economic review* 70 (2), pp. 288-292.
- Larionova, M., 2020. Role of BRICS in the Global Economy. *BRICS Information portal*, June 4. <<https://infobrics.org/post/31036/>>
- Lowe, P., 2016. The Rise of the BRICS in the Global Economy. *Teaching Geography* 41 (2), pp. 50-53.
- Medina-Smith, E.J., 2001. Is the Export-Led Growth Hypothesis Valid for Developing Countries? A Case Study of Costa Rica. *Policy Issues in International Trade and Commodities*.



- Mishra, B.R., 2020. Role of External and Domestic Demand in Economic Growth: A Study of BRICS Countries. *Global Business Review* 21 (2), pp. 547-66.
- Mishra, B.R. and Nancharaiyah, G., 2016. Export or Domestic Demand-Led Growth in BRICS Countries? *The Indian Economic Journal* 63 (4), pp. 725-49.
- Mohanty, S.K., 2012. Economic Growth, Exports and Domestic Demand in India: In Search of a New Paradigm of Development. In Zhang, Y., Kimura, F., and Oum, S. (eds.), *Moving Toward a New Development Model for East Asia – The Role of Domestic Policy and Regional Cooperation*. ERIA Research Project Report 2011-10, Jakarta: ERIA. pp. 191-222.
- Nasrin, S. and Koli, R., 2018. Investigating the Validity of Export-Led and Import-Led Growth Hypothesis in Bangladesh. *Journal of Economics and Sustainable Development* 9 (12), pp. 54-63.
- Nayyar, D., 2020. BRICS, Emerging Markets, and the World Economy. *Handbook of BRICS and Emerging Economies*, pp. 93-115.
- Odhiambo, N.M., 2021. Is Export-Led Growth Hypothesis Still Valid for Sub-Saharan African Countries? New Evidence from Panel Data Analysis. *European Journal of Management and Business Economics* ahead-of-print (ahead-of-print). <<https://doi.org/10.1108/ejmbe-06-2020-0156>>
- Palley, T.I., 2002. A New Development Paradigm Domestic Demand-Led Growth why it is needed and How to Make It Happen. *Foreign Policy in Focus*.
- Persyn, D. and Westerlund, J., 2008. Error-Correction-Based Cointegration Tests for Panel Data. *Stata Journal* 8 (2), pp. 232-241.
- Pesaran, M.H., 2006. Estimation and inference in large heterogeneous panels with a multifactor error structure. *Econometrica* 74 (4), pp. 967-1012.
- Pesaran, M.H., 2007. A simple panel unit root test in the presence of cross-section dependence. *Journal of applied econometrics* 22(2), pp. 265-312.
- Pesaran, M.H. and Yamagata, T., 2008. Testing slope homogeneity in large panels. *Journal of econometrics* 142 (1), pp. 50-93.
- Raghutla, C. and Chittedi, K.R., 2020. Is There an Export- or Import-Led Growth in Emerging Countries? A Case of BRICS Countries. *Journal of Public Affairs* 20 (3).
- Rani, R. and Kumar, N., 2018. Is There an Export- or Import-Led Growth in BRICS Countries? An Empirical Investigation. *Jindal Journal of Business Research* 7 (1), pp. 13-23.
- Sağlam, Y. and Egeli, H.A., 2017. Empirical Analysis of Export-Led Growth and Domestic Demand-Led Growth Hypothesis in East Asia. *Uluslararası İktisadi ve İdari İncelemeler Dergisi*. 19, pp. 211-226. <<https://doi.org/10.18092/ulikidince.309279>>
- Sağlam, Y. and Egeli, H.A., 2018. A Comparison of Domestic Demand and Export-Led Growth Strategies for European Transition Economies: Dynamic Panel Data Analysis. *Foreign Trade Review* 53 (3), pp. 156-173.
- Sgro, P.M., 2009. Strategic developments in international trade. *International Economics, Finance and Trade* 2, p. 91.
- Tang, C.F., Lai, Y.W. and Ozturk, I., 2015. How Stable Is the Export-Led Growth Hypothesis? Evidence from Asia's Four Little Dragons. *Economic Modelling*, 44, pp. 229-235.
- Tsen, W.H., 2007. Exports, Domestic Demand and Economic Growth: Some Empirical Evidence of the Middle East Countries. *Journal of Economic Cooperation* 28 (2), pp. 57-82.

- 
- Venkatraja, B., 2015. Does Export-led Growth strategy Sustain? An aggregate Demand Dimension: China's Experience; India's Lessons. *International Review of Research in Emerging Markets and the Global Economy (IRREM)* 1 (4).
- Westerlund, J., 2007. Testing for error correction in panel data. *Oxford Bulletin of Economics and Statistics* 69 (6), pp. 709-748.
- Yew Wah, L., 2004. The Role of Domestic Demand in the Economic Growth of Malaysia: A Cointegration Analysis. *International Economic Journal* 18 (3), pp. 337-352.

## Reinsurance – an efficient solution of catastrophe risk transfer for the housing stock of Romania

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**Abstract.** *As economic losses caused by natural disasters substantially increase in volume, impacting national economies, post-disaster reconstruction financing becomes crucial, especially for countries with fragile economies. The growing gap between economic and insured losses calls for a pragmatic approach related to financial protection solutions. Romania is one of the few countries that adopted a solution to cut down this deficit of protection in the case of the residential system. This system considers reinsurance as a sustainable risk transfer method, meant to quickly and efficiently attract the funds required to rebuild the housing stock in the event of a disaster.*

**Keywords:** reinsurance, risk transfer, mandatory insurance, natural catastrophe.

**JEL Classification:** G22.

## 1. Introduction

Reinsurance is the purchase of protection by the cedent insurer against risks, especially risks underwritten under policies issued by the insurer, in return for a reinsurance premium. Often, risk transfer goes beyond the jurisdictional boundaries of the cedent, geographically spreading risks related to exposures, especially in the case of natural catastrophes (Nat Cat), thus contributing to the financial stability of the jurisdiction.

Risk mitigation techniques are those techniques used by insurance companies to transfer part of the risk to financially sound companies. Reinsurance is one such technique, through which large exposures can be covered, which provides protection, security and liquidity to the insurance company in case of major events. "Reinsurance plays a pivotal role in supporting the solvency and capital efficiency of insurance risk transfer". (Chester et al., 2017)

World-wide, in comparison with insurance markets, the reinsurance markets are significantly lower in volume. However, "reinsurance being a form of insurance, many of the principles and practices applying to the conduct of insurance business equally apply". (Carter, 2013)

Simultaneously, reinsurance faces the same competitive pressures as insurance. As such, "there are many opportunities for the industry to maintain and increase its relevance, as new risks grow in importance and global macroeconomic conditions become more complex – and therefore riskier." (Chester et al., 2017).

Consequently, since the insurers could significantly reduce the underwriting risk, "reinsurance is a key instrument for insurers and supervisors to conduct risk management". (Gurenko et al., 2012)

According to Mayers and Smith (1990), "a broader interpretation of modern financial theory provides an important role for reinsurance as a mechanism for reducing unsystematic risk".

Prior to any other risk, reinsurance mitigate the risk of insolvency. However, reinsurance is a higher cost for any insurer due to the unpredictability of the losses. According to Froot (2001) "the pattern of hedging against catastrophe event risk deviates from the predicted by theory, in the sense that protection against the largest events is often not purchased or unavailable and the prices deviate substantially from fair value".

## 2. Reinsurance – an efficient risk transfer solution in the case of risks of catastrophe

Nat Cat are low-frequency and high-impact events characterized by a big and unforeseen volume of losses. As such, the major post-event risk of any insurer is to become suddenly insolvent if they do not have enough reimbursement capacity for claims. "Fortunately, resultant risk transfer mechanisms can be set in place to increase the risk capacity of insurers to withstand extreme risk events". (James, 2017)

Risk transfer through insurance/reinsurance aims to compensate direct and indirect losses, avoid long-term negative effects, ensure social and economic benefits, maintain welfare, stimulate/maintain economic activities, innovative investments, and maintain/increase productivity.

The main goals of reinsurance for an insurance company are:

- to provide the funds required to compensate loss in the case of catastrophic events;
- to protect company equity;
- to contribute to decreasing the capital requirement to ensure company solvability;
- to create financial stability through transferring and spreading risks to reinsurance companies from the entire world;
- to provide underwriting capacity for the company.

**The main forms of the reinsurance categories are:**

- *Proportionate of the Quota Share Treaty type* through which the reinsurer agrees to take on for reinsurance a certain share of “every risk accepted by the cedent company in the initial insurance company, proportionally supporting all claims in exchange for the same share of all the direct premiums, less the reinsurance commission, which is a win-win contract for both parties and is easily managed”. (Badea and Nagy, 2012)
- *Proportionate of the Surplus Treaty type* through which the reinsurer agrees to take on part of a risk above a certain limit called “plus/line”. The cedent reinsures only those amounts they do not wish to retain on their behalf. “The premium related to every risk is assigned to reinsurers in the same share as the insured sum of the respective risk is assigned for reinsurance, whereas claims are recovered from the reinsurer based on the same percentage calculation.” (Badea and Nagy, 2012). Pursuant to this type of contract, the cedent reinsures only part of any risk that goes beyond the level of its own retention.
- *Not proportionate of the Excess of Loss/Xol or X/L type* – through which the cedent sets “its own share, a value up to which the limit of assigning the liability of the cedent shall be set, respectively”. (Badea and Nagy, 2012) Reinsurance will only work, in case of damage, for the amount exceeding own retention. Pursuant to this contract, the insurer assigns a relatively small number of premiums and is able to build up substantial protection. This type of contract, divided into “layers” is recommended in the case of reinsurance for natural catastrophe.
- *Not proportionate of the Stop Loss type* through which the cedent commits to withstand loss caused during the time frame set in exchange for the equivalent of a certain share of the volume of premiums collected, whereas the reinsurer commits to cover everything that goes beyond this level.

Reinsurance may be viewed both as a risk transfer tool, and a corporate financing tool. According to Garven and Lamm-Tennant (2003), reinsurance is characterized as “both a leverage management and risk management mechanism”.

“Under the additional assumption that both the insurer and the reinsurer are obligated to pay more for larger loss, we have shown that the layer reinsurance is quite robust in the sense that it is always optimal over our assumed risk measures and our prescribed class of premium principles”. (Yichun and Tan, 2013)

Risk transfer pursuant to reinsurance agreement is a topic of interest for the insurance industry. As there are no detailed provisions regarding risk transfer implementation, the reasoning of the entities involved plays a significant role, as both knowledge and understanding of all agreements with reinsurers are a must.

By its nature, the reinsurance contract is a business agreement between two or several entities with expertise in managing risk and capital. To assess whether reinsurance is efficient, the supervisory authorities should understand the following aspects regarding the cedent insurer: the reinsurance strategy and program, the risk management system, the impact of reinsurance in managing liquidity, the risk transfer and its economic impact.

“A reinsurance contract could be called ‘most efficient’ if it, for a given net premium, maximized the reduction of the variance in the claim distribution of the ceding company.” (Borch, 1969)

An analysis of the international reinsurance market over the last 30 years shows that the price of catastrophe reinsurance has risen due to the increased frequency of events. “Cedents cut back on their limits and/or increase their retentions in periods of high prices... There is negative compromise between the amount of protection of insurance purchased and the expected loss. That is, prices are high when quantity is low and cedents respond by adapting their purchasing behavior” (Froot, 2008).

In 2015, one of the largest strategic partners in the area of reinsurance set up “Capital Partners”, meant to identify and use Munich Re reinsurance solutions as an integrated tool to manage risks and capital.

An alternative to traditional reinsurance is the issuing of Nat Cat type of catastrophe bonds. “An initial important point of difference in that reinsurance is provided in the insurance market, whereas cat bonds are issued in the much larger and more diverse financial market – a market that has a far greater capacity than the international insurance market to absorb losses due to natural disasters” (Zietsch and Harpke, 2014). According to Zietsch and Harpke (2014), in comparison to reinsurance, in the case of Nat Cat bonds, investors may diversify risk. As such the risk transfer tends to be a cheaper financing protection.

As a general rule, “policymakers should seek to increase regulatory resources, with further investments in people, systems, and training, so as to better enable supervisors to evaluate and monitor the risk management models that increasingly will be required of insurers”. (Groome et al., 2004)

### 3. Catastrophe risk reinsurance financing for residential insurance in Romania

In Romania there is a dual insurance scheme for residential buildings, which is made up of two complementary categories of products, namely a compulsory component and an optional component. Taking out voluntary insurance is conditional on the existence of compulsory insurance.

Since Romania is a country which is significantly exposed to natural disasters, especially earthquakes and floods, in the framework of the Project implemented with World Bank support, “Natural Hazard Risk Mitigation and Emergency Preparedness”, the ground was laid for the setting up of a compulsory home insurance scheme against natural disasters. The compulsory home insurance system against earthquakes, landslides and floods is regulated by the Law No. 260/2008. Since July 2010, a compulsory insurance program

against catastrophe risks has been implemented in order to reduce the financial efforts of the Romanian Government to mitigate the effects of a natural disaster and to use budgetary resources to rebuild infrastructure, while increasing public confidence in the insurance industry and the authorities.

The Insurance Pool against Natural Disasters (PAID) was set up having the main purpose of managing the compulsory home insurance system in Romania. PAID is an insurance pool, established through the association based on the expression of the consent of twelve insurance companies of Romania, which are licensed to underwrite natural disaster risks. The distributors of the compulsory home insurance are all the insurance companies that underwrite natural disaster risks. The insurance product managed by PAID is the compulsory home insurance policy, called PAD. It was created to provide simple and affordable coverage for all residential properties. The PAD insurance is a unique (product, with a compulsory nature, and should it not be issued, the other voluntary home insurance policies of Romania cannot be concluded. Voluntary home insurance policies are sold with a deductible excess equal to the PAD limits for earthquake, flood and landslide risks.

The main aspects which distinguish between the two coverage categories are shown in the table below:

**Table 1.** *Compulsory vs. voluntary system in Romania*

	Compulsory system	Voluntary system
Insurance contract	- the main insurance contract elements are provided in Law No. 260/2008	- the contract obligations are set by each company, as these also have the freedom of matching the premium with the insured risk
Insured object	- all residential buildings are insured, regardless of construction quality - the outbuildings and the contents are excluded	- residential buildings, their outbuildings and contents are insured. - the construction quality is high
Insured risks	- the 3 natural impact risks specific to Romania: earthquake, floods and landslides	- all risks are included: natural risks (earthquake, landslide, floods, thunderstorm, hail etc.), as well as other risks, such as fire, vandalism, explosion, theft, etc. - in the case of risks of earthquake, floods and landslides, the difference between the value of the residence and the sum covered through the mandatory policy is covered only for the building
Insurance Premium	- lump sum, 10/20 EUR, set through law, it may be changed through order of the President of the Financial Supervisory Authority - it operates based on the principle of solidarity, meaning the same level of insurance premium is applied for any residence, regardless of its vulnerability level	- it is actuarially set and varies based on the residence risk profile, insured sum, history of damages, insured object, area vulnerability, year of construction
Sum Insured	- standard 20.000/10.000 EUR, depending on the building materials used	- at the reconstruction or market value;
Deductible	- not applicable	- different deductibles may be applied, depending on risk, year of construction, vulnerable areas, etc.
Risk selection	- lack of risk selection and risk inspection - non-uniform risk spread - buildings technically assessed and classified in seismic risk class 1 are excluded	- it is possible to select risk based on the risk level - risk inspections are carried out - possibility of risk spread

**Source:** Information processed by the author based on Law No. 260/2008 and Financial Supervisory Authority of Romania regulations.

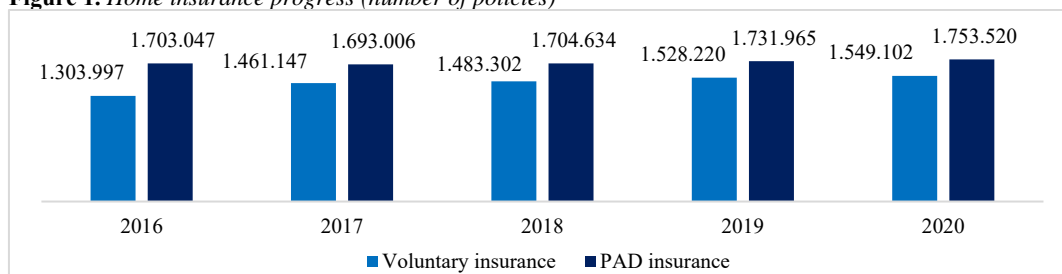
It is currently mandatory that all residential properties have a PAD policy. Voluntary home insurance policies are sold with a deductible excess equal to the PAD limits for earthquake,

flood and landslide risks and no voluntary policy may be issued unless the validity of the PAD policy is confirmed.

Since most of the risk for home insurance in case of natural catastrophes is taken by the compulsory system, it follows that the sustainability of the home insurance system in Romania depends to a large extent on the sustainability of the compulsory system.

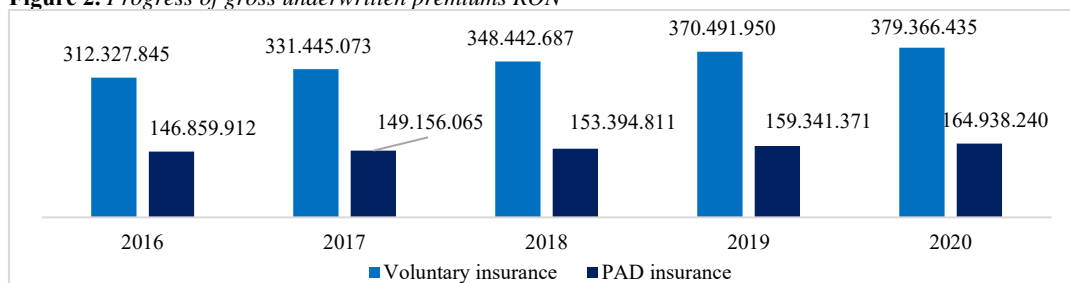
The figures below (Figure 1, Figure 2, and Figure 3) show the relationship between the two categories of insurance in terms of the gross underwritten premiums and the gross claims paid, respectively. “This relationship reflects the specific nature of the two types of insurance in terms of determining the insurance premiums and how damaging the insured risks may be”. (Radu and Alexandru, 2022)

**Figure 1.** Home insurance progress (number of policies)



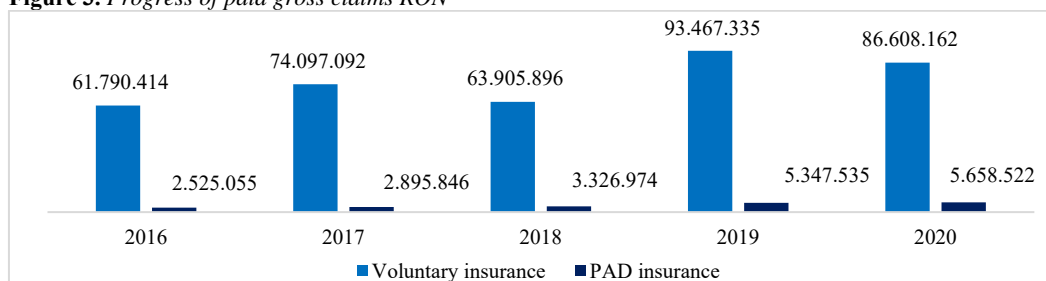
**Source:** Information processed by the author based on yearly reports submitted by the Financial Supervisory Authority of Romania.

**Figure 2.** Progress of gross underwritten premiums RON



**Source:** Information processed by the author based on yearly reports submitted by the Financial Supervisory Authority of Romania.

**Figure 3.** Progress of paid gross claims RON



**Source:** Information processed by the author based on yearly reports submitted by the Financial Supervisory Authority of Romania.



In the Table 2, the author compiles the figures from the Figure 1, Figure 2, and Figure 3, and measures the progress of PBS and paid gross claims for home insurance.

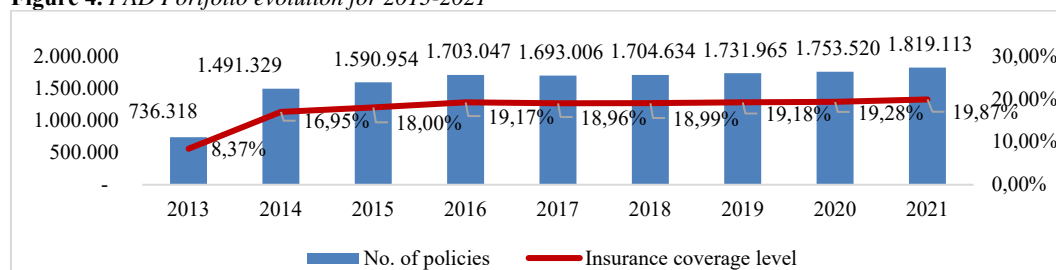
**Table 2.** *Progress of PBS and paid gross claims for home insurance*

RON	Home insurance	Gross underwritten premiums	Gross paid claims
2016	3,007,044	459,187,757	64,315,469
2017	3,154,153	480,601,138	76,992,938
2018	3,187,936	501,837,498	67,232,870
2019	3,260,185	529,833,321	98,814,870
2020	3,302,622	544,304,675	92,266,684

**Source:** compiled by the author based on the information submitted in the Financial Supervisory Authority reports.

The information presented in the PAID reports and that submitted by the National Institute of Statistics of Romania was processed to develop the following graph (Figure 4).

**Figure 4.** *PAD Portfolio evolution for 2013-2021*



**Source:** compiled by the author, based on the information submitted by the National Statistical Institute and PAID Romania.

### Overview of the residential stock and of the residential stock insured in the compulsory insurance system

The residential stock in Romania (Table 3) has recently recorded an upward trend, as a result of the construction of new housing units, as well as through the conversion of other premises into housing units.

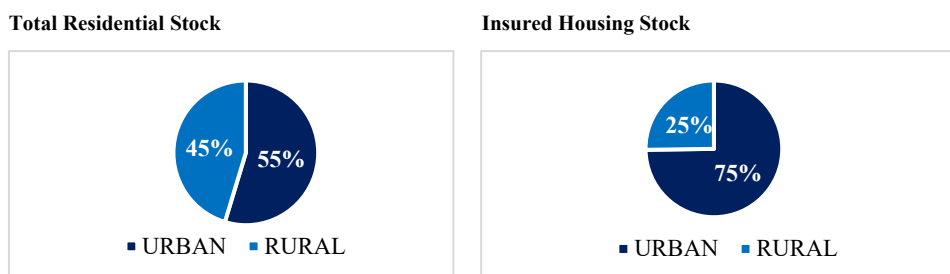
**Table 3.** *The residential stock of Romania*

Total households	Urban	Rural	Private property	State-owned property
9,156,311	5,005,544	4,150,767	9,042,824	113,487

**Source:** data processed by the author based on information from National Statistical Institute. TEMPO Online\_2020 query.

Of the total of 9,156,311 housing units registered in Romania (according to the National Statistical Institute-2020), on 31.12.2021, 1,819,113 housing units were insured in the compulsory system (a slight increase as compared to the same period of last year: 1,753,520 housing units), which add up to a level of coverage of 19.87%. Bucharest Municipality with the County of Ilfov has an insurance coverage level of 41.46% and an aggregated share of 25.40% in the total insured sum. The counties with the smallest insurance coverage level are Ilt (7.97%), Teleorman (8.23%) and Botosani (8.38%).

The breakdown of the residential stock and of the mandatorily insured housing stock by urban and rural Romania are shown in the Figure 5.

**Figure 5.** Residential stock split by urban/rural and insured stock split by urban/rural

**Source:** data processed by the author based on information from National Statistical Institute National Statistical Institute and [www.paidromania.ro](http://www.paidromania.ro)

In Table 4 the author structures the portfolio of PAID by years of construction at December, the 31<sup>st</sup> 2020, and December, the 31<sup>st</sup> 2021, underlining the variation in stock.

**Table 4.** PAID portfolio structure by years of construction

INTERVAL	31.12.2020		31.12.2021		2021 vs 2020 variation	
	PAD number	Share [%]	PAD number	Share [%]		%
Before 1919	14,123	0.81%	11,019	0.61%	- 3,104	-21.98%
1919-1945	53,812	3.07%	51,534	2.83%	- 2,278	-4.23%
1946-1960	117,419	6.70%	116,553	6.41%	- 866	-0.74%
1961-1970	219,721	12.53%	221,098	12.15%	1,377	0.63%
1971-1980	422,308	24.08%	425,344	23.38%	3,036	0.72%
1981-1990	300,093	17.11%	308,210	16.94%	8,117	2.70%
1991-2000	120,358	6.86%	124,098	6.82%	3,740	3.11%
2001-2010	197,728	11.28%	202,475	11.13%	4,747	2.40%
2011-2020	263,570	15.03%	316,994	17.43%	53,424	20.27%
Unavailable information	44,388	2.53%	41,788	2.30%	2,600	-5.86%
<b>Grand Total</b>	<b>1,753,520</b>	<b>100.00%</b>	<b>1,819,113</b>	<b>100.00%</b>	<b>65,593</b>	<b>3.74%</b>

**Source:** data processed by the author based on information from [www.paidromania.ro](http://www.paidromania.ro)

#### 4. Reinsurance program of the Insurance Pool against Natural Disasters (PAID SA). Case study

In keeping with the legal provisions, PAID SA must also contract reinsurance, thus ensuring the risk transfer. PAID has a reinsurance policy which ensures the continuity of a quality reinsurance program so as to provide for the optimization of the capital requirement and company protection.

For the period 01.06.2021-14.07.2022, PAID SA holds an *Excess of loss* reinsurance program worth 1 billion euro, the largest catastrophe reinsurance program in Central and Eastern Europe. The company renews the reinsurance program on a yearly basis, so that it can best address its needs.

The progress of the reinsurance program 2014-2020 (Table 5) follows the level of company exposure.

**Table 5.** Progress of the reinsurance program vs. PAID exposure

	Type A	Type B	Total	Aggregated exposure EUR	Reinsurance program capacity EUR
2014	1,360,478	130,851	1,491,329	28,518,070,000	450,000,000
2015	1,445,071	145,883	1,590,954	30,360,250,000	500,000,000
2016	1,568,354	134,693	1,703,047	32,714,010,000	800,000,000

	Type A	Type B	Total	Aggregated exposure EUR	Reinsurance program capacity EUR
2017	1,575,227	117,779	1,693,006	32,682,330,000	900,000,000
2018	1,594,110	110,524	1,704,634	32,987,440,000	901,000,000
2019	1,630,069	101,896	1,731,965	33,620,340,000	950,000,000
2020	1,660,445	93,075	1,753,520	34,139,650,000	950,000,000
2021	1,732,754	86,359	1,819,113	35,518,670,000	1,000,000,000

**Source:** data processed by the author based on information from PAID.

The construction and annual purchase of the reinsurance program follows a well-established process, going through a certain flow, in stages and deadlines, so that the renewal of the reinsurance program could be carried out in due time, while ensuring the quality of the contractual partners and optimizing costs.

#### **Analysis of PAID reinsurance program**

The reinsurance program capacity is set as a result of modelling PAID portfolio and estimating the probable maximum loss (PML) using various earthquake scenarios, using the Solvability II and RMS models. The return period scenario used for setting the limit of the reinsurance program is minimum of 1:200-year. Based on the portfolio, the capacity is adjusted recurrently with new layers.

*Company own retention* is set considering its impact on solvability and own funds. Pursuant to the articles of incorporation, own retention may only be a maximum of 50% of the company net assets. The risk management policy also limits the amount of own retention for earthquake and flood to a maximum of 75% of the catastrophe reserve.

*The lay-out of intake* considers the program placement strategy of the reinsured, the appetite and capacity that reinsurers can allocate, as well as ensuring an optimal ratio between cost and level of protection.

*The selection of reinsurers* is made considering the level of their ratings, given by the most important rating agencies, respectively: Standard & Poor's, A. M. Best, Fitch and Moody's. The minimum accepted rating is "A-" given by Standard & Poor's, A. M. Best and Fitch, or A3 given by Moody's. In order to maintain a high standard of reinsurers, there is a rating downgrade clause in the reinsurance treaty, which allows PAID SA to replace a reinsurer who is downgraded below the agreed minimum level during the reinsurance contract period. In order to avoid the risk of counterparty concentration, the company aims to ensure that no single reinsurer/group can hold more than 15% of the reinsurance program intake in the reinsurance portfolio.

The *reinsurance premium* is set separately for each layer of the Reinsurance Program. The information underlying the calculation of the reinsurance cost is: the company's portfolio (exposure), the loss history, the structure of the reinsurance program (intake, retention, layers, reunifications) and the terms of the reinsurance contract.

The *cover granted through reinsurance* fully follows the PAD cover conditions, i.e. the reinsurance contract covers direct and indirect damage caused by natural disasters (earthquake, landslides and floods) as provided for in Romanian laws and regulations and covered by the PAD policy.

*Categories of expenditure deducted on the reinsurance program:* Compensation paid to policy holders (in excess of own retention), benefits, expenses relating to expert appraisals and claims handling, court costs (including court costs in the event of an appeal against a claim), direct damage caused by demolition activities carried out by order of a duly constituted civil or local authority at the time and during the period of the event, for the purpose of providing claims management, subject to compliance with the terms and conditions of the reinsurance contract. The Nat Cat reinsurance contract only covers the natural catastrophes and not the man-made ones, as neither the PAD policy covers these risks. By way of an exception, the reinsurance contract covers damages caused to residential properties caused by landslides and/or floods, as a result of acts of terrorism.

*Loss recovery through the reinsurance program:* There is no need for any official certification to recover loss from reinsurance. The reinsured is the only party able to define/set a loss which is covered by the PAD policy and the limits of the contract. Loss shall be recovered from reinsurance based on the statements of claims.

*Claim notification:* Pursuant to the reinsurance contract, the Reinsured shall notify the Reinsurers in writing upon the receipt of a claim notification, if the claims paid and the reserve make up more than 75% of PAID net retention. As an event-related claims increase, the reinsurers shall be informed thereupon in the statements of claims which tabulate the damages on each layer. PAID shall inform the reinsurance brokers thereupon and the latter shall notify each reinsurer in its turn.

*Reserves:* The notified claims reserve shall be calculated by the Claims Department as the sum of the reserves for notified claims. The reserve for non-notified claims shall be calculated by the Actuarial Department. The assigned reserve for claims shall be calculated by the Reinsurance Department in the case of the notified claims and by the Actuarial Department in the case of the non-notified claims.

The recovery shall be performed vertically, based on layers, from a sublayer upwards until the last layer, depending on the size of the loss. Loss shall be recovered based on the estimated loss value, within the limits set in the *Claims settlement* clause, based on the assigned statements of claims, drafted by PAID.

*Reintegrating the program intake:* The reinsurance contract provides for a pre-paid reintegration. Reintegration is necessary to provide protection through post-event reinsurance and decrease the solvability capital requirement, pursuant to Solvency II provisions. In the case of Nat Cat contracts, the reintegration premium is usually 100% of the reinsurance premium. The reintegration premium shall be calculated pro-rata in connection with the value of the loss and the remaining contract time.

*Criteria to supplement the reinsurance program:* The reinsurance program may be supplemented by additional layers, whenever the PML exceeds the intake. Increasing portfolio results in increasing PML, which, in its turn, influences program intake. The reinsurance cost shall also increase depending on the intake increase. Thus, the relation between the two is a chain increase.

## Conclusions

Reinsurance should not only be understood as an element of cost, but more than ever, it should be seen as an element that brings added value for insurance companies and can be considered a risk transfer element, but also a financing system.

Currently, there is a growing trend in the regulatory and supervisory system at EU and even global level, which focuses on the risk sensitivity/vulnerability of the capital requirements and the transparency of the insurance market. In view of a stable growth of the insurance and reinsurance market, the trend is to further the intensive dialogue between the regulatory authorities and the insurance-reinsurance companies.

In the case of Romania, traditional reinsurance contracts are still seen as the best risk transfer option, as these also focus on other objectives, such as the level of financial results or efficient capital management. In fact, risk-based supervision is mainly aimed at the efficient management of the risk profile and the regulatory capital, considering the risk transfer in corroboration with partners' rating, which leads to the conclusion that reinsurance becomes a capital management tool.

Capital management through reinsurance can have effects on the volatility of profits/earnings, dividend levels and return on equity. One of the most important aspects of a reinsurance program is to estimate the reinsured risk transfer level. In order to determine this risk transfer level companies as well as the regulators may need to carry out quantitative tests. The regulators should be more risk-based oriented. The risk management should be enhanced in order to have a more prudential approach.

Due to the technical complexity of quantitative tests, the lack of resources and specialized technical tools, both insurance companies and supervisory and regulatory authorities may face problems in applying and using them individually and directly, having to turn to companies specialized in catastrophic risk modelling (reinsurance brokers) or actuarial consultancy. Romania, one of the objectives of the BSR (Balance Sheet Review) exercises in 2015 and 2021, as organized by the Financial Supervisory Authority at the insurance market level, was to verify the level of risk transfer in reinsurance programs.

Risk-based management allows insurance companies to include reinsurance as a capital management tool, transparently and increasing adequacy, whereas reinsurers focus on the value proposition of reinsurance solutions based on quantitative and qualitative capital management analyses.

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## References

- Badea, D. and Nagy, L., 2012. Lecture in Insurance and Reinsurance: <<https://www.scribd.com/document/79075271/Asigurari-Si-Reasigurari-Cursuri-Prof>>
- Boonen, T., 2020. A discussion of optimal reinsurance designs based on risk measures: a review'. *Statistical Theory and Related Fields*, Vol. 4, No. 1, 14-15, <<https://doi.org/10.1080/24754269.2020.1765128>>
- Borch, K., 1969. The optimal reinsurance treaty. *ASTIN Bulletin: The Journal of the IAA*, Vol. 5, No. 2, pp. 293-297.

- Carter, R.L. (Ed.), 2013 *Reinsurance*. Springer Science & Business Media.
- Chester, A., Johansson, S., Michel-Kerjan, E., Rachok, O. and Dong, M., 2017. Global reinsurance: Fit for the future?, September, p. 3, <<https://www.mckinsey.com/industries/financial-services/our-insights/global-reinsurance-fit-for-the-future>>
- Cheung, K., 2010. Optimal reinsurance revisited – a geometric approach. *ASTIN Bulletin: The Journal of the IAA*, Vol. 40, No. 1, pp. 221-239.
- Cole, C. and McCullough, K., 2006. A reexamination of the corporate demand for reinsurance. *Journal of Risk and Insurance*, Vol. 73, No.1, pp. 169-192.
- Cummins, J., Dionne, G., Gagné, R. and Noura, A., 2021. The costs and benefits of reinsurance. *The Geneva Papers on Risk and Insurance-Issues and Practice*, Vol. 46, No. 2, pp. 177-199.
- Ernst & Young, 2019. Reinsurance risk transfer and accounting key topics, Casualty Actuarial Society, David L. Brown, EY Bermuda Ltd., September 17, (conference).
- Eslyn, J. and Santomero, A., 2000. The design of private reinsurance contracts. *Journal of Financial Intermediation*, Vol. 9, No. 3, pp. 274-297.
- Froot, K., 2001. The market for catastrophe risk: a clinical examination. *Journal of Financial Economics*, Vol. 60, No. 2-3, pp. 529-571.
- Froot, K., 2008. The intermediation of financial risks: Evolution in the catastrophe reinsurance market. *Risk Management and Insurance Review*, Vol. 11, No. 2, pp. 281-294.
- Garven J. and Lamm-Tennant J., 2003. The demand for reinsurance: Theory and empirical tests. *Insurance and Risk Management*, Vol. 7, No. 3, pp. 217-237.
- Groome, T., Kim, Y., Lee, W., Ohashi, K., Schnure, C. and Thorne, R., 2004. Risk Transfer and the insurance industry, International Monetary Fund.
- Gurenko E., Itigin, A. and Wiechert, R., 2012. Insurance Risk Transfer and Categorization of Reinsurance Contracts, December, <[https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2194780](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2194780)>
- James, M., 2017. Risk Transfer Program and Economic Analysis of An Index-based Insurance for Earthquake Risk, 28 September, p. 2, <<https://www.asiarisktransfer.com/pdf/publications/Risk%20Transfer%20Programme%20and%20Economic%20Analysis%20of%20An%20Index-based%20Insurance%20for%20Earthquake%20Risk.pdf>>
- Mayers, D. and Smith Jr., C., 1990. On the corporate demand for insurance: evidence from the reinsurance market. *Journal of Business*, pp. 19-40.
- Radu, N. and Alexandru, F., 2022. Parametric Insurance – a possible and necessary solution to insure the earthquake risk of Romania, *Risks*, Vol. 10, No. 3, p. 59.
- Yichun, C. and Tan, K., 2013. Optimal reinsurance with general premium principles. *Insurance: Mathematics and Economics* Vol. 52, No. 2, pp. 180-189.
- Zhao, Y., Lee, J.P. and Yu, M.T., 2021. Catastrophe risk, reinsurance and securitized risk-transfer solutions: a review. *China Finance Review International*.
- Zietsch, D. and von Harpke, M. (Eds.), 2014. A Reader in Insurance and Reinsurance Metrics. Vol. 15. VVW GmbH.

#### Websites:

<[www.paidromania.ro](http://www.paidromania.ro)>

<[www.asfromania.ro](http://www.asfromania.ro)>

<[www.insse.ro](http://www.insse.ro)>

<[www.munichre.com](http://www.munichre.com)>

<[www.mdpi.com](http://www.mdpi.com)>

## Normative analysis of the impact of Covid-19 on prominent sectors of Indian economy by using ARCH Model

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**Abstract.** *Covid-19 has adversely affected all the nations and all the sectors of all nations. However, the effect of the same on all the sectors of the economy need not be uniform. Moreover, the severity of impact need not be the same across consequent waves. Knowing the severity of the impact across the waves as well as across the time periods shall be quite useful for the purpose of policy formulation. ARCH modelling helps us to gauge the intensity of shocks sustained across the sectors through heteroscedasticity which can be read as a proxy for shock. To understand the severity of shock across the sectors, the share value of the prominent companies across the sectors have been taken as a proxy for their performance. Evaluating the severity of shocks across the sectors shall help the government to note which sector needs greater support so as to create conducive fiscal and monetary initiatives to enable the economy to achieve the state of normality. This paper is designed to bridge the aforementioned research gap.*

**Keywords:** Covid-19, ARCH models, volatility, share market prices, impact on sectors, implications on government policies.

**JEL Classification:** C22, F63, F65, F68.

## Introduction

Covid-19, pandemic has caused severe disruption in the working of entire global economy by creating shocks in demand and supply chain. On one hand, there has been disruption in demand because of the disruption caused to the purchasing power of masses by the pandemic induced lockdown. On the other hand, due to the demand shock, it has created subsequent supply shock in the economy as well. The severity of impact across the globe could be seen in 3 phases. Initially China became the epicenter of the pandemic, Gradually Italy, UK, France became the epicenters of the pandemic. In the next phase the brunt of the pandemic was severely felt by the economies of United States of America and India. Given the scarcity of resources and the severity of the burden of the pandemic, Indian economy implemented lockdown spanning 7 to 8 months in the first wave and 3 to 4 months in the second wave. This, needless to say has adversely affected all the sectors of the economy. Although the scale and intensity may vary across various sectors, it is pertinent to quantify the same, to understand the severity of the shock across the sectors. This has important policy ramifications at various levels. To begin with at macro level, the Central and State Governments can be in a better position to understand the severity of impact of Covid-19 across various sectors so as to take measures to mitigate the adverse impact of the same. Moreover, understanding the severity of impact across the sectors can also enable the Government at national level to safeguard the interests of the said sectors while discussing terms of trade at international level in near future.

Our paper at hand focuses on analyzing the adverse effect of Covid-19 across Indian Economy. It is widely known and acknowledged that, the pandemic by shutting down the economy has adversely affected the purchasing power of masses which in turn has reduced the aggregate demand, thereby adversely affecting the production and investment cycle across all the sectors. However, at the same point of time having a general idea of how much the pandemic has affected various sectors in terms of intensity in first wave and the second wave is not only going to help the policy makers to identify the resilience of various sectors to demand shock, but it is also going to help them to analyze the effectiveness of the policy initiatives undertaken by the Government to help the sectors to recover. The paper also aims to identify the measures which could be taken by the Government to further enhance the resilience of the sectors so as to make them less vulnerable for the aforesaid type of shocks. The findings of the study are aimed to throw light on the repercussions of Covid-19 on the economy which can be used by important stakeholders like policy makers, market participants, portfolio managers and investment bankers to take appropriate decisions.

To measure the volatility across sectors the paper has taken the share prices of the prominent private and public companies across the sectors as a proxy for measuring the adverse impact of Covid-19 on Indian Economy which has been empirically analyzed by ARCH modelling technique.



### Literature review

Covid-19 has created a severe financial and health crisis across the Globe (Estrada, 2020; Gao et al., 2021). Some of the literature has likened the impact of the pandemic to be of a magnitude similar to that of great depression of 1930s. While the comparison may be debatable, one cannot shy away from the fact that, the pandemic has adversely affected all the sectors. Understanding the impact of the same would be pertinent in relevant policy formulation. Share market has been seen as a barometer for the movement of economic activities at macrolevel. The performance of share prices of prominent companies in Industries can be used as a proxy to understand the health of the given sector. (Black, 1976.; Glosten et al., 1993, and Nelson, 1991) In the context of Indian economy, fluctuations in share values across the sectors can be inferred by analyzing the trends in stock indices like National Stock Exchange (Nifty) or Bombay Stock Exchange-Sensex.

ARCH and various variants of GARCH models have been widely used by previous studies for understanding the impact of Covid-19 on share market. (Alfaro et al., 2020; Ashraf, 2020; Baig et al., 2021) Some studies have also tried to understand the impact of natural disasters on the performance of share market by constructing various variants of ARCH and GARCH models (Estrada, 2020; Schoenfeld, 2020; Fomby et al., 2013; Ferreira and Karali, 2015). Needless, to say such studies which have been undertaken at earlier level have shown that the natural disasters have adversely affected the performance of share markets. (Skidmore and Toya, 2002; Ramelli and Wagner, 2020) Even recent studies have used similar econometric tools to understand the impact of Covid-19 on performance of share markets of China, which of course has been negative.

There can be no second thought that, the effect of Covid-19 has adversely affected on various sectors on the world economy (Estrada, 2020 and Schoenfeld, 2020). In no uncertain terms, the prominent capital markets were adversely affected by the global pandemic which was duly reflected in respective indices of capital market worldwide. However, knowing the problem exists is one thing and knowing the severity of the problem is other. Since the effect of the pandemic across the sectors will not be even, the measures which needs to be taken by the government across the sectors need not be even as well. Moreover, when it comes to Indian Economy, the contributions of the sectors are highly skewed. The most prominent sector in Indian economy is the Service Sector which contributes nearly 54 percent of the gross domestic product while employing 32.28 percentage of the workforce, while Industry contributes nearly 26 percent to the nation's GDP while employing 25.12 percentage of workforce while Agriculture contributes nearly 20 percent to the nation's GDP while employing 42.6 percent of India's workforce. Agricultural sector has been relatively robust and immune to the adverse impact of the pandemic. However, it was the Industrial and service sector which were severely affected from the pandemic, which together contributes to nearly 80 percentage of Gross Domestic Product. The blatant contraction of the two sectors is reflected in the contraction of Indian GDP by nearly 24 percentage in the wake of first Covid-19 wave which was severely experienced from the period of March 2020 to mid-September 2020, in which the entire nation was under lock down. This severely affected both service sector and Industrial sector. The second wave's impact was profoundly felt from the month of beginning of

March 2021 to the late of August 2021. However, the second wave in terms of devastation on human life was more severe, particularly due to shortage of medicines and hospitals. The impact was profoundly felt in industrial and service sector. This shock in the macroeconomic variables is reflected in the finance market indices as well.

**Research Gap.** Although it is evident that the pandemics effect has been severely felt across all the sectors, it will be pertinent to know the intensity of shock across the sectors. This shall enable the Government to formulate appropriate policies to utilize the scarce resources to promote necessary sectors so as to help the economy recover. The research tries understand the intensity and severity of shock spread across the sectors so as to bring out implications concerning policy formulation.

**Hypotheses.** In the hindsight, it seems that the severity of shock will be more on Industrial sector as compared to financial or Service sector as Industrial sector depends prominently on domestic demand as opposed to service sector whose demand would seem to be more resilient due to diversified markets and relatively higher global presence. Hence the hypotheses for the given research is formulated as under:

1. Severity of shock will be more pronounced in Industrial Sector as opposed to Service sector.
2. Severity of Shock due to adverse effect of Covid-19 will be more pronounced in case of Companies which are less diversified than the companies which are more diversified.

**Research methodology.** The objective of the research paper is to analyze the intensity of the adverse impact of the pandemic on various sectors of the Indian Economy. For reaching the aforesaid objective, to begin with we acknowledge that the Financial Market Indices like NSE-NIFTY or Bombay Stock Exchange SENSEX, can be considered as barometers for the performance of the economy. Based on the market capitalization, we identified three prominent companies in Industrial Sector, Financial Sector and Service sector for the purpose of analyzing the trends in their share values over a period spanning two years from March 10<sup>th</sup> 2018 to March 10<sup>th</sup> 2021 which was collected on daily basis. In Industrial Sector the three companies which has been chosen based on their share value and market presence were Maruti Suzuki which is the largest car manufacturer in India (Mukherjee, 2020), Ultra Tech Cement which is the largest grey cement manufacturer in India and Tata Steel which is the second largest steel producer in India. To assess the repercussions on the pandemic on Financial sector the chosen banks were State Bank of India which is the largest Public Sector Bank in India which also the only public sector bank which is listed in fortune 500 companies., Canara Bank which is the third largest Nationalized Bank in India, Bank of Baroda, which is the second largest Nationalized Bank in India (Business Today, 2019). Finally, to assess the impact on Service Sector the prominent companies which were chosen were Tata Consultancy Services which is the largest Information Technology Service company in the world by Market Capitalization, Tech Mahindra which has its presence in 90 countries and which is also the 5<sup>th</sup> largest IT company in the world, HCL Tech, which is in the Forbes Global 2000 list and which is among the top 20 traded public companies in India with a market Capitalization of 50 billion dollars as of September 2021.

To analyze the impact of pandemic's shock in the course of two waves we have been built stable ARCH models for the 9 companies chosen across the three sectors. Before dwelling

into the intricacies and stability of the model, a brief introduction to the Concept of volatility and ARCH Model becomes relevant.

**Volatility** being one of the measures of dispersion, helps in assessing returns for a given particular security or market index. The concept of volatility in terms of financial market can be understood as measurement of risk. If volatility is more, it means the security is subject to greater amount of risk and vice-versa. (McAleer and Medeiros, 2008) The macroeconomic indicators play a vital role in affecting the volatility in Bombay Stock Exchange or National Stock Exchange. Since pandemic has adversely affected the macroeconomic indicators, the effect of the same is going to be reflected in BSE and NSE as well, hence for the purpose of research they are regarded as barometers of economic performance. Now, when we assess the volatility of prominent companies across the chosen sectors, juxtaposing them during the period of pandemic, we will be able to assess the adverse shock created by Nation Wide lockdown which was imposed in the backdrop of pandemic waves in the span of two years. To assess the impact of shock in the chosen Time Series ARCH Model has been used.

**Auto regressive conditional heteroscedasticity model** is an econometric tool used to analyze the residual result which is left unexplained by other econometric models which is represented by the error term. ARCH models are effectively used to model time varying volatility and volatility clustering in financial time series (Bollerslev, 1986; Engle, 1982; Caporin and McAleer, 2008; Mishra, 2017) Before constructing ARCH models, first we have to ensure that there is presence of ARCH effect in the chosen time series. The ARCH effect basically implies that periods of low volatility tends to be followed by periods of low volatility over a prolonged period of time and period of high volatility is followed by the period of high volatility over a prolonged period of time. It is to be noted that ARCH type models are different from stochastic volatility models since at any given point of time 't', the volatility is pre-determined, given, the previous values (Asai et al., 2006) ARCH (1,1) model has two equations. One is the Conditional Mean Equation which is represented as:

$$Y_t = \alpha + \beta X_t + \varepsilon_t \quad (1)$$

Wherein  $\varepsilon_t | \varepsilon_{t-1} \sim N(0, \sigma_t^2)$

The variance Equation is represented as:

$$\sigma_t^2 = \omega + \sum_{i=1}^p \delta_i \varepsilon_{t-i}^2 \quad (2)$$

In Equation 1,  $\varepsilon_t$  is the error generated from the mean equation at time t and  $\sigma_t^2$  is the conditional variance equation. The conditional mean equation shall be helpful in forecasting, whereas the conditional variance equation shall be helpful in observing the volatility or shocks in the given time series.

**Residual diagnostics to check the stability of the model.** In order to ensure that the ARCH Model which is built for the given time series is stable, there are 2 important conditions which needs to be satisfied. The first and foremost being absence of autocorrelation in the model. This can be verified with the help of Durbin-Watson Statistic whose value must be close to two and Q statistic. In Q statistic, the probability of

standardized residual value must be insignificant, implying there is white noise in the model. The next important residual diagnostic for ensuring the stability of the model is to ensure absence of heteroscedasticity. For ensuring absence of heteroscedasticity in the final model, we can go for ARCH-LM test. The null hypothesis for the test is that there is absence of heteroscedasticity in the model. If the probability value of the relevant test statistic is insignificant, then we will not be having enough evidence to reject the null hypothesis and we can infer that there is absence of heteroscedasticity in the final model.

**Results and discussion.** The objective of the research paper was to examine the intensity of the volatility with the help of ARCH modelling across financial, service and industrial sectors by analyzing the volatility of share prices among prominent three companies chosen in each sector based of their market capitalization.

**Financial sector.** To understand the repercussion of the pandemic wave on financial sector, three prominent banks were chosen: State Bank of India, Canara Bank and Bank of Baroda. The ARCH equation and conditional variance graph for the respective banks are illustrated in Tables 1, 2, and 3 along with Figures 1, 2, and 3 respectively.

**Table 1.** Representing the ARCH (1,1) model for State Bank of India

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(2)	0.029	0.038	0.76	0.44
MA(5)	0.076	0.034	2.19	0.02
Variance Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0005	2.96E-05	19.00	0.00
RESID <sup>2</sup> (-1)	0.1715	0.042	4.00	0.0001

**Figure 1.** Representing the volatility in closing prices for State Bank of India along with conditional variance



**Table 2.** Representing the ARCH Model for Canara Bank

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(5)	0.114	0.027	4.07	0.00
MA(6)	-0.146	0.026	-5.59	0.00
Variance Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0006	3.05E-05	22.19	0.00
RESID <sup>2</sup> (-1)	0.2874	0.042	6.72	0.00

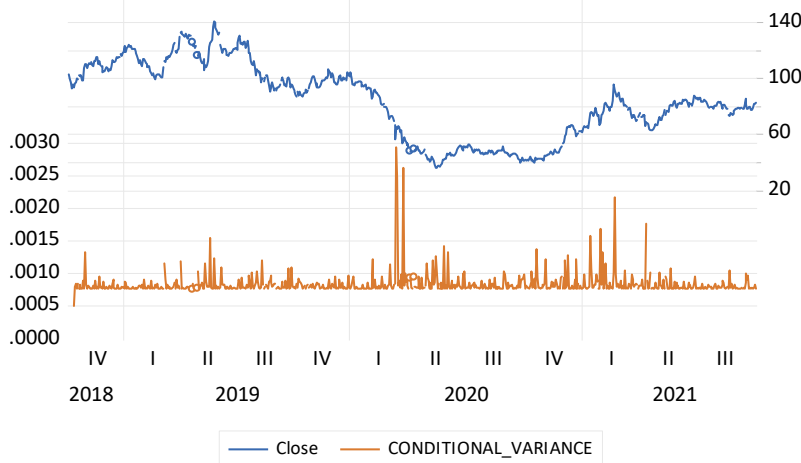
**Figure 2.** Representing the volatility in closing prices for Canara Bank along with conditional variance



**Table 3.** Representing the ARCH Model for Bank of Baroda

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(5)	0.063	0.033	1.90	0.05
MA(6)	-0.077	0.029	-2.61	0.00
Variance Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0007	3.24E-05	23.69	0.00
RESID <sup>2</sup> (-1)	0.0839	0.022	3.66	0.00

**Figure 3.** Representing the volatility in closing prices for Bank of Baroda along with conditional variance



From the above Tables 1 to 3 and Figures 1 to 3, representing the ARCH models of prominent banks in India, we can see that, the impact of pandemic was more severe in the first wave induced lockdown. Although in terms of life lost, the effect of second wave was more devastating, the shock of the same on the financial sector has been relatively less severe as compared to the first shock. The most prominent reason, for the same is Government was more prepared to handle the second wave from the bitter experience of

lockdown initiated during the first wave. Relaxations were given to some prominent sectors like construction and transportation, which in turn created demand for finances in Money and Capital market. Moreover, due to heavy health expenditure incurred by the people in the second wave they were more prone to take credit from the money market.

**Industrial sector.** To understand the repercussion of pandemic wave on Industrial Sector, three prominent companies were chosen for the purpose of analysis. They were Maruti Suzuki, the largest car manufacturer in India, Ultra Tech Cement which is the largest grey cement manufacturer in India and Tata Steel which is the second largest steel producer in India.

The ARCH equations and conditional variance graphs of the three prominent companies representing Industrial sector are illustrated in Tables 4, 5 and 6 along with Figures 4, 5 and 6 respectively.

**Table 4.** Representing the ARCH Model for Maruti Suzuki

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(6)	0.46	0.24	1.89	0.05
MA(6)	-0.42	0.24	-1.73	0.08
Variance Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0003	1.42E-05	24.40	0.00
RESID <sup>2</sup> (-1)	0.1714	0.0151	11.32	0.00

**Figure 4.** Representing the volatility in closing prices for car manufacturer Maruti Suzuki along with conditional variance



**Table 5.** Representing the ARCH Model for UltraTech Cement

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(1)	-0.059	0.28	-2.08	0.03
MA(6)	-0.043	0.24	-1.76	0.07
Variance Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0002	1.07E-05	25.59	0.00
RESID <sup>2</sup> (-1)	0.1714	0.0247	66.91	0.00

**Figure 5.** Representing the volatility in closing prices for UltraTech Cement along with conditional variance



**Table 6.** Representing the ARCH Model for Tata Steel

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(4)	0.069	0.03	2.08	0.03
MA(5)	0.101	0.03	3.01	0.02
Variance Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0006	3.73E-05	16.54	0.00
RESID^2(-1)	0.1715	0.0434	03.94	0.00

**Figure 6.** Representing the volatility in closing prices for Tata Steel along with conditional variance



From Tables and Figures 4 to 6, we observe that even Industries too had suffered severe shock in first wave and interestingly in the second wave, industries especially automobile and cement doesn't seem to have born any shock in second wave at all. Even when we analyze the shocks of steel company, we do not see any particular spike in variance during the second lockdown, although we do observe some shock, it is to be noted that it has occurred after the end of second wave which may have been due to some factors other than the pandemic. Hence, Industries seem to have borne the shock of 2<sup>nd</sup> wave of the pandemic

in a more resilient manner as compared to the financial sector. This is not what was expected as, one of our hypotheses was Industries would be more severely affected by pandemic's shock across two waves due to their dependence on domestic demand. However, the resilience may be attributed to the relaxations given by Government to industrial sector during second wave of the pandemic, which have helped them to cope up with the pandemic in a more resilient manner. Hence although the market of the companies under consideration were limited to India and few other countries, due to the relaxation provided by the Government and the predominant share of the domestic market of the industries, the major players of Industrial sector were able to absorb the second wave's shock in a resilient manner.

**Service sector.** To gauge the repercussions of pandemic on tertiary sector, three prominent service sector enterprises were taken into consideration which were namely, Tata Consultancy Services, Mahindra Tech and HCL Tech. The ARCH equations and the conditional variance graphs of these prominent enterprises are illustrated through Tables 7 to 9 and Figures 7 to 9 respectively.

**Table 7.** Representing the ARCH Model for Tata Consultancy Services

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(1)	-0.03	0.02	-1.62	0.10
MA(5)	0.08	0.02	-3.11	0.00
Variance Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0001	6.62E-05	30.01	0.00
RESID <sup>2</sup> (-1)	0.1714	0.0313	05.47	0.00

**Figure 7.** Representing the volatility in closing prices for Tata Consultancy Services along with conditional variance

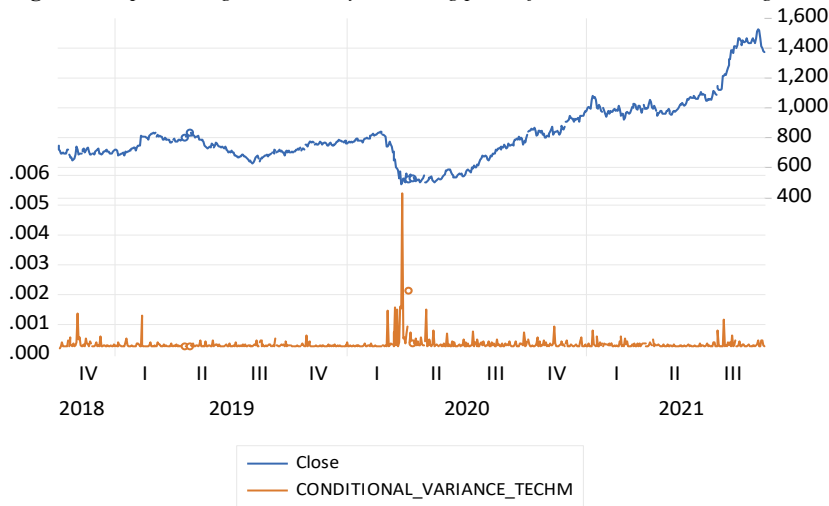


**Table 8.** Representing the ARCH Model for Tech Mahindra

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(1)	0.06	0.030	-1.62	0.04
MA(6)	-0.03	0.022	-1.67	0.09
Variance Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0002	1.01E-05	27.99	0.00
RESID <sup>2</sup> (-1)	0.1714	0.0180	09.49	0.00



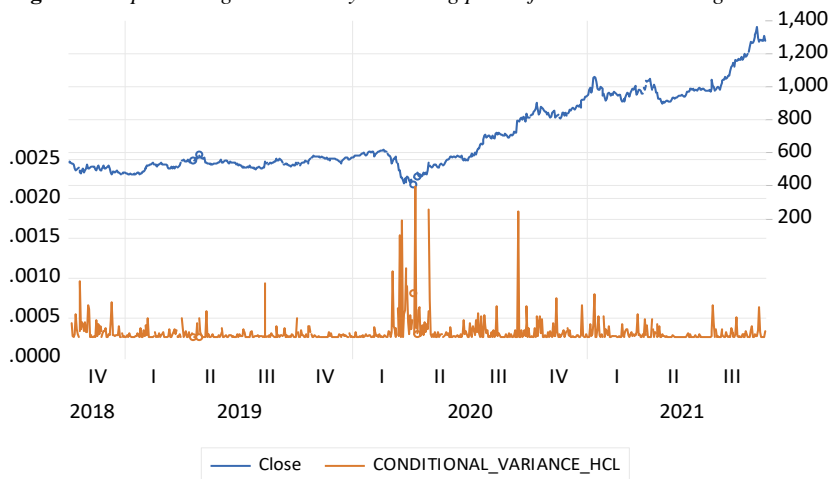
**Figure 8.** Representing the volatility in closing prices for Tech Mahindra along with conditional variance



**Table 9.** Representing the ARCH Model for HCL Tech

Variable	Coefficient	Std. Error	z-Statistic	Prob.
AR(2)	-0.04	0.023	-2.14	0.03
MA(5)	0.05	0.023	2.22	0.02
Variance Equation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.0002	8.24E-06	30.53	0.00
RESID^2(-1)	0.1714	0.0277	06.16	0.00

**Figure 9.** Representing the volatility in closing prices for HCL Tech along with conditional variance



According to the hypotheses framed, we assumed that, the companies which had diversified markets were relatively more resilient in facing demand shock induced by the pandemic waves as opposed to the companies which had relatively less diversified markets. Diversification of markets was measured in terms of the number of countries in which the enterprises had their subsidiaries. It was also assumed that, service sector would be more

resilient as compared to Industrial sector due to their diversified base. From analysing the volatility in the share prices of the prominent enterprises we infer that the intensity of demand shock was quite severe in the first wave. However, the second wave which made its presence felt in from late 1<sup>st</sup> to early 3<sup>rd</sup> quarter of 2021 does not seem to have affected the share prices. It seems that the diversified markets of the prominent service sector enterprises have indeed enabled them to stay resilient in the face of second wave of the pandemic. It is to be noted that, the intensity of first wave was severely felt all across the world, so, despite diversification of the market, the intensity of demand shock was also felt by service sector enterprises in a significant manner.

**Summary and policy implications.** The objective of the paper was to analyse the intensity and impact of demand shock caused by pandemic across the prominent sectors of the economy. To analyse the same two hypotheses had been framed. One of which being the companies with less diversified markets would be more prone to demand shocks as opposed to the companies which were more diversified. However, this hypothesis although seemed right in context of service sector, did not stand true in context of Industrial Sector. It is true that service sector due to its market diversification seemed resilient in the second. However, in the first wave despite market diversification, we see Indian Service sector receiving severe shock. This may be attributed to the fact that first wave had created a global disruption across all the nations, for which none of the nations were prepared. Hence diversification of markets, couldn't boost the resilience of service sector in the first wave. However, when it comes to second wave, globally the nations were more prepared and most of the nations had put in place adequate infrastructure to systematically deal with the pandemic. Thus, the service sector was able to leverage the diversification of its market to boost its resilience in the face of pandemic's second wave.

Although the market diversification of Industrial companies in terms of their global presence was relatively very less as compared to the global presence of Service Sector Enterprises, the big Industrial Players were able to sail through the second wave relatively smoothly due to the support which was provided to them through relaxation of rules by the Government. The relaxation of restrictions and concessions given by the Government, particularly for construction, transportation and steel production created cross industrial demand enabling these three prominent sub sectors to stay resilient in the face of second wave.

The other hypothesis of the research was that the Industrial sector would be more susceptible to demand shocks as compared to their service counterparts due to their relatively higher dependence on domestic demand. However, due to timely support and relaxations given by the Government to construction and transportation companies they were not as vulnerable as they were supposed to be during the second pandemic induced lockdown.

It is also to be noted that, across the two waves, intensity of shock to the financial sector was more severe than Industrial or Information Technology sector.

Thus, keeping in context the backdrop of the health of prominent players of prominent sectors of the economy, the following measures, if taken by the Government shall aid in faster recovery of the economy:

1. Since, the intensity of shock was more severe in financial sector across the two waves as compared to Industrial or IT Sector, the monetary authority could employ expansionary monetary policy. This shall not only help financial sector to revert back to normalcy at a faster pace, it shall also help the economy recover faster through operation of both multiplier and accelerator effect.
2. It is interesting to observe that, due to domestic support provided by the Government in the eve of second Wave, Industry and transportation sector were able to face the demand shock in a more resilient manner. On the other hand, the improving global condition, helped to provide conducive environment for the prominent players in the Information Technology sector to remain resilient in the backdrop of second wave. Thus, in the current position, it would be rational for the Government to follow balanced approach when it comes to framing measures for putting Industrial and Service Sector in path of recovery and growth.

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## References

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- Alfaro, L., Chari, A., Greenland, A.N. and Schott, P.K., 2020. Aggregate and firm-level stock returns during pandemics, in real-time (0898-2937). NBER Working Papers.
- Asai, M., McAleer, M. and Yu, J., 2006. Multivariate Stochastic Volatility: A Review, *Econometric Reviews*, 25, pp. 145-175.
- McAleer, M. and Medeiros, M.C., 2008. Realized Volatility: A Review, *Econometric Reviews*, 27, pp. 10-45.
- Ashraf, B.N., 2020. Economic impact of government interventions during the Covid-19 pandemic: International evidence from financial markets. *Journal of Behavioral and Experimental Finance*, 27, 100371, <<https://doi.org/10.1016/j.jbef.2020.100371>>
- Baig, A.S., Butt, H.A., Haroon, O. and Rizvi, S.A.R., 2021. Deaths, panic, lockdowns and US equity markets: The case of Covid-19 pandemic. *Finance Research Letters*, 38, 101701, <<https://doi.org/10.1016/j.frl.2020.101701>>
- Black, F., 1976. Studies of stock market volatility changes, Proceedings of the American Statistical Association, Business and Economic Statistics Section, pp. 177-181.
- Bollerslev, T., 1986. Generalised Autoregressive Conditional Heteroscedasticity, *Journal of Econometrics*, 31, pp. 307-327.
- Caporin, M. and McAleer, M., 2008. Scalar BEKK and Indirect DCC, *Journal of Forecasting*, 27, pp. 537-549.
- Estrada, M.A.R., 2020. Economic Waves: The Effect of the Wuhan Covid-19 on the World Economy (2019-2020). *SSRN*, <[https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3545758](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3545758)>

- Ferreira, S. and Karali, B., 2015. Do Earthquakes Shake Stock Markets?, *Plus One*, <<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4510879/>>
- Fomby, T., Ikeda, Y. and Loayza, N.V., 2013. The growth aftermath of natural disasters. *Journal of Applied Econometrics*, 28, pp. 412-434.
- Gao, X., Ren, Y. and Umar, M., 2021. To what extent does Covid-19 drive stock market volatility? A comparison between the US and China. *Economic Research-Ekonomska Istraživanja*, 0(0), pp. 1-21, <<https://doi.org/10.1080/1331677X.2021.1906730>>
- Glosten, L.R., Jagannathan, R. and Runkle, D., 1993. On the relation between the expected value and the volatility of the nominal excess return on stocks, *Journal of Finance*, 48, pp. 1779-1801.
- Mishra, S., 2017. Volatility and calendar anomaly through GARCH model: Evidence from the selected G20 stock exchanges. *International Journal of Business and Globalisation*, 19(1), pp. 126-144, <<https://doi.org/10.1504/IJBG.2017.085105>>
- Mukherjee, S., 2020. Maruti Suzuki grabs 53% of passenger vehicle market in January. *The Economic Times*.
- Nelson, D.B. 1991. Conditional heteroskedasticity in asset returns: a new approach, *Econometrica*, 59(2), pp. 347-370.
- Ramelli, S. and Wagner, A., 2020. What the stock market tells us about the consequences of Covid-19. Mitigating the Covid Economic Crisis, <<https://voxeu.org/article/what-stock-market-tells-us-about-consequences-covid-19>>
- Schoenfeld, J., 2020. The invisible risk: Pandemics and the financial markets, <[https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3567249](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3567249)>
- Skidmore, M. and Toya, H., 2002. Do natural disasters promote long-run growth? *Economic Inquiry*, 40, pp. 664-687.
- Zakoian, J.-M., 1994. Threshold heteroskedastic models, *Journal of Economic Dynamics and Control*, 18(5), pp. 931-955.

## Linear and nonlinear effect of exchange rate on inflation in Pakistan

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**Abstract.** *This study analyzes linear and nonlinear impact of exchange rate on inflation in Pakistan. Time series analysis is performed under ARDL and nonlinear ARDL framework to analyze that how in long and short run inflation get affected by exchange rate. Time series data (monthly) of Pakistan from 1980 (January) to 2019 (April) is utilized for analysis. ARDL model shows that real effective exchange rate has negative and significant impact on inflation in the long run, however, nonlinear ARDL (NARDL) model found that exchange rate depreciation increases inflation in long run, while appreciation decreases inflation in long run. The NARDL model proves that exchange rate has nonlinear effects on inflation in Pakistan. One-way causality exists from inflation to exchange rate as well as to appreciation of exchange rate in Pakistan. Government has to formulate policies to stabilize the exchange rate, while strong financial and capital markets are required to minimize risk of exchange rate to protect the international competitiveness.*

**Keywords:** exchange rate, inflation, ARDL, NARDL, Pakistan.

**JEL Classification:** C22, E31, F31.

## 1. Introduction

Continuous increase in prices have always been a serious concern for policy makers in developing economies. It is more adverse when the imported prices cause to increase or decrease the domestic prices. Imported prices lead to fluctuate in the domestic prices due to which the domestic policies become less effective. Policy makers show reluctance to undertake the adjustment of exchange rate, despite the recognition of overvaluation of the prices. Increase in price level undercut the competitiveness that devaluation is designed to achieve. Several developing economies faces the fluctuation in prices which is considered to be dangerous for economic growth and prosperity. Prices started to increase from mid-1970 in Pakistan, while exchange rate shows depreciation continuously from 1980.

Fluctuations in the domestic price level is explained by foreign inflation in less developed economies of Asia (Rana and Dowling, 1985). Therefore, developing countries cannot perform much to control domestic inflation, while developed economies have efficient policies to control inflation as well as influence the developing countries inflation. Generally, monetary expansion is linked with inflation. Price level increase is represented through proliferation of money supply. Exchange rate elasticity is chosen because it socializes devaluation and is less disturbing for the economy. Exchange rate adjustment is considered to be a controversial policy. Fluctuation in exchange rate policy leads to disturbance in income distribution and economy as whole. Various researchers analyzed association among exchange rate and inflation. Dornbusch (1987), Krugman (1986), Knetter (1989), and Choudhary and Khan (2002) showed no association among exchange rate and inflation. Rana and Dowling (1985), Deravi et al. (1995), Choudhri and Hakura (2006), Choudhri et al. (2005), Zorzi et al. (2007), Jaffri (2010), Monfared and Akin (2017), and Musawa and Mwaanga (2017) found positive relation between inflation and exchange rate. However, Wang (2013), Wu and Yu (2017) argued that exchange rate causes domestic prices to fall.

In recent times, the major objective of government policy is to control domestic inflation as well as exchange rate. These policies maintain economic stability and employment in the country without direct intervention of government. Much work is done in this context in developed economies, but there is slight work in Pakistan. This paper fills the gap by providing empirical analysis on the association among inflation and exchange rate. Major goal of this research is to measure linear and nonlinear impact of exchange rate on inflation in Pakistan. Major prominence of this research is to provide better knowledge and understanding to policy makers in evaluating and understanding how exchange rate affects the inflation. This study is useful for government officials and central banks for making the desirable decision in macroeconomic policy to maintain exchange rate fluctuation and economic growth.

Remaining paper is arranged as: Review of literature is discussed in Section 2. Section 3 focused on methodology and data. Section 4 contain findings of linear and nonlinear impact of exchange rate on inflation. Conclusion and policy recommendations are provided in Section 5.

## 2. Literature review

Pass-through of incomplete exchange rate is explained through industrial organization theory of Dornbusch (1987), Krugman (1986), and Knetter (1989), which argued about no effect on prices of exchange rate. Rana and Dowling (1985) analyzed relationship among inflation and exchange rate in nine Asian under-developed economies. Results depicted that increase in money supply and fluctuation of exchange rate showed no effect on inflation. Krugman (1986) examined the real impact of prices to market by foreign suppliers in Germany through movement in exchange rate. Results depicted that pricing to market is not universal, while the import prices of transport equipment and machinery are sticky. Deravi et al. (1995) examined how exchange rate depreciation impacts price level. Results depicted that inflation rise because of money supply and exchange rate. Moreover, depreciation of dollar lead to increase in the inflation over the last two decades.

Siddiqui and Akhtar (1999) analyzed that how fluctuations in foreign prices affect domestic prices in Pakistan. They found that significant unidirectional and bi-directional association exists among the fluctuation in the domestic prices and exchange rate. Choudhary and Khan (2002) examined linear association of inflation with exchange rate. Results showed that no association exists among inflation and devaluation of rupees. Hyder and Shah (2004) examined exchange rate impact on wholesale and consumer price index in Pakistan. Findings depicted moderate effects on domestic prices of exchange rate. However, exchange rate impacts wholesale prices more than consumer prices.

Choudhri et al. (2005) analyzed exchange rate pass-through on prices under open economy macroeconomic models. Results showed positive association among inflation and exchange rate, while currency policy is used to control the inflation by keeping the inflation at lower levels. Choudhri and Hakura (2006) investigated association among low inflationary pressure and less exchange rate in seventy-one countries from 1979 to 2000. They showed significantly positive association among exchange rate and inflation. Zorzi et al. (2007) analyzed mechanism of pass through of exchange rate to prices in twelve developing economies of Asia, Latin America and various parts of Europe. Positive association among pass through of exchange rate and inflation was found, this also supports Taylor's hypothesis.

Jaffri (2010) examined effects on consumer price index in Pakistan of exchange rate from 1995 to 2009. Results showed that foreign inflation lead to increase in domestic inflation. Wang (2013) examined how exchange rate impacts fluctuations in prices in China from 2005 (July) to 2013 (June). They found that nominal exchange rate and CPI are negatively associated, while ratio of pass through depicts hysteretic behavior. Helali et al. (2014) examined how exchange rate fluctuations impact in long and short run in Tunisia. Results depicted that exchange rate effects prices strongly but not output.

Monfared and Akin (2017) analyzed relationship among inflation and exchange rate in Iran. Findings showed direct proportionality among inflation and exchange rate. Moreover, money supply has positive relation with inflation and inflation only gets affected by money supply but not exchange rate. Musawa and Mwaanga (2017) examined how macroeconomic components and prices of commodities impact stock market. They found

that exchange rate immediately affects stock market and causes price level to increase. Wu and Yu (2017) analyzed effect of fluctuation in Australian dollar- Chinese renminbi exchange rate on consumer price index. Findings showed negative association among consumer price index and Australian dollar-Chinese renminbi.

### 3. Methodology and data

Fluctuation in exchange rate causes import prices to change which then leads to change domestic prices of goods and services. Bailliu and Fujii (2004), Khundrakpam (2007), and Ghosh and Rajan (2008) proposed theoretical and empirical model to inspect effects on domestic prices of exchange rate pass-through. Following time series model is used to estimate the association among inflation and exchange rate. First model measures linear impact of exchange rate on inflation as:

$$INF = f(REER) \quad (1)$$

Where, INF is inflation, and REER is real effective exchange rate.

Second model examines nonlinear impact of exchange rate on inflation as:

$$INF = f(REER^+, REER^-) \quad (2)$$

Where,  $REER^+$  and  $REER^-$  are decomposition of partial sums of variables.

Time series analysis should be deal with proper care otherwise it produce misleading results. For avoiding unit root problem, PP and ADF tests are used. Dickey and Fuller (1981) described the “Dickey Fuller (DF)” unit root test assumes that error term is uncorrelated. Augmented Dickey Fuller (ADF) test is used when there is problem of serial correlation and Dickey Fuller unit root test is augmented via considering the lag of dependent variable. To avoid the problem of serial correlation, Phillips and Perron (1988) does not add the lag of dependent variable, while it uses the non-parametric statistical method to resolve the issue.

Cointegration among variables can be checked through different techniques (Johansen and Juselius, 1990; Engle and Granger, 1987). Pesaran et al. (2001) proposed “Autoregressive Distributive Lag (ARDL)” model in which variables have mixed integration order. ARDL bound test have two assumptions such as no variable is integrated of I(2), while regressand must be integrated of order I(1). ARDL bound technique is much better than other approaches because pre-testing is not necessary. However, adjustment in short run is depicted by error correction term (ECT) with long run specification of ARDL model with the simple linear transformation:

$$\Delta \ln Y_t = C + \sum_{i=1}^p \alpha_i \Delta \ln Y_{t-i} + \sum_{i=1}^p \beta_i \Delta \ln X_{t-i} + \varphi_1 \ln Y_{t-1} + \varphi_2 \ln X_{t-1} + \varepsilon_t \quad (3)$$

Where,  $\alpha$  and  $\beta$  represent the dynamics of short run coefficients, long run coefficients are represented by  $\varphi_1$  and  $\varphi_2$  which depicts the marginal changes in dependent variable caused by fluctuations in independent variables, and first difference of the variable is represented by  $\Delta$ . Following null hypothesis is used to check cointegration:



$H_0: \varphi_1 = \varphi_2 = 0$  (No cointegration)

$H_1: \varphi_1 = \varphi_2 \neq 0$  (Cointegration)

Null hypothesis should be rejected if F-statistics is more than the upper bound value, while accepted if the value of F-statistics falls below the lower bound values. If value lies among the upper and lower values then results would be indecisive. Dynamics of short run are measured by converting the ARDL model into ‘‘ECM (Error Correction Model)’’. ECT explains adjustment rate of variables towards equilibrium and convergence in short run by a negative sign.

Nonlinear ARDL (NARDL) model explained by Shin et al. (2014) based on Pesaran and Shin (1999), and Pesaran et al. (2001) linear ARDL model. Granger and Yoon (2002) and Schroedert (2003) methodology was adopted by Shin et al. (2014) to decompose a stationary variable into different variations i.e. positive and negative. So, two components for variable  $x$ , partial sum of variables are:

$$x^+ = \sum_{j=1}^t \Delta x_j^+ = \sum_{j=1}^t \max(\Delta x_j, 0) \quad (4)$$

$$x^- = \sum_{j=1}^t \Delta x_j^- = \sum_{j=1}^t \min(\Delta x_j, 0) \quad (5)$$

Long run relation of  $y$  and  $x$  in a nonlinear structure is as follows:

$$y_t = \beta^+ x_t^+ + \beta^- x_t^- + \mu_t \quad (6)$$

$$x_t = x_0 + x_t^+ + x_t^- \quad (7)$$

Where,  $\beta^+$  and  $\beta^-$  are long run parameters, and  $x^+$  and  $x^-$  are scalars of decomposition partial sums. NARDL models can be specified for two variables as:

$$\Delta y_t = \rho y_{t-1} + \theta^+ x_{t-1}^+ + \theta^- x_{t-1}^- + \sum_{j=1}^p \phi_j \Delta y_{t-j} + \sum_{j=0}^q (n_j^+ \Delta x_{t-j}^+ + n_j^- \Delta x_{t-j}^-) + \varepsilon_t \quad (8)$$

The asymmetric changes in the component of  $x$  are given by:

$$m_h^+ = \sum_{j=0}^h \frac{\partial y_{t+j}}{\partial x_t^+} \quad \& \quad m_h^- = \sum_{j=0}^h \frac{\partial y_{t+j}}{\partial x_t^-} \quad (9)$$

ARDL bound test determines long run relation of variables but direction of causality is not provided. Causality is determined through Granger causality test. Granger (1988) said that framework of ECM can be used to determine causal association among variables. Coefficients of lagged term captures dynamics of short run and error correction term has information of causality of long run.

Monthly time series data of Pakistan from January 1980 to April 2019 is utilized for analysis. Data of real effective exchange rate and inflation is taken from Pakistan Economic Survey (various issues). Both the variables are converted into standardize unit for a meaningful comparison.

#### 4. Results

PP and ADF tests result are stated in Table 1. ADF test shows that inflation and exchange rate are integrated of order one. Phillip-Perron (PP) unit root test is used to confirm the results of ADF test and shows that both variables are I(0).

**Table 1. Unit Root Tests Result**

Var	ADF Test		PP Test		Results	
	I(0)	I(1)	I(0)	I(1)	ADF	PP
Inflation	-1.9986	-10.9782***	-3.2122**	-19.4500***	I(1)	I(0)
Exchange Rate	-1.9149	-14.8456***	-1.8143*	-14.7544***	I(1)	I(0)

Note: \*\*\*, \*\*, \* shows significance at 1%, 5% and 10% level respectively.

ARDL bound test is used to find the long run association among the variables. Bound test is applied on both the models and Table 2 reports results. Lag length criterion is based on SIC. Lower and upper bound values is compared with F-statistics (Pesaran et al., 2001). Bound test results depict that F-statistics is greater than upper bound at 1 percent level of significance which shows rejection of null hypothesis in both the models.

**Table 2. Results of Bound Test**

Dependent Variable: Inflation	F-Statistics	1 % critical values Bound Test		Co-integration Exist
<b>ARDL Model</b>				
Model		I(0)	I(1)	
$F_{(Inf REER)}(4, 1)$	10.0048	6.56	7.3	Yes
<b>NARDL Model</b>				
$F_{(Inf REER+, REER-)}(4, 1, 0)$	10.2778	4.19	5.06	Yes

Serial correlation and model specification tests are used to escape from deceptive results. Before estimating the short and long run parameters, Ramsey Reset test and Breusch-Godfrey LM tests for misspecification problem and serial correlation are applied. Diagnostic tests results are shown in Table 3 and indicates that ARDL and NARDL models have no misspecification or serial correlation problem.

**Table 3. Results of diagnostic tests**

Model	Diagnostic Test	F-statistics (p-value)	Results
ARDL Model	Breusch-Godfrey LM Test for Serial Correlation:	1.4226 (0.2422)	No Serial Correlation exists
	Ramsey Reset Test for Model Specifications:	0.40094 (0.6887)	No Misspecification Error
NARDL Model	Breusch-Godfrey LM Test for Serial Correlation:	2.1677 (0.1156)	No Serial Correlation exists
	Ramsey Reset Test for Model Specifications:	0.4891 (0.4847)	No Misspecification Error

Long run and short run parameters are estimated after applying the diagnostic tests as suggested by Pesaran et al. (2001). Long run and short run dynamics of ARDL and NARDL model are reported in Table 4 panel A and B respectively.

**Table 4. Long run and short run dynamics**

Dependent Variable Inflation		
	ARDL Model	NARDL Model
<b>Panel A: Long Run</b>		
REER	-0.5769* (0.3388)	-
REER+	-	-3.1306*** (0.9536)

Dependent Variable Inflation		
	ARDL Model	NARDL Model
REER	-	0.7842*** (0.2668)
Panel B: Short Run ECM		
ECT(-1)	-0.0463*** (0.0103)	-0.0617*** (0.0110)

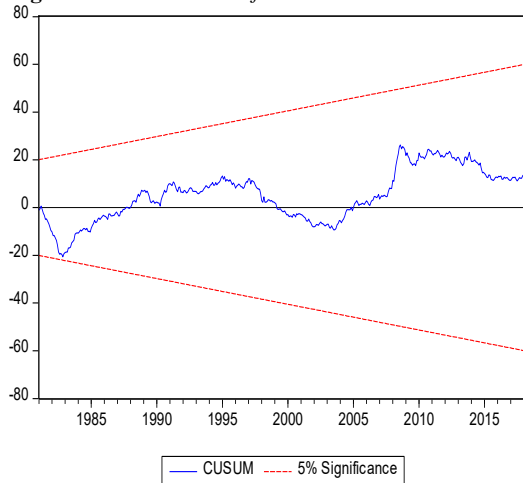
\*\*\*, \*\*, \* shows significance at 1%, 5% and 10% respectively.

**Note:** Standard errors are in parenthesis.

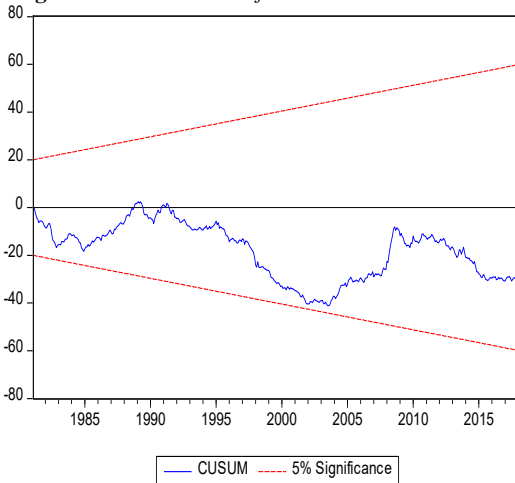
Negative and significant impact of real effective exchange rate exists on inflation in the long run in ARDL model. It indicates that appreciation of exchange rate reduces domestic inflation. These results are consistent with exchange rate depreciation and increase in domestic prices of Rana and Dowling (1985), Deravi et al. (1995), Choudhri and Hakura (2006), Choudhri et al. (2005), Zorzi et al. (2007), Jaffri (2010), Monfared and Akin (2017), and Musawa and Mwaanga (2017). Exchange rate is negatively related with extremely high inflation rate, while favorable exchange rate is linked with low inflation rate for a country. Interest rate have direct association with inflation that influences the exchange rate of the country. Increased consumption level and economic growth is directly proportional to the low level of interest rate due to which currency value increases. When demand increases due to increase in consumption then it eventually lead to increase in inflation. Foreign investment is attracted by high interest rate which tend to increase the fluctuation in the demand for currency.

However, nonlinear ARDL (NARDL) model shows that variable representing positive partial sum (REER+) representing appreciation carries a significantly negative coefficient and implies that appreciation is associated with decrease in domestic prices in long run in Pakistan. Negative sum of real effective exchange rate (REER-) representing depreciation is significantly and positively associated with domestic inflation in Pakistan. The NARDL model shows that exchange rate has nonlinear impact on inflation. Linear ARDL model leads to misleading results, while NARDL shows that exchange rate nonlinearly affected inflation in Pakistan. A country with stable exchange rate leads to higher economic growth and prosperity.

**Figure 1. CUSUM Test of ARDL**



**Figure 2. CUSUM Test of NARDL**



Dynamics of short run is measured by error correction term. ECT explains adjustment rate of variables towards equilibrium and convergence in short run by a negative sign. Table 4 panel B reports the dynamics of short run. ECT term in both models is significant and negative in short run, hence convergence exists. CUSUM test measures the stability of parameters of both ARDL and NARDL model. Figures 1 and 2 shows the CUSUM test of ARDL and NARDL model respectively and shows that both the models are stable. Results of causality test are shown in Table 5. In short run, one-way causality exists from inflation to exchange rate and positive partial sum of exchange rate exchange rate.

**Table 5.** Results of causality test

Model	F-Statistics	Causality
Inflation → Exchange Rate	3.1388*	Yes
Exchange Rate → Inflation	1.1298	No
Inflation → Positive Exchange Rate	6.2659**	Yes
Positive Exchange Rate → Inflation	0.2389	No
Inflation → Negative Exchange Rate	0.5909	No
Negative Exchange Rate → Inflation	0.0064	No

**Note:** \*\* and \*\*\* shows significance at 5% and 1% level respectively.

## 5. Conclusion

Policy makers in developing countries face severe problems to manage imported inflation. Fluctuation of exchange rate increases or decreases domestic prices. This study analyzes linear and nonlinear impact of exchange rate on inflation in Pakistan. Time series analysis is performed under ARDL and nonlinear ARDL framework to analyze long and short run impact. Time series data (monthly) of Pakistan from 1980 (January) to 2019 (April) is utilized for analysis. The major rationale of this research is to provide better understanding to policy makers in evaluating and understanding how exchange rate affects the inflation.

Results of ARDL model in long run showed that real effective exchange rate has negative and significant impact on inflation and indicates that exchange rate appreciation decreases domestic inflation. Results of NARDL model shows that in long run, depreciation increases inflation, while appreciation is negatively and significantly related with inflation. The NARDL model proves that exchange rate has nonlinear impact on inflation in Pakistan. Stable exchange rate increases economic growth and prosperity in a country. One-way causality exists from inflation to exchange rate and positive partial sum of exchange rate exchange rate in Pakistan.

Following policy recommendations are advocated on the basis of above results: firstly, government has to formulate policies for exchange rate stability. Secondly, strong capital and financial markets are required to reduce risk of exchange rate as well as to protect the international competitiveness.

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**References**

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- Bailliu, J. and Fujii, E., 2004. Exchange Rate Pass-Through and the Inflation Environment in Industrialized Countries: An Empirical Investigation, Working Paper No. 21, Bank of Canada.
- Choudhri, E.U. and Hakura, D.S., 2006. Exchange Rate Pass Through Domestic Prices: Does the Inflationary Environment Matter? *Journal of International Money and Finance*, Vol. 25, No. 4, pp. 614-639.
- Choudhri, E.U. and Khan, M.S., 2002. The Exchange Rate and Consumer Prices in Pakistan: Is Rupee Devaluation Inflationary? *Pakistan Development Review*, Vol. 41, No. 2, pp. 107-120.
- Choudhri, E.U., Faruquee, H. and Hakura, D.S., 2005. Explaining the Exchange Rate Pass-through in Different Prices, *Journal of International Economics*, Vol. 65, No. 2, pp. 349-374.
- Deravi, K., Gregorowicz, P. and Hegji, C.E., 1995. Exchange Rates and the Inflation Rate, *Quarterly Journal of Business and Economics*, Vol. 34, No. 1, pp. 42-54.
- Dickey, D.A. and Fuller, W.A., 1981. Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root, *Econometrica*, Vol. 49, No. 4, pp. 1057-1072.
- Dornbusch, R., 1987. Exchange Rates and Prices, *American Economic Review*, Vol. 77, No. 1, pp. 93-106.
- Engle, R.F. and Granger, C.W.J., 1987. Co-integration and error correction: Representation, estimation and testing, *Econometrica*, Vol. 55, No. 2, pp. 251-276.
- Ghosh, A. and Rajan, R.S., 2008. Exchange Rate Pass-through in Korea and Thailand: Trends and Determinants, *Japan and the World Economy*, Vol. 21, No. 1, pp. 55-70.
- Granger, C.W., 1988. Causality, cointegration and control, *Journal of Economic Dynamics and Control*, Vol. 12, No. 2-3, pp. 551-559.
- Granger, C.W. and Yoon, G., 2002. Hidden Cointegration, Economics Working Paper No. 2002-02, University of California.
- Helali, K., Kalai, M. and Boujelben, T., 2014. Exchange rate Pass-Through to Domestic Price in Tunisia: A Short and Long Run Analysis, MPRA Working Paper No. 62204.
- Hyder, Z. and Shah, S., 2004. Exchange Rate Pass-Through to Domestic Prices in Pakistan, Working Paper No. 5, State Bank of Pakistan.
- Jaffri, A.A., 2010. Exchange Rate Pass-through to Consumer Prices in Pakistan: Does Misalignment Matter? *Pakistan Development Review*, Vol. 49, No. 1, pp. 19-35.
- Johansen, S. and Juselius, K., 1990. Maximum likelihood estimation and inference on cointegration-with applications to the demand for money, *Oxford Bulletin of Economics and Statistics*, Vol. 52, No. 2, pp. 169-210.
- Khundrakpam, J.K., 2007. Economic Reforms and Exchange Rate Pass-Through to Domestic Prices in India, Working Paper No. 225, Bank for International Settlements.
- Knetter, M.M., 1989. Price Discrimination by U.S. and German Exporters, *American Economic Review*, Vol. 79, No. 1, pp. 198-210.
- Krugman, P., 1986. Pricing to Market When the Exchange Rate Changes, NBER Working Paper No. 1926, National Bureau of Economic Research.
- Monfared, S.S. and Akin, F., 2017. The Relationship Between Exchange Rates and Inflation: The Case of Iran, *European Journal of Sustainable Development*, Vol. 6, No. 4, pp. 329-340.
- Musawa, N. and Mwaanga, C., 2017. The Impact of Commodity Prices, Interest Rate and Exchange Rate on Stock Market Performance: Evidence from Zambia, *Journal of Financial Risk Management*, Vol. 6, No. 3, pp. 300-313.

- Pesaran, M.H. and Shin, Y., 1999. An Autoregressive Distributed-Lag Modelling Approach to Cointegration Analysis. In S. Strom (Ed.), *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium* (pp. 371-413), Cambridge University Press.
- Pesaran, M.H., Shin, Y. and Smith, R.J., 2001. Bounds testing approaches to the analysis of level relationships, *Journal of Applied Econometrics*, Vol. 16, No. 3, pp. 289-326.
- Philips, P.C.B. and Perron, P., 1998. Testing for Unit Root in Time Series Regression, *Biometrika*, Vol. 75, No. 2, pp. 335-346.
- Rana, P.B. and Dowling, J.M., 1985. Inflationary Effects of Small but Continuous Changes in Effective Exchange Rates: Nine Asian LDCs, *Review of Economics and Statistics*, Vol. 67, No. 3, pp. 496-500.
- Schorderet, Y., 2003. Asymmetric Cointegration, Working Paper No. 2003.01, University of Geneva.
- Shin, Y., Yu, B. and Greenwood-Nimmo, M., 2014. Modelling Asymmetric Cointegration and Dynamic Multipliers in a Nonlinear ARDL Framework, In W. Horrace, and R. Sickles (Eds.), *The Festschrift in Honor of Peter Schmidt: Econometric Methods and Applications*, pp. 281-314, Springer.
- Siddiqui, R. and Akhtar, N., 1999. The Impact of Changes in Exchange Rate on Prices: A Case Study of Pakistan, *Pakistan Development Review*, Vol. 38, No. 4, pp. 1059-1066.
- Wang, Y., 2013. Impact of Exchange Rate Changes on Inflation: Case of China. Available at <<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.847.8906&rep=rep1&type=pdf>>
- Wu, M. and Yu, Y., 2017. The Impact of Australian Consumer Price Index on the Exchange Rate of Australian Dollar-Chinese Renminbi, *European Scientific Journal*, Vol. 13, No. 22, pp. 1857-7881.
- Zorzi, M.C., Hahn, E. and Sanchez, M., 2007. Exchange rate Pass Through in Emerging Markets, Working Paper No. 739, European Central Bank.

## **Assessing the performance of mutual funds**

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**Abstract.** *An open-ended mutual fund is an institution designed to provide both diversification and professional management at a relatively low cost. The directors consider issuing new shares or withdrawing old shares at any time, depending on the evolution of the capital market. In this context, in the article we started from identifying the possibilities to consider mutual portfolios as diversified ones, being included, as a rule, over 100 different titles. This is due more to the size of the fund than to the desire to minimize risk. In these circumstances, given that most funds diversify extensively, volatility should provide a good arrangement for variability to ensure a fairly high return on capital market placement. The purpose of this article was to clarify the issues related to these mutual funds, so that the analysis focuses on determining what is the prospect of achieving a reasonable return from the point of view of the holder of the invested portfolios. The methodology used was, by taking brief but important examples, what the situations are and how the mutual portfolios placed on the market behave. We used the graphical representations, but also a method of analysis by using the Dow-Jones portfolio, consisting of 23 funds with low rates. We also used the logical method of interpreting and comparing the results obtained in different circumstances, indicating through some models what should be the analytical capacity of investors of asset portfolios on the capital market.*

**Keywords:** mutual funds, portfolios, capital market, investor, yield.

**JEL Classification:** G11, G17.

## Introduction

In this article, we started by defining the concept of mutual fund context in which, then, we performed an evaluation of the performance of such a placement. Of course, we have presented various cases, taking and processing a small amount of data that can be further extended, so that we can reach a conclusion on the return that the investor can expect by placing mutual portfolios.

The mutual fund portfolio is more conservative than the standard securities portfolio. This is because a certain perspective is assigned to such a placement.

We have also dealt with this as a special situation, when several funds are represented below the yield line that any portfolio investor considers to be the desired one or the one that provides a convenient financial solution.

Of course, differences in diversification may not have resulted in poor results, as risk was measured by volatility, not variability. The volatility of a portfolio and its variability are two notions that have different meanings, but which can have influences on mutual fund investments in the capital market.

## Literature review

The capital market and the prospects of investors to get the best returns are topics that have been in the attention of many researchers. Amenc and Le Sourd (2003) approached portfolio theory, and in 2013 M.G. Anghel has published a paper on portfolio management and analysis models. Anghelache, Anghel and Bodo (2016) published a study on the static model of portfolio choice. Armeanu (2008) was concerned with the profitability and risk of the portfolio consisting of two securities. Baule (2010) presented a paper on the selection of the optimal portfolio for a small investor, given the risk and cost of the transaction. Clemenccon and Skanderbeg (2009) conducted a study on the selection of a portfolio at extreme risk of measurement. Cox and Huang (1989) analyzes the optimal consumption and the policies of placing portfolios according to the share price. Dragotă et al. (2009) published a paper in which he gives a comprehensive presentation on how to manage securities portfolios. In 2011 Geromichalos and Simonovska analyzed a number of aspects regarding the liquidity of assets in the formation of international portfolios, and Harvey et al. (2010) focus on the analysis of portfolio selection with high moments. Li and Smetters (2011) published a study on choosing the optimal portfolio in the context of ensuring social security indexation. Markowitz (1959) published extensive material on portfolio selection in the context of investment diversification. Merton (1971) was concerned with optimal consumption and portfolio rules when using a continuous time model. Stancu (2007) published a paper in which he presents a study on the financial market and portfolio management. In 2012 K.D. West performed an econometric analysis using a model in which the reduction factor is close to one.



### Methodology, data, results and discussions

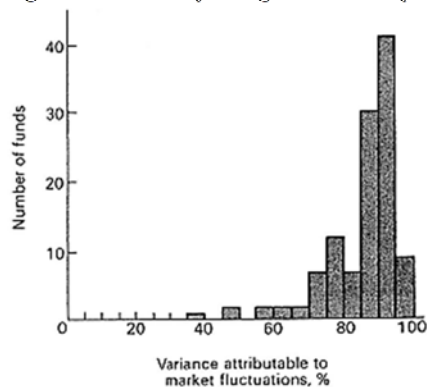
An open-ended mutual fund is an institution designed to provide both diversification and professional management at a relatively low cost. Administrators are prepared to issue new shares or withdraw old shares at any time. The net asset value per share is calculated by dividing the current market value of the fund's holdings by the number of its outstanding shares. In general, old shares can be redeemed for the total (current) net asset value. New shares are usually sold for an amount equal to the net asset value plus an 8 to 10 percent tax that is intended for sale. When securities are bought or sold, additional brokerage fees are incurred. Such costs are not explicitly reported. They are simply added to the purchase price when calculating purchase costs and are deducted from the selling price when calculating sales proceeds.

Mutual funds are important for two reasons. First of all, managers invest a lot of money for many investors. Secondly, the performance of a mutual fund is a matter of public record. The results can be reasonably considered typical for the performance of professional securities analysts and investment managers.

Most mutual funds have diversified portfolios, usually including over 100 different securities. This may be due more to the size of the fund than to the desire to minimize risk. The very act of investing 1 or 2 percentage points in the capital of a large fund could bid for the price of a security to rob it of its original appeal.

As most mutual fund portfolios are highly diversified, their performance is closely correlated with that of the market as a whole. Figure 1 shows the proportion of change in the rate of return attributed to market fluctuations for a group of 115 mutual funds.

**Figure 1.** *The rate of change in the rate of return attributed to market fluctuations*



**Source:** The authors established conventional data that they represented graphically.

On average, about 85 percent of the variation could be attributed to market fluctuations. In other words:

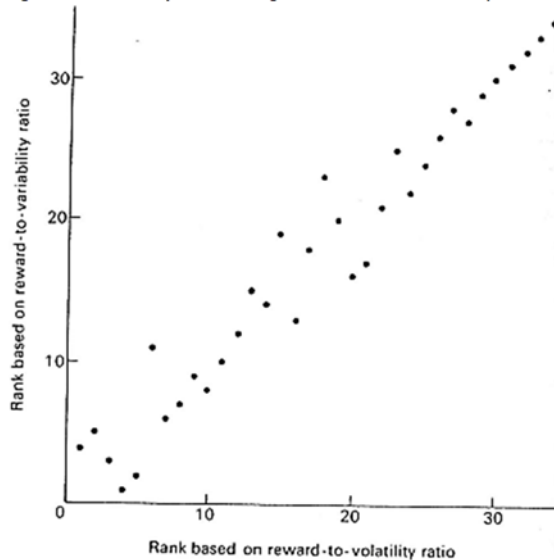
$$b_p^2 \sigma_M^2 \sim 0,85 \sigma_p^2$$

Considering the square root of both axes, we can rewrite the above relation as follows:

$$\sigma_p = (1,085 \sigma_M) b_p$$

As most funds diversify extensively, volatility ( $b_p$ ) should provide a good arrangement for variability ( $\sigma_p$ ). Figure 2 shows that the performance of each of the 34 mutual funds was assessed using the reward-variability ratio and the funds were ranked from best (1st place) to most unsatisfactory (34th place). The procedure was repeated, using the reward-volatility ratio. As Figure 2 shows, the rankings were very similar.

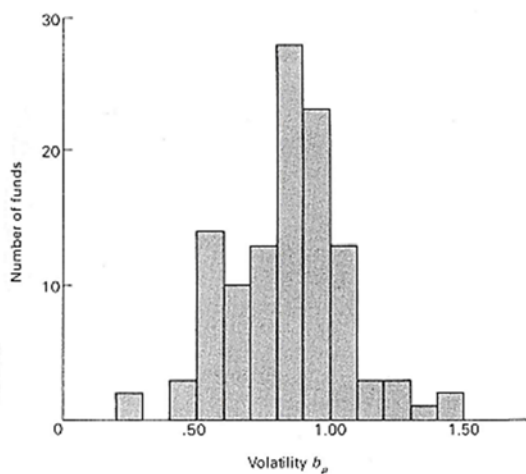
**Figure 2.** Mutual funds using the reward-variability ratio



**Source:** The authors established conventional data that they represented graphically.

Although the funds differ slightly in terms of market correlation, they differ considerably in terms of volatility, as shown in Figure 3. The mutual fund portfolio appears to be more conservative than that of the securities in the Standard and Poor's Composite Index, the average value of  $b_p$  was about 0.84.

**Figure 3.** Number of funds and volatility

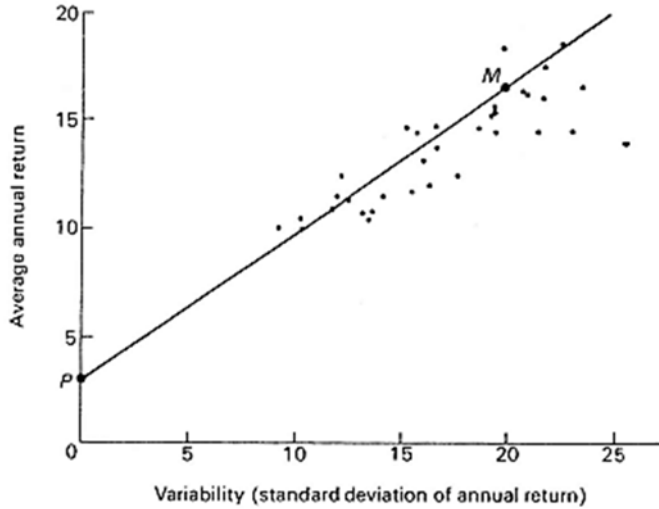


**Source:** The authors established conventional data that they represented graphically.

The differences in volatility shown in Figure 3 are not solely due to chance.

Figure 4 provides some evidence that each unlabeled item indicates the performance of one of the 34 mutual funds. Point *M* shows the results that would have been obtained from a portfolio of the 30 stocks used to calculate the Dow-Jones Industrial Average. Point *P* represents the approximate level of the pure interest rate during that period. The *PM* line is the empirical counterpart of the capital market line.

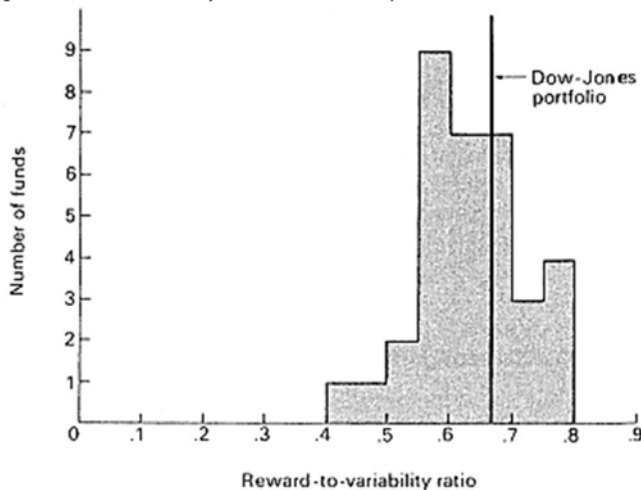
**Figure 4.** Average annual return and variability



**Source:** The authors established conventional data that they represented graphically.

More funds are represented below the line in Figure 4 than above. This is reflected in the distribution of reward-variability ratios shown in Figure 5. Only 11 funds had higher rates than the Dow-Jones portfolio, 23 funds had lower rates.

**Figure 5.** Distribution of reward-variability ratios



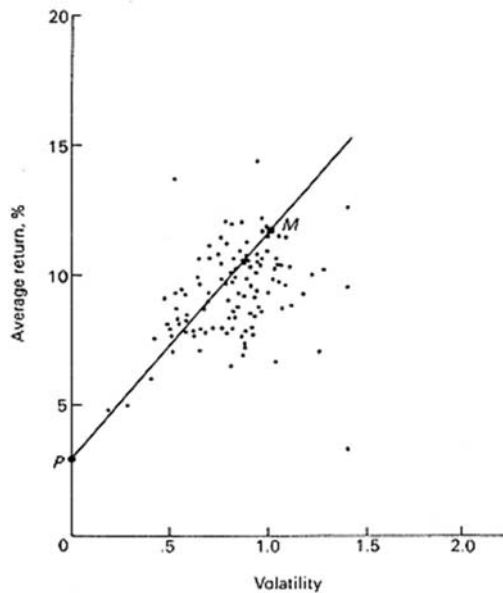
**Source:** The authors established conventional data that they represented graphically.

Such results are not particularly encouraging for the supporter of mutual funds. The underperformance could be attributed to insufficient diversification, but even the nature of the portfolios held and the high correlation of the fund's return with market fluctuations preclude this explanation. Mutual fund managers are unlikely to make uncertain judgments.

The results presented in Figures 4 and 5 are based on the net returns obtained by the investor after deducting management fees and broker fees. The reported figures make it difficult to determine the amounts spent on brokerage fees. Adding these costs provides the gross return for each year.

Reward-variability ratios based on gross yields are randomly scattered around the market portfolio. Of the 34 funds shown in Figures 4 and 5, nineteen had higher gross returns rates than the Dow-Jones portfolio (fifteen had lower ratios).

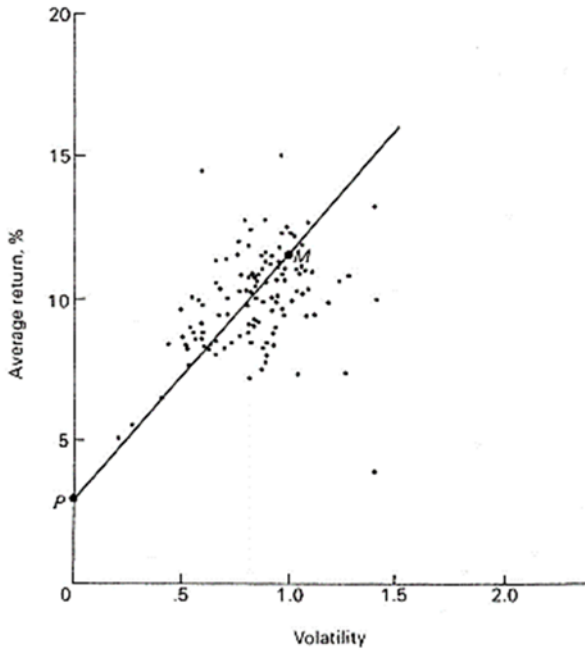
**Figure 6.** Average yield and volatility (net returns)



**Source:** The authors established conventional data that they represented graphically.

Figure 6 shows the average return and volatility for the 115 funds studied (values are based on net returns). Point *M* indicates the performance of a market portfolio composed of securities in the Standard and Poor's Composite Index. Point *P* represents the pure interest rate (based on the yield on a ten-year government bond). The *PM* line is the empirical counterpart of the securities market line. Figure 7 shows the results obtained using the gross returns.

**Figure 7.** Average yield and volatility (gross returns)

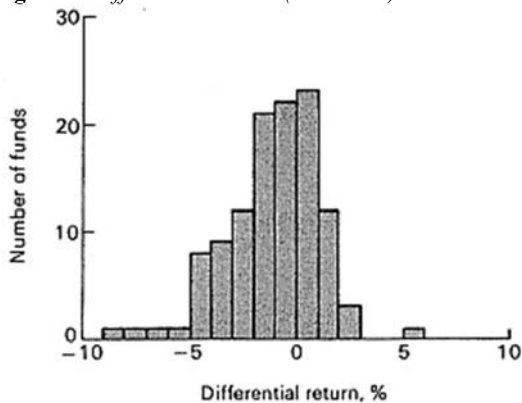


**Source:** The authors established conventional data that they represented graphically.

In Figure 6, which shows the net performance, more funds are represented below the securities market line than above it, but in Figure 7, which shows the gross performance, the points are more or less randomly located around the line. Differences in diversification may not have caused these results, as risk was measured by volatility, not variability. The most plausible explanation is that excessive spending on portfolio management has a direct influence.

Figure 8 shows the differential yields for the 115 funds based on net worth. The average was -1.1 percentage points per year. Of the 115 funds, 76 had negative differential returns.

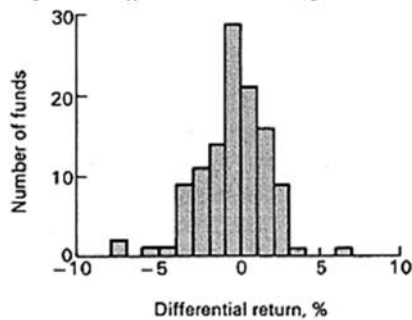
**Figure 8.** Differential returns (net values)



**Source:** The authors established conventional data that they represented graphically.

Figure 9 shows the differential yields based on gross values. The average value was -0.4 percentage points per year. Only 55 of the 115 funds had negative differential returns.

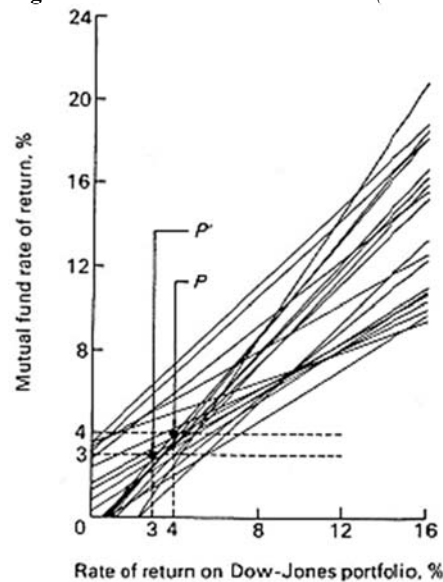
**Figure 9.** *Differential returns (gross values)*



**Source:** The authors established conventional data that they represented graphically.

Figure 10 shows the characteristic lines for the 20 funds studied using net annual returns. The securities included in the Dow-Jones Industrial Average were chosen to represent the market. In general, the funds did not perform better than comparable market-based portfolios. Taking 4 percentage points as an approximation of the pure interest rate, eight of the lines are to the left of point  $P$  while 12 are to the right. Taking 3 percentage points as an approximation, eight lines are to the left of point  $P$ , while 12 are to the right.

**Figure 10.** *Funds characteristic lines (net annual returns)*

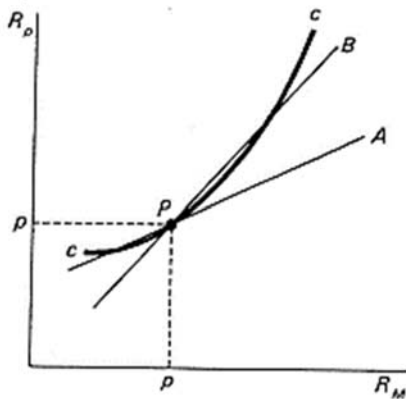


**Source:** The authors established conventional data that they represented graphically.

The procedure used to fit a characteristic line may not fully reveal a possible strength of a fund's management. We will consider the two characteristic lines shown in Figure 11. Each is consistent with the perfect capital market equilibrium. Suppose that the administrator of a mutual fund could anticipate the general direction of the market as a whole, that is, predict

whether  $RM$  would be above or below  $p$ . If the brokerage fees were not excessive, it would be desirable to change the fund's portfolio from time to time, holding portfolio A when  $RM$  is expected to fall below  $p$  and portfolio B when  $RM$  is expected to exceed  $p$ .

**Figure 11.** Model with two characteristic lines

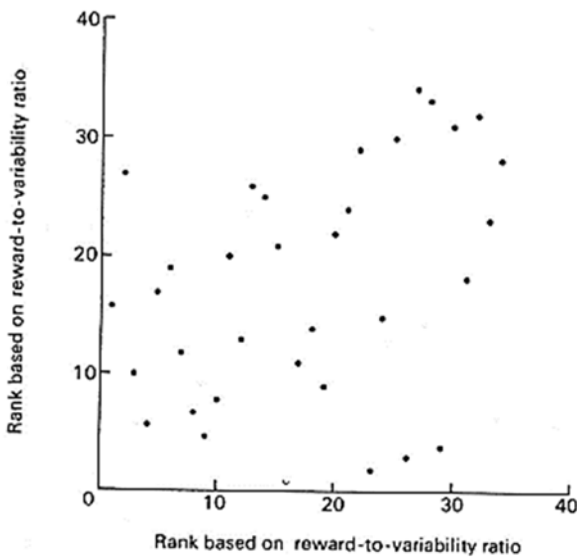


**Source:** The authors established conventional data that they represented graphically.

If it did, the actual results could be approximated more accurately by a curve like the one in Figure 11 than by a straight line. It seems that mutual funds do not value portfolios based on comparable volatility better on average than on the market.

Figure 12 compares the performance of 34 funds from one period with their performance from another period. The horizontal axis shows the rank of each fund based on the reward-variability ratios for the previous period. The vertical axis draws the rank based on the reward-variability ratios for the last period. There seems to be a slightly positive relationship.

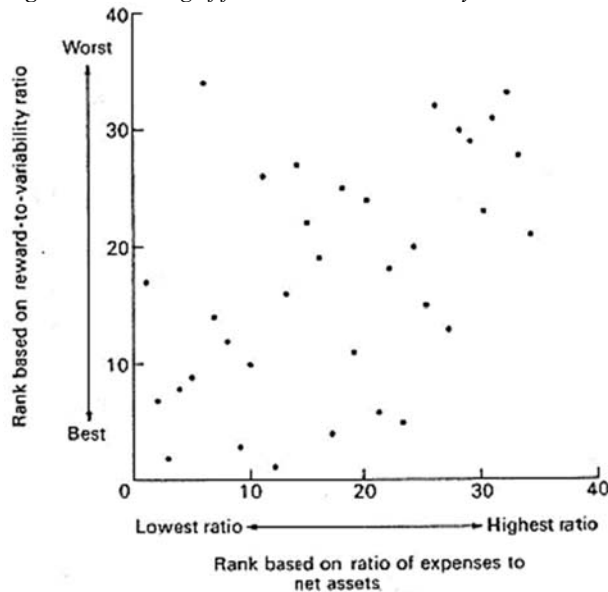
**Figure 12.** Ranking of funds based on ratios rewards variability in different periods



**Source:** The authors established conventional data that they represented graphically.

Figure 13 provides further evidence. The horizontal axis graphically represents the rank of each of the 34 funds based on the ratio of expenditure to total assets. The vertical axis represents graphically based on the reward-variability ratios for the considered period. Again, there is a slightly positive relationship.

**Figure 13.** Ranking of funds based on variability reward ratios and the ratio of expenditures to total assets



**Source:** The authors established conventional data that they represented graphically.

A comparison of Figures 12 and 13 suggests that persistent differences in performance based on net returns may be due more to differences in management cost than to differences in cost effectiveness.

## Conclusions

From the careful study of this article, based on the theoretical aspects, but exemplified by several individual cases, a series of conclusions can be drawn. First of all, an open-ended mutual fund is an institution designed to provide both diversification and relatively low-cost professional management.

Before placing a mutual fund, it is desirable to study the situation of such a fund. As a rule, the directors consider issuing shares or withdrawing old shares at any time, depending on the evolution of the value on the capital market, which leads to the profitability with which this placement on the capital market is completed.

Mutual portfolios are diversified, usually including a number of different securities, which correlate in a certain way in the market after their investment, placement.

Various cases taken over and presented will lead to a precise conclusion on the return that the investor can expect by placing mutual portfolios. It should be noted that the mutual fund portfolio is more conservative than the standard securities portfolio. This is because a



certain perspective is assigned to such a mutual investment. The differences that arise from the very careful diversification of these mutual portfolios appear and offer the investor the possibility to opt for a more secure portfolio in order to have a financial solution with final return at the end of the investment period.

It should be noted that a number of methods can be used in the early analysis of a mutual fund before it is placed on the capital market, such as the method of analysis using the Dow-Jones portfolio, which is quite conducive to such an operation. It turns out that mutual funds have the prospect of a higher return than other portfolios set up without a thorough analysis.

It should be noted that the analysis of the evolution of this mutual fund on the capital market must also take into account a number of risks that may develop as a result of surprising phenomena that occur in the capital market.

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## References

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- Amenc, N. and Le Sourd, V., 2003. *Theorie du portefeuille et analyse de sa performance*, Economica, Paris.
- Anghel, M.G., 2013. *Modele de gestiune și analiză a portofoliilor*, Economica, Bucharest.
- Anghelache, G.V., Anghel, M.G. and Bodo, G., 2016. Model of static portfolio choices in an Arrow-Debreu economy. *Romanian Statistical Review. Supplement*, No. 1, pp. 58-62.
- Armeanu, D., 2008. Rentabilitatea și riscul portofoliului format din două titluri, *Romanian Statistical Review. Supplement*, pp. 157-164.
- Baule, R., 2010. Optimal portfolio selection for the small investor considering risk and transaction costs, *OR Spectrum*, Vol. 32, Issue 1, pp. 61-76.
- Clemencon, S. and Skander, S., 2009. On portfolio selection under extreme risk measure, *The Journal of Finance*, Vol. 10, No. 3, pp. 449-474.
- Cox, J. and Huang, C.F., 1989. Optimal consumption and portfolio policies when asset prices, *Econometrica*, 53(2), pp. 385-407.
- Dragotă, V. (coord.), Dragotă, M., Dămian, O.A., Stoian, A., Mitrică, E., Lăcătuș, C.M., Manăte, D., Țătu and L., Hândoreanu, C.A., 2009. *Gestiunea portofoliului de valori mobiliare*, 2<sup>nd</sup> edition, Economica, Bucharest.
- Geromichalos, A. and Simonovska, I., 2011. Asset liquidity and international portfolio choice, Working Paper 17331.
- Harvey, C.R., Liechty, J.C., Liechty, M.W. and Müller, P., 2010. Portfolio selection with higher moments, *Quantitative Finance*, 10(5), pp. 469-485.
- Li, J. and Smetters, K., 2011. Optimal portfolio choice with wage-indexed social security, Working Paper 17025.
- Markowitz, H., 1959. *Portfolio selection. Efficient diversification of investment*, John Wiley & Sons, New York.

- Merton, R.C., 1971. Optimum consumption and portfolio rules in a continuous time model, *Journal of Economic Theory*, Vol. 23, pp. 373-413.
- Stancu, I., 2007. *Finanțe*, Vol. 1. *Piețe financiare și gestiunea portofoliului*, Economica, Bucharest.
- West, K.D. (2012), Econometric analysis of present value models when the discount factor is near one, Working Paper 18247.

## **Model for estimating the profitability of placing asset portfolios on the capital market**

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**Abstract.** *The capital market is a reality today. The capital market has an important role to play in regularizing the surplus revenues available to the economic society. In this context, a number of portfolios may be placed on the capital market by investors, individuals or legal entities. The placement must take into account a number of aspects such as: the defined and reasoned market portfolio, the market and the factors acting on the market at a given time, the measurement of the performance of the placement of the portfolios on the capital market. In this article, the authors have studied and analyzed the methods of investigation that investors in the capital market must carry out before carrying out this operation. Asset portfolios are, in theory, within the reach of anyone, but a profitable investment must be based on a study that is well-developed enough to be able to capitalize on market developments influenced by a number of factors and subject to market risk in a future period. One by one, these aspects were analyzed, presented in the form of theories, statistical-econometric relations of calculation and graphical representations, which express more efficiently the way in which the portfolio in question is a real bearer of a performance and will result with a level of profitability thought by the investor. As a methodology, we used first of all a series of statistical quantities that characterize the evolution of the capital market, indicators that refer to the profitability (return) of asset portfolios, adequate graphical representations as well as comparative, structural analysis, leading to the proposed return (expected) by the asset portfolio investor.*

**Keywords:** investors, portfolios, profitability, market, developments, risks.

**JEL Classification:** C10, G11.

## **Introduction**

In this article, we started with the presentation of the main key elements involved in placing a portfolio of assets on the capital market.

We presented in detail the rate of return of the portfolio on the market, in a given period of time and in this sense, through graphical representations, we managed to highlight its yield and oscillation which is supposed to exist after placing that portfolio on the market.

We graphically represented the distribution of the return rate of the portfolio on the market in several variants, performing an analysis of the cumulative distribution that assures the investor that doing so will intuit and gain a return in accordance with the quality of the portfolio to be placed on the market.

It is known that the average profitability is the one related to the variability, the rate of return, which is sometimes fluctuating and which also differs over time. The real importance of the market portfolio consists in correlating it with other highly diversified portfolios so that, starting from the fluctuations of the rate of return, we can intuit what the concrete forecasts will be in relation to the profitability of the considered portfolio.

Of course, for testing the positive theory, the normative theory, the choice of a certain index or the level of correlation of the indices that can influence the profitability can be applied. The greater the diversification, i.e. the higher the value of the number of assets, the closer it will be to a certain identified value and the profitability of that portfolio.

Next, we analyzed the market starting from the fact that the relationship between market fluctuations and the variability of the typical rate of return of a security are closely correlated, ie knowing this interdependence of the two we can anticipate the prospect of ensuring a suitable return for that portfolio.

At the end of this article we analyzed the market and industry factors starting from the fact that the relationship between market fluctuations and the variability of the typical rate of return of a security are closely correlated, i.e. knowing this interdependence of the two we can anticipate.

## **Literature review**

The topic addressed by the authors in this article has come to the attention of many researchers. Thus, Altăr (2002) was concerned and approached the theory of portfolios, and Ameur and Prigent (2010) were concerned with the study of structural portfolio management. Anghel et al. (2020) treated in their paper the model for the analysis of significance in the conditions of using the portfolio grouping. Buraschi et al. (2006) were concerned with the correlation of risk with the optimal chosen portfolio. In 2009, S. Clemencon and S. Skanderbeg conducted a study on the selection of a portfolio at extreme risk, and Cox and Huang (1989) analyzes the optimal consumption and the conditions of placing portfolios according to the share price. Geromichalos and Simonovska (2011) considered the liquidity of assets in the formation of international portfolios. Harvey et al. (2010) turned their attention to the analysis of High Selection Portfolio Selection. Li and

Smetters (2011), analyzed a number of issues related to choosing the optimal portfolio in the context of ensuring social security indexation. Markowitz (1959) publishes an extensive paper on portfolio selection in the context of investment diversification, and Merton (1971) was concerned with optimal consumption and portfolio rules when using a continuous time model. In 2012 K.D. West makes a presentation on the econometric analysis of the use of a model when the reduction factor is close to one.

### **Methodology, data, results and discussions**

Portfolio theory, as well as capital market theory, deals with past predictions for the future. The past can provide data on previous predictions. If people predicted the right future ten years ago, the records of the last ten years could be used to measure their previous predictions. Capital market theory can be tested in this way. Such a test does not refer to the capital market theory itself, but to a combined market theory: capital plus the assumption that the record reflects previous predictions.

Some researchers assume that the future will be similar to the past. Predictions based on past relationships can be as useful as those obtained with more traditional methods. Normative procedures that use such methods can be tested. Again, a combination is considered: portfolio theory plus the assumption that the future will be similar to the past.

Simple steps are needed to properly summarize the past. It is not difficult to redefine the concepts used. To predict the future, weights are assigned weights based on their probabilities of occurrence. To summarize the past, the results are assigned weights based on their relative frequency of occurrence.

The rate of return can be determined by multiplying each possible rate of return by the probability of its occurrence. On the other hand, the average rate of return is determined by multiplying each rate of return observed by its relative frequency of occurrence.

The risk of a portfolio is measured by the standard deviation of the rate of return, based on the probability that various deviations from the expected value will occur. The variability of a portfolio's rate of return is also measured by the standard deviation of the rate of return, which is instead based on the relative frequencies of the various deviations from the average rate of return.

The relationship between two variables can be summarized as a correlation coefficient (real), and the volatility (real) of a security or a portfolio that can be calculated. The nature of the measure should be clear in the context in which it is discussed.

Summary measures can be used to describe a data set. For such purposes, the known formulas are sufficient (with relative frequencies substituted for probabilities). But there may be another way to get such measures. The data can simply be considered as a small set of results generated by an underlying process. The purpose is to deduce from the data some aspects of the more general process. For such purposes, the formulas may be slightly modified and various statistical procedures may be relied upon to test the significance of the results as indicators of the characteristics of the basic process.

A key element is the market portfolio, which consists of the proportional holdings of all securities. Theoretically, it includes various types of capital assets. It is nonsense to effectively measure the performance of such a portfolio.

Several stock price indices are available, and two of the most popular are the Dow-Jones Index with 30 Industrial Shares and the Standard and Poor's Composite Index. None include dividends. It is possible to estimate the dividends received by the owner of such a group of securities and then calculate the overall rate of return.

A number of researchers have taken a different approach. First, the rate of return is determined for each of the number of securities in each time period. It is assumed that the rate of return on the market portfolio is equal to the average of the values for the individual securities, respectively:

$$R_{Mt} = \frac{1}{N} \sum_{i=1}^N R_{it} \quad (1)$$

Where:

$R_{Mt}$  is the rate of return on the market portfolio over time  $t$ ;

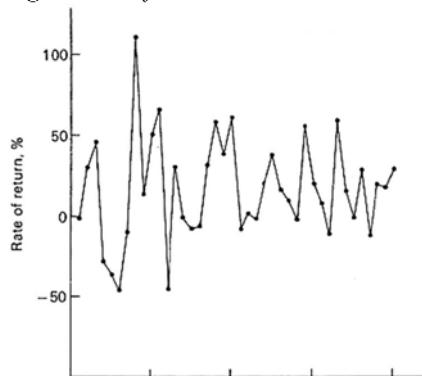
$R_{it}$  is the rate of return on the title  $i$  over time  $t$ ;

$N$  represents the number of titles.

The value  $R_{Mt}$  is equivalent to the return obtained by investing an equal amount in monetary units in each security.

Figure 1 shows the annual rate of return, including both dividends and price changes, but no compensation was made for taxes or brokerage fees.

**Figure 1.** *Portfolio return rate*

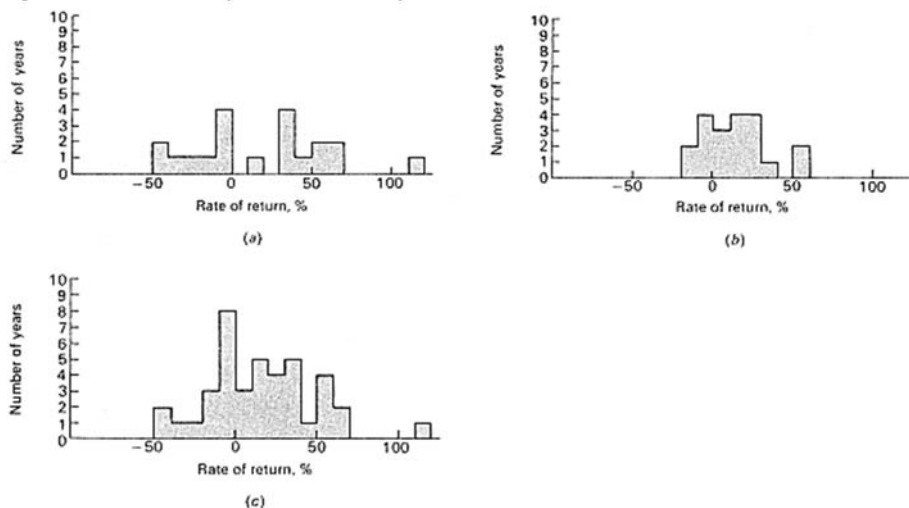


**Source:** The authors established conventional data that they represented graphically.

As shown in Figure 1, the yield fluctuated more or less randomly to around 16.5% per year. The change was attributed to factors such as improved securities regulation, increased government control over the business cycle, greater investor sophistication and changes in risk attitudes. Whatever the causes, it is believed that there has been a permanent change in the behavior of the securities listed on the Stock Exchange.

The diagrams in Figure 2 are frequency distributions, showing the number of years in which, the rate of return has decreased in various intervals (for example, 0 to 10 percent).

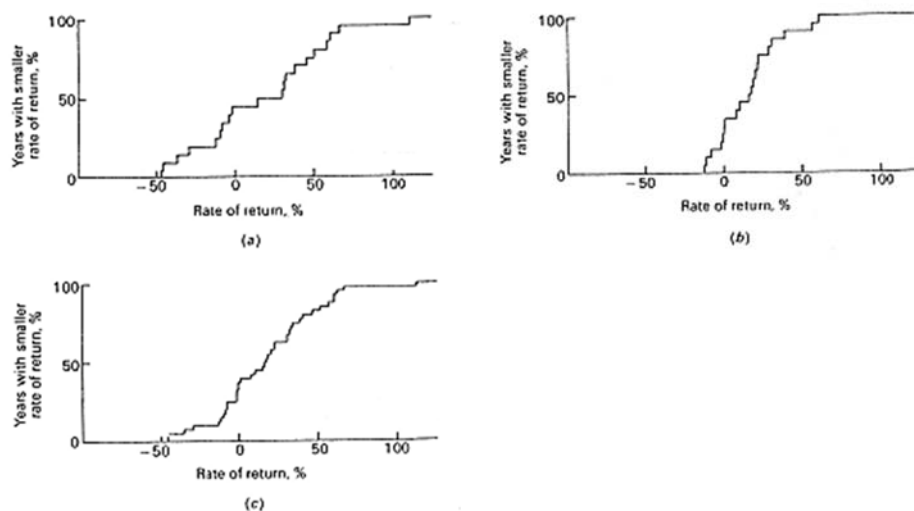
**Figure 2.** *Distribution of the return rate of the market portfolio*



**Source:** The authors established conventional data that they represented graphically.

The diagrams in Figure 3 are cumulative distributions, showing the percentage of years in which, the rate of return has fallen below each possible level.

**Figure 3.** *Cumulative distributions*



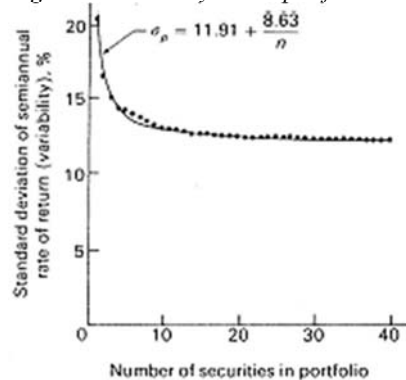
**Source:** The authors established conventional data that they represented graphically.

The real importance of the market portfolio lies in its correlation with highly diversified portfolios. Fluctuations in the rate of return should explain the change in the yields of individual securities more than fluctuations in the yield of any other portfolio. Some researchers have used this attribute to build an index directly. Given the rates of return for a number of securities over time, statistical techniques are used to derive a series of values. There are many ways to build an index of your market portfolio.

The high degree of correlation between the rates of return is not surprising. If much of the risk of most securities is systematic (in response to market fluctuations), then the rate of return on any reasonably diversified portfolio will be highly correlated with that of the market as a whole. But how many securities must be included in order to obtain a fairly well-diversified portfolio? In other words, how effective is diversification in reducing variability? A study in this regard provides an answer.

The variability of the rate of return was measured for 2,400 selected portfolios from a set of 470 common shares. Each of the first 60 portfolios included only one value. Each of the following 60 portfolios included two securities of equal value. Each of the last 60 portfolios included 40 equals. For each group of 60 portfolios, the average value of the standard deviation of the rate of return was calculated. This figure provides an estimate of the rate of return variability for a typical portfolio of comparable diversification. It is important that the systematic component of variability approximates that of a portfolio with a volatility equal to one.

**Figure 4.** *Variability versus portfolio diversification*



**Source:** The authors established conventional data that they represented graphically.

Figure 4 expresses the results it has reached. Each point indicates the average variability of a group of 60 comparable diversification portfolios. As diversification increases, the standard deviation of the rate of return decreases, approaching a level easily interpreted as the standard deviation of the profitability of the market portfolio. The data can be approximated very well by a simple formula:

$$\sigma_p = 11.91 + \frac{8.63}{n}$$

Where:

$n$  = the number of securities in the portfolio in equal amounts.

The greater the diversification, i.e. the higher the value of  $n$ , the closer  $\sigma_p$  will be to 11.91. The variability due to the systematic risk for a portfolio with a volatility equal to 1 can be assumed to be approximately 11.9 percent over six months.

According to the formula, the total variability of a typical portfolio of securities with  $n = 1$  is about 20.5 percent over six months. Assuming that each point in the figure is in fact a



portfolio with a volatility equal to 1, it is a simple matter to estimate the proportion of the total risk of an average security due to its relationship.

Let  $\sigma_r$  and  $\sigma_s$  represent the total and systematic risk, respectively. For a typical security, we have:

$$\sigma_r = 20.5 \text{ and } \sigma_s = 11.9 \Rightarrow \frac{\sigma_s^2}{\sigma_r^2} = 0.34.$$

During the period considered, approximately 34% of the change in the rate of return of a typical security appeared to be attributed to its relationship with the market as a whole. As Figure 4 shows, under such condition's diversification can be extremely beneficial. A typical portfolio with equal amounts in five-currency units will have only 14% more risk, measured by  $\sigma_p$ , than the most diversified portfolio imaginable. A typical portfolio with equal amounts in monetary units of 10 securities will have only 7% more risk than the minimum possible, while a typical portfolio with equal amounts of 20 securities will have only 3 percent more than the minimum.

A study provides further evidence on the relationship between market fluctuations and the variability of the typical rate of return of a security. Sixty-three joint actions were analyzed, with monthly profitability rates calculated.

For each month, the average value of the 63 rates of return was used to represent the return on the market portfolio. The volatility of each security was estimated, along with the proportion of variation attributed to market fluctuations. In order to estimate the typical proportion of variation attributed to market factors, the average value of the corresponding figures for the 63 securities was used.

The analysis was performed for four separate time periods and for the entire period. The figure for the most recent subperiod does not differ substantially from the initial estimate, but the others do. Over the entire period, approximately half of the change in the rate of return of a typical security was attributed to market fluctuations. Under these conditions, diversification can reduce risk very quickly.

The rate of return on the market portfolio fluctuated more reasonably, leading to a corresponding decrease in the change in the rate of return of a typical security attributed to the market (systematic risk). Variability due to other factors (unsystematic risk) also decreased. However, the decrease in the proportion of variance attributed to market factors indicates that the systematic risk has decreased more than the non-systematic risk. Some researchers have attributed this to greater investor sophistication.

It is assumed that each title is evaluated (reevaluated) more on its own decisions than before. Some have argued that change may not be permanent, regardless of its (temporary) cause. For investors who intend to hold sufficiently well-diversified portfolios, change is not important, only systematic risk will matter. In addition, relatively little diversification will go a long way, even if no more than 30% of the total risk of a typical security is systematic.

For regulatory applications it may be sufficient to take the risk into account due to market fluctuations, but additional indices may be useful.

The analysis of the relationships between securities over the entire research period provides some relevant evidence. Market fluctuations accounted for 52% of the change in the typical rate of return on securities. Another group of industry index accounted for 11%. Most importantly, a procedure designed to group securities solely on the basis of the co-movement of their returns over the period produced results consistent with those involved in traditional industrial classifications.

If an index model is to be used for regulatory purposes, it is clearly necessary for the market as a whole to be represented as an index. If additional indices are to be used, it seems reasonable to allow them to represent the conditions in major industries, using standard classifications.

### **Conclusions**

From the study of the article published by the authors and from the interpretation of the presented data, a series of theoretical and practical conclusions can be drawn. First of all, it is necessary to carefully analyze the results of this activity before placing the portfolios of shares on the capital market. This can be done by a fairly careful analysis of how the rate of return of the portfolio over a period of time must reach a certain point, ie a certain result.

The graphical representations show that the analysis of the rate of return of the portfolio must be done in several variants, so as to reach the best return from the investor's point of view.

We can consider that the portfolio placed on the market must be analyzed in correlation with other variables such as market interest, stock values, so that the results are determined as accurately as possible in advance.

The testing of the positive theory can be applied by the normative method, which consists in choosing a certain index or level of correlation of the indices that can influence the profitability of the portfolio.

Another conclusion is that from a practical point of view we analyze the data recorded in the same type of portfolios in a given period and through a forecast study on the factors influencing the profitability we can obtain the parameters that predict the trend of the portfolio of assets we want to place it so that at the end of the period we record results as close as possible to what the investor wants.

These portfolio models are theoretically available to anyone interested, but a profitable investment must be based on a well-developed study to be able to capitalize on them in this context and on the portfolio of assets that the shareholder wishes to place on the capital market.

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**References**

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- Altăr, M., 2002. *Teoria portofoliului*, <www.dofin.ase.ro>
- Ameur, H.B. and Prigent, J.L. (2010), Behaviour towards risk in structured portfolio management, *International Journal of Economics and Finance*, Vol. 2, No. 5, pp. 91-102.
- Anghel, M.G., Hasegan, D.A., Dumitru, D. and Popovici, M., 2020. Model for analyzing the significance and usefulness of grouping portfolios, *International Journal of Academic Research in Accounting, Finance and Management Sciences*, Vol. 10, No. 1, January, pp. 229-238.
- Buraschi, A., Porchia, P. and Trojani, F., 2006. Correlation risk and optimal portfolio choice, AFA New Orleans Meetings Paper.
- Clemencon, S. and Skander, S., 2009. On portfolio selection under extreme risk measure, *The Journal of Finance*, Vol. 10, No. 3, pp. 449-474.
- Cox, J. and Huang, C.F., 1989. Optimal consumption and portfolio policies when asset prices, *Econometrica*, 53(2), pp. 385-407.
- Geromichalos, A. and Simonovska, I., 2011. Asset liquidity and international portfolio choice, Working Paper 17331.
- Harvey, C.R., Liechty, J.C., Liechty, M.W. and Müller, P., 2010. Portfolio selection with higher moments, *Quantitative Finance*, 10(5), pp. 469-485.
- Li, J. and Smetters, K., 2011. Optimal portfolio choice with wage-indexed social security, Working Paper 17025.
- Markowitz, H., 1959. *Portfolio selection. Efficient diversification of investment*, John Wiley & Sons, New York.
- Merton, R.C., 1971. Optimum consumption and portfolio rules in a continuous time model, *Journal of Economic Theory*, 23, pp. 373-413.
- West, K.D., 2012. Econometric analysis of present value models when the discount factor is near one, Working Paper 18247.