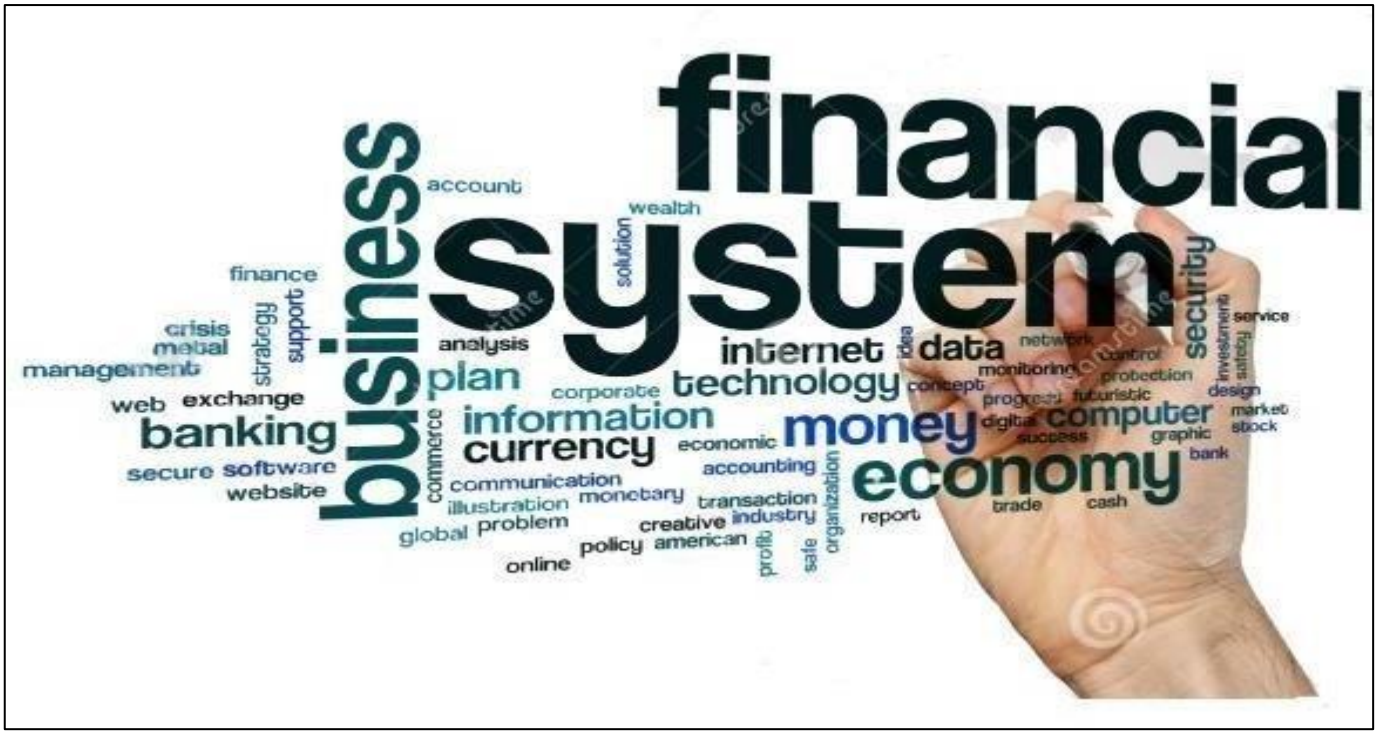
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519




# Does Financial Development Foster Economic Growth: Empirical Evidence from 27 EU Countries

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Publication Date: 2025/05/30

**How to Cite:** Jasurbek Tursunov. (2025). Does Financial Development Foster Economic Growth: Empirical Evidence from 27 EU Countries. *International Journal of Innovative Science and Research Technology*, 10(4), 4338-4369. https://doi.org/10.38124/ijisrt/25apr1519.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

## ACKNOWLEDGEMENT

I would like to express my gratitude for some people who supported me and who put a valuable contribution in accomplishment of this research project

Initially, I am truly honored being supervised by Dr. Tursun Shodiev, former head of economics department and currently the head of UNESCO Chairs. With his continuously demonstrated valuable advice and critical feedbacks, a comprehensive and proper research project was completed on time. Even in the last months when I had to change my topic, due to some issues, he continued to support me and provided me with possible solutions and directions for further work. I am very grateful for all of it. Moreover, I am very thankful to all of my teachers that gave me comprehensive knowledge on economics subject and to university students' support service department, specifically, Gayrat Suyunov for his valuable lessons and advice in model constructions and instructions on the utilization of Stata software. Also, I feel deep gratefulness towards my parents for the continuous motivation and support that kept me enthusiastic and encouraged to finalize the project outstandingly. Finally, I would like to express my appreciation to my friends and colleagues, namely, Javokhirkhon Jurakhonov, Aleksandra Pelevina and Kamola Aliqulova who all gave me critical feedbacks, good insights, and metal support to work hard and to accomplish proper research project.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519


## ABSTRACT

**The following empirical paper targets to analyze the causal relationship of the financial system and economic growth using panel data cointegration, Granger causality test, and fixed effect regression model approach. The empirical research based on the sample of 27 EU countries during 1990-2017, reveals the following results: a panel cointegration analysis confirms a long-term relationship between the financial system and economic growth for EU countries. Different results in terms of significance level for different channels of the financial system were observed but in general the financial system exhibited positive results. The Fixed effect model displays that financial development and real GDP per capita are positively and strongly linked. Granger causality shows that causality between the financial system and economic growth is bidirectional for EU countries that means economic growth also stimulates financial development. That is financial development stimulates growth, then/or economic growth reciprocally stimulates financial development. Generally, results are consistent with the previous works except for some few aspects.**


***Keywords:*** *Financial System, Economic Growth, Financial Deepening, Market Capitalization Granger-Causality, Cointegration And Fixed Effect Model.*

*"The lesson of history is that you do not get a sustained economic growth as long as the finance system in in crisis"*

**Ben Bernanke**
**- Former chairperson of the Federal Reserve of the United States of America**

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# CHAPTER ONE
# INTRODUCTION

Over the years, there are contradicting views regarding finance-growth nexus that is: is there a significant correlation between them or not?; if yes, negative or positive?; is the causality between them unidirectional or bi-directional? These questions arose the interest of the writer as well so this paper aims to identify the relationship between the financial system and economic growth.

Historically, many models have been made to define economic growth through different proxy variables, notably, macroeconomic variables. Many economists do agree with those models but at the same time, many highlight the importance of the financial sector that is missing in early models as in the Solow Growth model. The importance of the financial system on economic growth has received sizeable attention in recent couple of decades, but, startlingly different views were present regarding its role in economic growth. There are conflicting arguments in literatures about its importance, its causality relationship with growth and even concerning its positive correlation. Levine in his paper proves that financial intermediaries improve economic efficiency by supporting the allocation of capital to its best use and channel savings into investment projects ultimately leading to growth (supply-led effect) (1997). One of the early papers by Joseph and Schumpeter, also, revealed supporting insights and stated that well-functioning banks spur technological innovation facilitating those entrepreneurs with the best chances to success in implementation of innovative products (1912). Contrarily, Robinson states that finance is followed by economic growth where it creates additional demand for financial resources and finance sector responds automatically to accommodate it (demand-led effect) (1952). Some economists even do not support finance-growth relationship. Lucas affirms that the importance of financial sector in growth is over-stressed and declares that literatures combine microeconomics of financial systems and the endogenous growth theory (1988). Authors in “pioneers of development economics” (essay collections) including three Nobel Laureates does not even highlight the finance in their analysis (Gerald Meir and Dudley Seers 1984). In light of these conflicting views, by analysing previous works and contributing to them with new ideas and models this paper will try to shed the light on the quantitative importance of the financial system in economic growth.

Notwithstanding the above views against finance-growth nexus, there is indeed evidence that financial development is a good predictor of the success rate of policies in economic growth, technological changes, and capital accumulation. Many cross country, time series, firm- and industry-level analyses report extensive cases in which the financial development or its lack thereof crucially affects economic development’s speed and patterns. Efficiently organized the financial system stimulates improved financial services facilitating the growth speed of economy, while weak the financial system prompts unfavorable conditions into the economy and as history proves, poor financial supervision can be crisis prone with devastating effects on entire nations. This significance of the financial system is not new in development economics and it can be backed to Schumpeter’s Theory of Economic Development (1911). He stresses the role of banks and loans in boosting growth in his theory and suggests policy implications like an increasing number of financial institutions, and a number of financial services and products to create a positive effect on the saving-investment process to foster the economic growth. However, this theory had just a slight impact on development policies in post-war decades since the deeply rooted dominance of Keynesian financial repression ideology (Lucas 1988). Considering all the above, it can be said that the financial sector calls for close attention of policymakers and in these research, it will be attempted to check these views.

In retrospect, additional to the aforementioned motivations some more factors were in the interest of analysis. Initially, it is stated that well-developed financial sectors in developed countries (OECD countries) or the union of countries can increase the economic system through different channels (Becsi and Wang, 1997). Most developing countries following that idea reformed their economic and the financial system after mid of 80s. Therefore, progress achieved by these countries in the case of European Union countries over the about last three decades is documented in terms of revamping their financial systems and evaluate the links between financial reforms and economic performance. Financial development indicators were also used from literature to draw some conclusions about their impact on economic growth as measured by the annual growth rate of the domestic product (GDP) per capita. Further contributions to the literature are the choice of countries and the period used in the study. Besides, the new qualitative measure is used. This variable has been constructed to calibrate some of the institutional reforms and is used in conjunction with macroeconomic variables. Finally, I take a different approach in this paper. Instead of analyzing each country or pooling worldwide data, I study the relationship between finance and growth in a close geographic region, namely, in the EU.

The paper is organized as follows. The Second section discusses the literature review, theoretical linkage of finance and growth, and selected proxy measures. The third section is dedicated to data and methodology part where origins of data, selected methodology and prior expectations are explained. The fourth section provides clearance on data description and interpretation of empirical results and performed tests. The final section provides concluding remarks, policy recommendations and limitations of the current research paper.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

# CHAPTER TWO
# LITERATURE REVIEW

*A. Finance Linkage to Economic Growth*

At this point, the main concern starts by understanding the theoretical linkage of economic growth and the financial system and figuring out proxy measures for financial development. To make it more comprehensive literature part is divided into three parts: first part analyses the theoretical relationship of finance-growth nexus; the second part discusses some previous works to understand their methodologies and proxy choices; third part discusses chosen proxies for financial development level that will be used to construct the model in this paper.

The financial system's core function is to provide assistance for savings to transform from surplus sectors to deficit sectors. Mostly, households are the surplus sectors that save money and government and entrepreneurs are deficit sectors that borrow for investment purposes. Nevertheless, the financial markets finance just a segment of a state's aggregate investment, since, households and firms finance a big part of their investments directly thought their savings. It is necessary to borrow only when investment surpasses saving, just as it is necessary to lend when saving exceeds the investment. The main job of the financial sector is to transform surplus savings from economic units into those in deficit. After a deep analysis of theoretical linkage, the below chart was created that shows different channels by which the financial system influences economic growth.

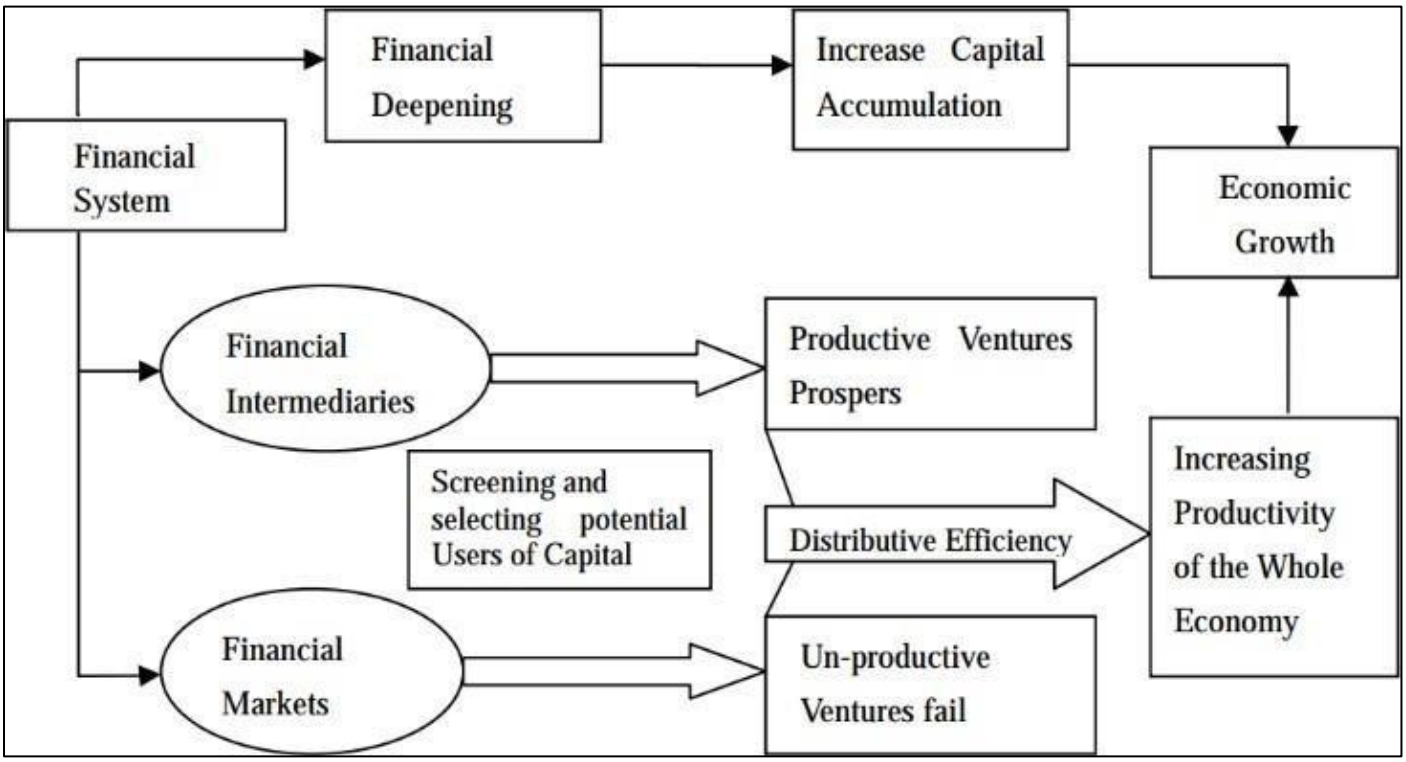


Fig 1: Theoretical Linkage of Finance and Economic Growth
Source: Waheed and Najia (2009), Done by Author

A good financial system promotes economic growth through two important ways: by increasing investment and savings (quantity effect) and by increasing productivity (quality effect). The quality of investment is at least as crucial for growth as quantity. Generally, empirical works revealed that the increase in capital and labor is responsible for less than half of the output growth, while, the rest is explained by high productivity (Levine 1999). Greater financial deepening, increased investment and higher growth all mostly come from higher savings, however, financial depth contributes to economic growth through productivity improvement of investment. A productivity of investment as measured by GDP ratio to investment is significantly bigger in the countries that are growing fast and that have a deeper financial system (Barro 1991). Thus, efficient intermediation ensures that good quality investments are financed and thereby increase the productivity of investment.

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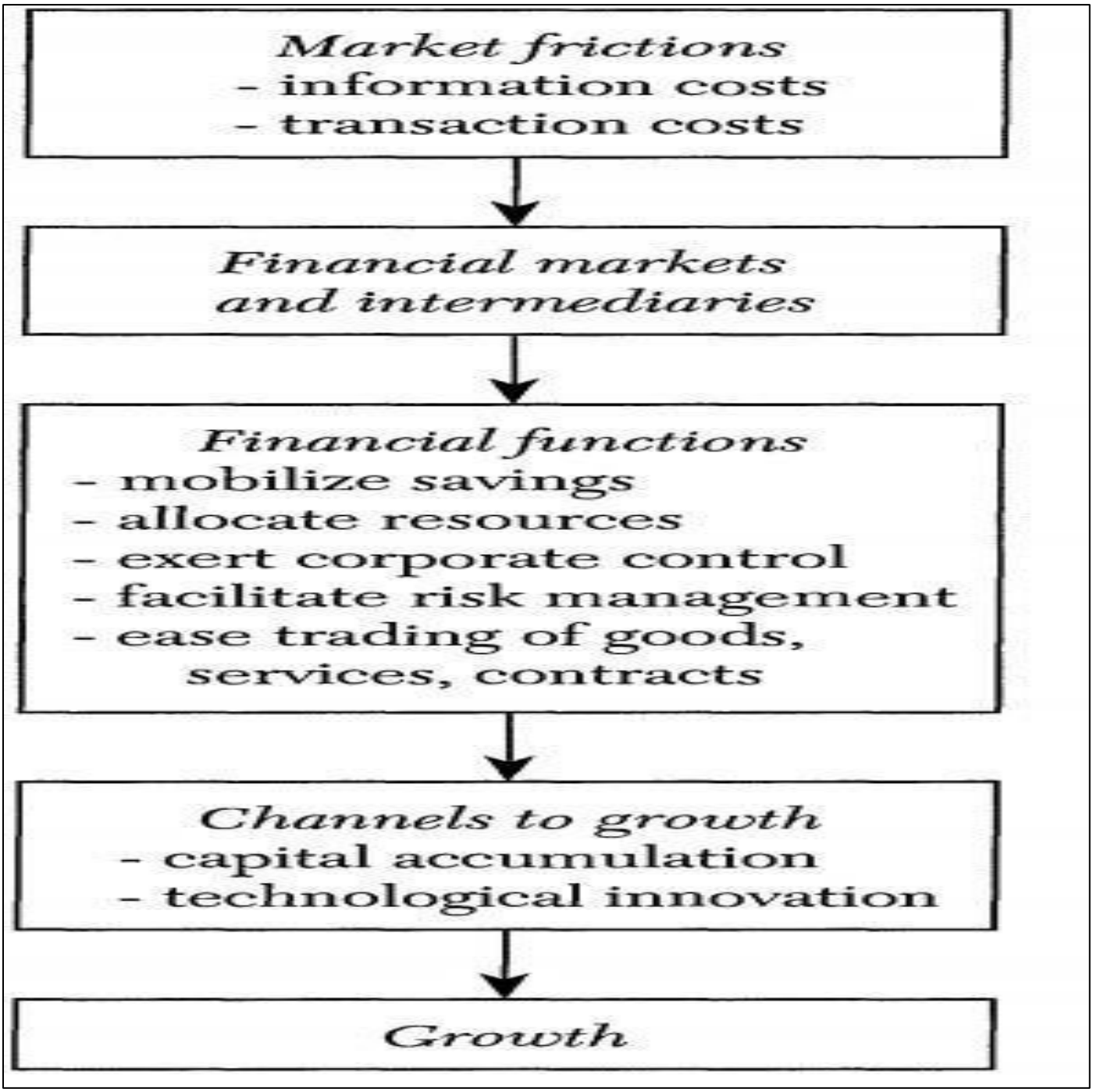


Fig 2: Levine Five Functions of the Financial System (Levine 1997)

The model by Jovanovic and Greenwood in which growth rate and financial intermediation endogenously determined concluded that financial intermediation fosters growth since investment is efficiently undertaken in well-developed financial markets (1990). Analysis by Bencivenga and Smith supported this view and revealed that financial intermediation directs savings more effectively to activities with high productivity contributing to economic growth (1991).

Furthermore, one of the highly contributed people in analyzing financial linkage to growth was Levine. He in his paper reveals and organizes the main aspects of this linkage and states that the primary function of financial systems in ameliorating transaction and information costs is: they facilitate allocation of recourses across time and space in certain conditions that enables decreasing costs and avoiding asymmetric information leading to efficient investments followed by growth (Levine 1997). A brief summary of this theoretical linkage can be seen in figure 2.

In general, aforementioned mechanisms and theories suggest that finance in its all aspects should have a significant positive effect on real economic growth as it leads to productivity advantages and capital accumulation thanks to the efficient allocation of resources.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

*B. Core Literatures Contributed to Finance-Growth Nexus*

The pioneering works by McKinnon, Shaw, and Goldsmith were a big contribution in finance-growth nexus analysis that arouse the interest of many academics and policymakers and caused continuous debates among them (De Gregorio and Guidotti 1995). Levine is one of the scholars that even dedicated most of his works to this field (about 10 paper) and his works were very clear and served as a cornerstone for many researchers so I start with his work and go further (1993). Levine with King in 1993 studied the relationship of growth and finance in the case of 80 countries between 1960 and 1989 and they included other financial and non-financial factors that account for economic growth. By using four financial development proxy measures they found a strong positive correlation with each three growth indicators, namely, productivity growth, capital accumulation, and long-run real per capita growth. Performing causality analysis, they also, concluded that in the early stages of growth financial development predicts economic growth indicating one-way causality. Besides, they declared that policies altering the financial intermediation's efficiency exert a first-order impact on growth (Levine and King 1993).

Analysis by Calderon and Liu found strong evidence that economic growth is led by financial development in the sample of 109 developed and developing countries, but for the developing countries Granger causality was bidirectional. It suggests that causality depends on countries development level and proponents of this idea declare that finance causes growth during the first phases of development, however, its effect diminishes gradually all along the process of development until it reverses back (2003).

Time series analysis by Rousseau and Watchell finance-growth nexus in the case of 5 EU countries that included banking and non-banking assets as a measure of financial development found that dominant and significant causality direction is from finance towards growth (1995). Their VAR approach allowed identifying the long-term effects of financial development on economic growth and enabled considering the dynamic interaction among explanatory variables found significant long-terms growth correlation. Research by Christopoulos and Tizianos used cointegration and panel-based unit roots to study the relationship between growth and finance in 10 developing countries. They increased sample size assuming that time series analysis generate less accurate results due to the short duration of data and used proper tests to test for causality. Their findings were in line with previous studies and they find no evidence for growth towards financial development causality. Findings showed a unique cointegration vector between finance and growth, denying the short-term relationship between them (Christopoulos and Tizianos 2004).

Koivu (2002) in his research of finance-growth relationship uses sample of 25 Eurasian transition countries for 1993-2000 period and as a measure of finance development uses three banking sector variables, notably, banking credit to the private sector, non-performing loans in the banking sector, and financial spread. Surprisingly, banking credit to the private sector showed negative correlation on economic growth that can be because of banking crisis in 90s in transition economies. However, other two variables were in line with previous research and revealed positive correlation. This paper misses important variables such as government expenditure, growth volatility, and exports that effect growth.

Some works studied the finance-growth relationship by individual country data. Jayarathe and Strahan in their study of US economy found that economic growth boosted after banking sector reforms and loan lending quality improvement. Since no consistent increase in investment and loan size was observed, it implies that financial institutions efficiency not the size that accelerates the economic growth (Jayarathe and Strahan, 1995). Similarly, in the case of Italy Guiso, Sapienza, and Zingales studied whether the financial system impacts on growth in high international capital mobility period. Results showed that in regions with the efficient financial system firms flourish faster and the probability that people open personal businesses increases that increases competition in the economy ultimately leading to high economic growth (Guiso, Sapienza, and Zingales 2004). Bertrand and others in 2007 conducted similar empirical analysis in the case of France and found a positive effect of banking sector reforms on capital accumulation and behaviour of firms. They also noted that removal of government intervention in banking system improves efficiency of resource allocation and the quality of lending decisions that fosters economic growth (Bertrand et.al, 2007).

Research by Raddatz found that financial sector development decreases the firms' output fluctuations that with high demand for liquidity. It implies that the financial system helps to stabilise firm's production. Besides, it was observed that in reduction of output volatility the financial intermediaries are more efficient than capital markets, however, no evidence that quality of accounting information impacts the output volatility in firms was found (Raddatz, 2006). Contrarily, study by Ram in the case of 95 countries during the period 1960-1989 discovered weak negative correlation between financial development and economic growth. Findings indicated that associations between financial depth and growth, measured by liquid liabilities ratio to GDP, are positive in 39 countries 9 of which only significant at 5% level. Nevertheless, 56 remaining countries showed negative correlations 16 of which significant at 5% level (Ram, 1999). It was also observed that the effect of finance is significant and positive for countries with lower income when the inflation is low while at the time with high inflation rates effect of finance on growth diminishes so the models should control on this variable as well (Rousseau and Yilmazkuday 2009).

One more cross-country study conducted by Khan and Senhadji, with the data from 159 countries between 1960 and 1999, revealed strong positive correlation between financial depth and growth (2000). They constructed standard growth model with financial indicators that covers banking and financial markets sector effects. Also, Christopoulos and Tsionas examined long-run relationship of financial depth and growth through cointegration test for 10 developing countries. Results indicated to single equilibrium correlation between growth, ancillary variables, and financial depth. Unidirectional causality from financial depth to economic growth was also observed in their analysis (Christopoulos and Tsionas 2004).

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Lastly, one of the recent studies in this field done by Waheed and Najia that examined long-run relationship between finance and growth in the case of Pakistan between 1971 and 2006. Their test for cointegration revealed that the significant long-run robust positive relation between finance and growth in Pakistan do exist. Furthermore, regarding econometric investigations it is said that macroeconomic variables in the model do provide proof in explaining changes in per capita income in the country. They also found that level of government spending and investment on education exerts positive statistically significant effect on per capita income in the long run so its presence in the model improves accuracy of calculations (Waheed and Najia 2009).

*C. Proxy Measures for Finance*

Many measures have been used as a measure of level of financial development in previous works, ranging from financial ratios, interest rates, banking sector size, to financial deepening. At the beginning of the chapter, I discussed the three channels through which finance influences the economic development (Figure 1) so in this paper I choose three proxy variables, considering methods of all the previous literatures presented in the paper, to measure the level financial development one for each of these above mentioned channels.

Firstly, I choose domestic credit to private sector as a percent of GDP to measure the financial development effect to economic growth through intermediary channel. A high domestic credit to GDP ratio indicates not only a high domestic investment, but also high development in the finance sector, notably, banking system. High credit ratio implies that banks are more likely to facilitate the five financial functions more effectively, discussed above in the Levine theory, improving financial sector and leading to growth (1997). Financial systems that distribute more credits to private sectors are engaged in seeking firms in need of finance, providing risk management control, facilitating transactions, exerting corporate control, and mobilizing savings that all requires better financial development. Besides, it is worth to note that the higher the competition among banks, the faster the finance-dependent industries growth, suggesting higher financial development and ultimately faster economic growth (Claessens and Laeven 2005).

Secondly, while previously M2 ratio was commonly used as a measure of financial deepening (the second channel) of the financial system towards growth, I choose the broadest definition of money (M3) as a ratio of GDP to measure the banking system's liquid liabilities in the economy. I choose this ratio since other two monetary aggregates, M1 and M2, can be poor proxies for economies with underdeveloped financial systems. Because, rather than being related to the ability to transfer funds from savers to borrowers they are more related to transaction services (Khan and Senhadji, 2000). With economic development M2 ratio to GDP tend to increase as well, due to access to saving and banking instruments spreads. However, as markets mature other financial instruments become available so the M2 to GDP ratio tends to drop so M3 is better measure. A higher ratio of liquidity means higher intensity in the banking system. The size of the financial sector is positively correlated with financial services is the assumption here.

Thirdly, for the measure of our last channel that is financial markets effect on economic growth I choose the financial market capitalization as a percent of GDP for each country. Higher rate of market capitalization shows that bigger amount of money is facilitated through the financial system more efficiently and productively. In other words, transaction costs and acquiring information costs create incentives for the development of financial markets and institutions. With no transaction or information costs, there is no need for the financial system that expands scrutinizing managers, designing arrangements to ease risk management and facilitate transactions or others. Theoretically, any works regarding the role of the financial system in growth, implicitly or explicitly, adds specific frictions to the Arrow-Debreu model (model of competitive equilibrium theory) (Kenneth Arrow, 1964). Financial markets arise to ameliorate the problems made by information and transactions frictions, different combinations and types of transaction and information costs stimulate distinct financial markets, institutions, and contracts.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

# CHAPTER THREE
# DATA AND METHODOLOGY

## A. *Research Question*

- *General Research Question:*
  Does the financial system foster economic growth?

- *Specific Research Question:*

- Does financial development leads to growth or vice versa?
- Through which channels does the financial system effect economic growth and in what ways (positive or negative correlation)?
- Are all independent variable statistically significant in determining economic growth? Research objectives:
- Investigate critically the casual relationship between the financial system and Economic growth, and select proper proxies for the financial system development that determine economic growth.
- Figure out causal direction of finance-growth nexus.
- Work out proper model that efficiently defines finance-growth nexus
- Check theories in practice, come up with valuable proposals in policymaking, and try to give proper recommendations.
- The main hypothesis of the research: the financial system development level significantly and positively defines economic growth level.
- Sub-Hypothesis: The financial system fosters economic growth through all its channels positively.

## B. *Data Interpretation*

This research paper intends to analyze the causal correlation between the financial system and economic growth in the sample of 27 European Union countries in the period from 1990 to 2017 (for list of countries see Appendix). Since there were changes in the membership during this period, I consider these countries separately and select them as a geographically close group of countries. If I consider them from the period of their acceptance, I have to drop important data that is in the interest of analysis since 13 countries entered EU after 2004 and one left (UK). The data was mainly sourced from the World Bank and some flaws were fulfilled by the data from International Monetary Fund. The response variable for growth GDP PPP per capita is in constant 2011 prices. Overall data quality was good with some missing figures for market capitalization and expenditure on education. However, missing data represents about less than 6 % of the total data and were replaced with the numbers that come before or after them.

## C. *Used methodology*

OLS models are mainly used to investigate the linear relationship of response and explanatory variables that all should fit at best. In line with, Gauss-Markov assumptions should also be considered in the model investigations so assure the BLUE results (Gujarati 2009). Holding these all theories in mind similar to the works of Levine et al (2000), I construct dynamic panel models (fixed effect and random effect) to test the relationship between finance and growth. The reason for choosing this model is that Levine in his works created a solid framework with strong theoretical base to analyze growth. Although other reviewed papers used different models and factors, these works mainly focused on a particular determinant and were mainly empirical in nature. Since that, to avoid running arbitrary regression analysis it was decided to choose this model but modification in the choice of determinants and improvements were made.

In the paper, three models are estimated with different measures of finance that are discussed above, namely, market capitalization, financial deepening, and credit to private sectors. I investigated these proxies separately since as explained above all of them represent finance but just stand for different channels through which they effect the growth. This implies that theoretically there would be high multicollinearity problem among them if included in one model. Besides, analysing them separately helps to understand the significance level of each separately to conclude which channel more successfully leads to economic growth. Moreover, I included some more factors to control for macroeconomic stabilisation (inflation and fdi) and human capital (unemployment and expenditure on education) that will be explained below. Importantly, to avoid diminishing the degrees of freedom in these models, many variables found in the literature considered as growth determinants in market economies (investment, government expenditure or others) are excluded. Nevertheless, these variables were found to be statistically insignificant in other finance-growth nexus studies (for instance Fidrmic 2003).

Furthermore, fixed effect and random effect models were analyzed and tested by Hausman test to identify if there is a random or fixed effect in the regression analysis. It is unethical, while using OLS models, to be sure that no other unobservable variables are dropped from the model while considering so can lead to biased results. Thus, to eliminate omitted variable bias and fix uncontrollable factors random and fixed effect models should be analyzed. Considering these all above below model is constructed.

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Table 1: Definitions of Variables and their Expected Sign

| Independent Variables | Definition | Expected Effect on the GDP per capita |
|---|---|---|
| CAP | Market capitalization as a % of GDP | positive |
| EDU | Expenditure on education as a % of GDP | positive |
| FDI | Foreign direct investment, net inflows, in % | ambiguous |
| INF | Inflation rate in % terms | positive |
| UNE | Unemployment rate in % terms | negative |
| FDE | Financial deepening (M3) ratio to GDP | positive |
| CPS | Credit to the private sector as a % of GDP | positive |

**Model:** $GDP = \alpha + \beta 1Finance + \beta 2INF + \beta 3EDU + \beta 4FDI + \beta 5UNE + \varepsilon$

The definitions of the variables are explained in the table on the right. GDP here stands for GDP PPP per capita for each country at constant 2011 prices. The variable Finance is divided into three determinants (cap, fde, and cps) and included separately in three different models. Market capitalization (cap) is the total market value of the all companies' outstanding shares of stocks at a current market price for each country and defined as a percent of GDP. For financial deepening (fde) I choose the broadest definition of money (M3) as a ratio of GDP and calculated separately for each. Credit to the Private sector (cps) is the banking total credit to the privately owned enterprises in the country during the given year and calculated for each country as a percent of GDP. Expenditure on education (edu) is the total amount directed on education sector in each country. Foreign direct investment (fdi) is the equity flows in the reporting economy and it is the sum of equity capital, reinvestment of earnings, and other capital in each country as a percent of GDP. Inflation (inf) is measured by consumer price index that reveals the annual percent change in the price of all goods and services that consumers acquire during the year for each country in percentage terms. Unemployment (une) refers to the share of the labor force (aged 15 or older regardless of their gender) that are without work but available for and seeking employment is defined in percentage terms for each country. We may have Many other variables that has a significant impact on economic growth but can not be quantified, they are all accepted in as the (e) error term of our model and these determinants are chosen backing the literature and some were added to the model by independent interest to analyze.

*D. Prior Expectations and Theoretical Backing*

To begin with, finance is generally expected to have positive correlation due to the reasons discussed in literature part. Thus, CAP, FDE, and CPS are tend to be positively correlated with economic growth because all of them are targeted to increase the overall efficiency level leading to fostered growth (see literature section). Secondly, education is included to the model in order to control for the human capital as it is essential and directly affects economic growth. An increase in the general education level means more educated and skilled labor in the market that is highly productive workers and efficient allocation of resources and potential of the companies (Barro 1997). This idea is also supported by reviewed literature that found significant positive correlation with growth so we expect the same sign (Waheed and Najia 2009). Thirdly, foreign direct investment is considered as a very good trigger for the economic flourishment in recipient country and generally, it increases number of businesses and improves competition in the country so it is expected to have positive correlation (Omran and Bolbol 2005). However, theoretically, FDI inflows into the manufacturing sectors tend to have positive effect on economic growth while FDI inflows in the primary sectors negative one (Mankiw 2016). Also, its effect on the economy depends on the development level of the financial system of the recipient country since that its sign is ambiguous. Fourthly, from literature it is clear that inflation is important parameter that can deflate the results importance so I included the inflation rate (INF) to control for price distortions (Rousseau and Yilmazkuday 2009). Theoretically, inflation have positive correlation with economic growth and negative one with unemployment as to Phillips theory (Mankiw 2016). Thus we expect positive correlation between growth and inflation. Lastly, according to the Okun's law unemployment and GDP growth is negatively correlated that is one percent change in former is expected to lead a 2 % decrease of the letter (Mankiw 2016). High unemployment level indicates that economy is unable to fully use its labor force that is the sign of low productivity. However, this parameter is not observed in previous finance-growth nexus studies, I decided to include this parameter to control for the human capital and expect it to have negative sign.

*E. Used Tests*

Required tests were used in order to test whether OLS assumptions are met. Couple of methods were facilitated to check for the normality of the data. Heteroscedasticity problem may arise in the panel data more often so Modified-Wald test was applied to check for group-wise heteroscedasticity in the residuals of the fixed effect model in the regression with equal variance hypothesis:

$$\mathbf{N_0: \sigma 2i = \sigma^2}$$

Levin-Lin-Chu test was also applied to check for the presence of unit root that determines the consistency of the series and the stochastic trend that is indeed stationary condition. Granger causality test was used to check the causal direction of finance-growth nexus. Moreover, I examined for autocorrelation problem by Wooldridge test that very common in dynamic models. Sargan test of absence of serial correlation of the residuals and over- identifying restrictions is used and correlation matrix was built to check for multicollinearity problem. However, taking into consideration only correlations of pairs of explanatory variables is not enough but still a linear correlation may stay among explanatory variable as $Y_3 = 2X_1 + 5X_2 + error$ so Variation Inflation Factor (VIF) test was used. Lastly, Hausman test was used in order to determine the consistency of the variables and to help the evaluate the case if

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

model of random or fixed corresponds to the data. That has the following equation:

$$H = (b_1 - b_0)' \left( \mathrm{Var}(b_0) - \mathrm{Var}(b_1) \right)^{\dagger} (b_1 - b_0),$$

It also needs to be mentioned that fixed effect is mostly used under the null hypothesis because it generates highly efficient results (Sheytanova, 2014).

Table 2: Fixed and Random Model Hypothesis

| | **$H_0$ is true** | **$H_1$ is true** |
|---|---|---|
| ***$b_1$* (RE estimator)** | Consistent Efficient | Inconsistent |
| ***$b_0$* (FE estimator)** | Consistent Inefficient | Consistent |

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

# CHAPTER FOUR
# EMPIRICAL RESULTS AND INTERPRETATIONS

*A. Descriptive Statistics*

Initially, I transformed the FDI and GDP per capita into the log formation to change the numerical quantity into percentage (other variables are in percentage form), as the measurement should be the same among variables in order to make proper conclusion. Taking *log* also helps to remove the skewness of the residuals and approximate them around the mean of the independent variables. Before going to the regression analysis, the first step is to analyze the descriptive statistics. Below in table 3 primary summary statistics regarding variables can be found. Generally, data is quite well and follows the theoretical background, however, there are some interesting figures that are highlighted in the table.

Table 3: Summary Statistics of Variables

| Variable | Obs | Mean | Std.Dev. | Min | Max |
|---|---|---|---|---|---|
| GDP | 756 | 9.685923 | . 9644388 | 7. 004976 | 11.6854 |
| CAP | 756 | 47.86063 | 37.70056 | . 0459584 | 326.359 |
| EDU | 756 | 4. 922194 | 1. 169788 | 1. 93433 | 8. 55955 |
| FDI | 756 | 21.95741 | 2.106446 | 9.21034 | 27.32154 |
| INF | 756 | 19.91106 | 103.5 | -4.478103 | 1058.374 |
| UNE | 756 | 9.017549 | 9.017549 | 1.1 | 27.466 |
| FDE | 756 | .5086101 | .2006484 | 0 | .9115772 |
| CPS | 756 | 77.17531 | 77.17531 | .1861522 | 255.1936 |

Firstly, market capitalization as a percent of gdp (cap) is too high. This high figure is only recorded in Luxemburg in 2007 and in other years this figure was still high in this country, while other countries showed normal results. Secondly, negative inflation is usually observed in the data in different countries and it can be the results of the recession in some countries, however, over 1000% inflation is very unusual in the data and it is observed in Bulgaria in 1997. In that year and year after Bulgaria experienced economic crash that lead to the hyperinflation. Thirdly, credit to the private sector as a percent of gdp (cps) showed high unusual figures as well. These high figures are observed in Cyprus, Germany, Portugal and Sweden mostly after 2000s.

Table 4: Correlation Matrix of Variables

| Variables | GDP | CAP | EDU | FDI | INF | UNE | FDE | CPS |
|---|---|---|---|---|---|---|---|---|
| GDP | 1.000 | | | | | | | |
| CAP | 0.2828 | 1.000 | | | | | | |
| EDU | 0.1985 | 0.1663 | 1.000 | | | | | |
| FDI | 0.6383 | 0.0862 | 0.0716 | 1.000 | | | | |
| INF | -0.3443 | -0.0809 | -0.0843 | -0.3419 | 1.000 | | | |
| UNE | -0.1958 | -0.1903 | -0.0923 | -0.1656 | -0.0158 | 1.000 | | |
| FDE | 0.4183 | 0.4652 | 0.2477 | 0.2584 | -0.1892 | -0.1863 | 1.000 | |
| CPS | 0.2020 | 0.2841 | 0.3221 | 0.0803 | -0.0683 | -0.0955 | 0.5598 | 1.000 |

Correlation matrix of variables is one of the important pre-estimation analysis in the model construction. Theoretically, high correlation coefficients that is between 0.7 and 1.0 can create multicollinearity problems in the model so variables must be weakly correlated about 0.5 or less (Gujarati 2009). As can be seen from the table 4 above, except two correlations that are higher than 0.5, which is still lower than 0.7, all other correlations are weakly correlated. Thus, we can be confident that multicollinearity is not likely to cause problems in our model, however, I will recheck for this problem after regression once more.

*B. Regression Estimates and Post-Estimation Tests*

Models were constructed in two ways, random effect and fixed effect models, that are in total 6 models, two for each of our three separate models. Below the reader can find all 6 regression models in figures 1, 2, and 3. Econometrically, in random effect model, group means are random sample from population as opposed to fixed effect model that has fixed group means. Individual-specific effects are uncorrelated with explanatory variables is the assumption in random effect models while it is the vice versa for fixed effect models. If the assumption of random effect is true than its estimators are more efficient than fixed effect's, otherwise fixed effect model is preferable. Thus, the first step here is to choose between fixed effect and random effect model for each of our three models. In order to do so I run three Hausman specification tests to choose between fixed and random effect models. Null hypothesis of the test implies that there is no any correlation between independent variables and the error term, sustaining the Random effect model, while the alternative one sustains the fixed effect model and existence of the endogeneity (see the table 5).

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

Model 1: With CPS

| | Fixed Effects Estimates | | Random Effects Estimates | |
|---|---|---|---|---|
| | Slope | Standard error | Slope | Standard error |
| CPS | 0.0066 | 0.0006*** | 0.0064 | 0.0006*** |
| EDU | 0.1093 | 0.0218*** | 0.1084 | 0.0215*** |
| FDI | 0.1653 | 0.0097*** | 0.1685 | 0.0097*** |
| INF | -0.0009 | 0.0001*** | -0.0008 | 0.0001*** |
| UNE | -0.0150 | 0.0043*** | -0.0150 | 0.0043*** |
| Constant | 5.1572 | 0.2321*** | 5.1070 | 0.2586*** |
| $R^2$ – within | | 0.53 | | 0.53 |
| $R^2$ – between | | 0.34 | | 0.34 |
| $R^2$ – overall | | 0.39 | | 0.39 |
| individual specific error – u | | 0.68 | | 0.597 |
| idiosyncratic term - e | | 0.362 | | 0.362 |
| fraction of variance due to u - | | 0.779 | | 0.731 |
| F-score/Wald chi2 score | | 160*** | | 811*** |
| correlation(u, X) | | 0.066 | | 0-assumed |

*significant at 10%, **significant at 5%, ***significant at 1%. Sample size = 756

Model 2: With CAP

| | Fixed Effects Estimates | | Random Effects Estimates | |
|---|---|---|---|---|
| | Slope | Standard error | Slope | Standard error |
| CAP | **-0.0003** | **0.0006** | -0.0001 | 0.0006 |
| EDU | 0.1761 | 0.0227*** | 0.1729 | 0.0223*** |
| FDI | 0.1929 | 0.0105*** | 0.1949 | 0.0104*** |
| INF | -0.0007 | 0.0002*** | -0.0007 | 0.0002*** |
| UNE | -0.0133 | 0.0048*** | -0.0132 | 0.0047*** |
| Constant | 4.7354 | 0.2482*** | 4.6936 | 0.2674*** |
| $R^2$ – within | | 0.44 | | 0.44 |
| $R^2$ – between | | 0.44 | | 0.44 |
| $R^2$ – overall | | 0.43 | | 0.43 |
| individual specific error – u | | 0.643 | | 0.518 |
| idiosyncratic term - e | | 0.392 | | 0.392 |
| fraction of variance due to u - | | 0.729 | | 0.635 |
| F-score/Wald chi2 score | | 115*** | | 592*** |
| correlation(u, X) | | 0.193 | | 0-assumed |

Model 3: With FDE

| | Fixed Effects Estimates | | Random Effects Estimates | |
|---|---|---|---|---|
| | Slope | Standard error | Slope | Standard error |
| FDE | 1.9183 | 0.1808*** | 1.8282 | 0.1747*** |
| EDU | 0.1319 | 0.0215*** | 0.1301 | 0.0215*** |
| FDI | 0.1179 | 0.0118*** | 0.1244 | 0.0116*** |
| INF | -0.0006 | 0.0001*** | -0.0006 | 0.0001*** |
| UNE | -0.0087 | 0.0044*** | -0.0089 | 0.0043*** |
| Constant | 5.5642 | 0.2436*** | 5.4764 | 0.2661*** |
| $R^2$ – within | | 0.52 | | 0.52 |
| $R^2$ – between | | 0.36 | | 0.38 |
| $R^2$ – overall | | 0.41 | | 0.42 |
| individual specific error – u | | 0.663 | | 0.575 |
| idiosyncratic term - e | | 0.365 | | 0.365 |
| fraction of variance due to u - | | 0.768 | | 0.713 |
| F-score/Wald chi2 score | | 155*** | | 790*** |
| correlation(u, X) | | 0.0272 | | 0-assumed |

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

According to the results of Hausman test in table 5 we reject the null hypothesis in all three models and select the fixed model as the primary model for all of them. Besides, results also showed that there is endogeneity problem between error terms and variables, so, OLS and pooled OLS models were not appropriate in this case as well. Regarding to Wooldridge (2010), fixed model suggests more consistent approximations if explanatory variables have correlation with the country-specific effects. Also, test of significance of the model, F test displays that overall significance of explanatory variables is high in all three fixed models.

Table 5: Hausman Specification Test for Models (5% Significance)

| | **Chi2 score** | **P-value** |
|---|---|---|
| Model 1 with CPS | 14.97 | 0.0105*** |
| Model 2 with CAP | 140.21 | 0.0000*** |
| Model 3 with FDE | 14.50 | 0.0107*** |

- H0: The estimator is efficient: random effects model
- Ha: The estimator is consistent: fixed effects model

Before going further to interpretation of regression estimates some more post-estimation validity tests of the model must be run. Firstly, models were checked for normality assumption though Shapiro-Wilk test for normality and two other graphical ways. The normality assumption is important in calculation of values for significance and it is the one of the 10 assumptions of OLS. Results of the test can be found in the appendix 2, 3, and 4. Regarding the results, all our models fit the normality assumption. Secondly, models were also checked for multicollinearity problem that arises when the explanatory variables are mutually correlated with each other. Since the main aim of regression is to examine the individual relationship of each single independent variable to dependent variable, multicollinearity problem can bias this process so multicollinearity problem should not exist between the variables. Multicollinearity problem was checked by Variance Inflation Factor test and the results are presented in table 7.

Table 6: Variance Inflation Factor Test

| **Variable** | **VIF** | **1/VIF** |
|---|---|---|
| FDE | 1.86 | 0.5374 |
| CPS | 1.55 | 0.6435 |
| CAP | 1.30 | 0.7672 |
| FDI | 1.22 | 0.8178 |
| INF | 1.17 | 0.8572 |
| UNE | 1.13 | 0.8817 |
| EDU | 1.09 | 0.9207 |
| Mean VIF | 1.33 | |

Regarding the theory, multicollinearity problem arises if the mean VIF value of the variables exceeds 5, nevertheless, as can be seen from the results in the table I do not have multicollinearity problem in our analysis.

Another issue that may arise in regression is heteroscedasticity problem. In general, with heteroscedasticity problem, results are still unbiased but it leads to inefficient results that is true covariance and variance are underestimated, and possibly below or above the actual or population variance. Thus, to satisfy regression assumptions residuals should have a homoscedastic variance. So I checked for heteroscedasticity problem through different tests and results for all models can be found in tables 7 and 8. Apparently, our models do have heteroscedasticity problem regarding the results.

Table 7: Breusch-Pagan/Cook-Weisberg Test for Heteroscedasticity

| | **Chi2 score** | **P-value** |
|---|---|---|
| Model 1 with CPS | 51.19 | 0.000*** |
| Model 2 with CAP | 58.03 | 0.000*** |
| Model 3 with FDE | 49.54 | 0.000*** |

- H0: Constant variance
- Ha: Fitted value of GDP

Table 8: White's Test for Heteroscedasticity

| | **Chi2 score** | **P-value** | **Skewness** | **Kurtosis** |
|---|---|---|---|---|
| Model 1 with CPS | 188.33 | 0.000*** | 0.000 | 0.4172 |
| Model 2 with CAP | 170.18 | 0.000*** | 0.000 | 0.2256 |
| Model 3 with FDE | 153.28 | 0.000*** | 0.000 | 0.2395 |

- H0: Homoscedasticity
- Ha: Unrestricted heteroscedasticity

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

To further support the argument, modified Wald test for groupwise heteroscedasticity with null hypothesis of homoscedastic groupwise variance was applied. The test revealed highly significant results indicating to heteroscedasticity problem in all three models (see table 9) . Thus, the FE models with robust standard errors were performed for all models. Despite minor reductions in significance level, general model performance remains highly significant and all variables are significant at 5 %, except unemployment rate that become insignificant in all three models. Rest will be discussed in regression estimates interpretation part.

Table 9: Modified Wald Test for Groupwise Heteroscedasticity in FE Models

| | **Chi2 score** | **P-value** |
|---|---|---|
| Model 1 with CPS | 944.20 | 0.000*** |
| Model 2 with CAP | 1344.25 | 0.000*** |
| Model 3 with FDE | 1902.12 | 0.000*** |

Cross-sectional dependence is another usual issue in panel data analysis that can lead to serial correlation. To check for it Breusch-Pagan LM test and Pesaran's test of independence were applied to the models. Both test revealed statistical evidence of cross-sectional dependence (see tables 10 and 11). Nevertheless, it must be highlighted that such dependence is most likely due to pure spatial correlation that is natural case in analyzing geographically close countries. In our case, we are analyzing EU countries that are very closely situated to each other. However, cross-sectional dependence can result to bias in estimates, cointegration, and causality tests (which will be discussed later). This issue is currently a topic of heated discussions in econometrics field and is still being observed. Using Generalized Methods of Moments (GMM) can be a cure for this problem, however, this method is based on Arellano-Bond estimator that requires some not applicable factors here. Therefore, we are not able to use GMM model. Another solution was offered by Levin, Lin, Chu (2002) is simply subtract cross sectional means which will decrease the cross-sectional dependence. This elemental approach is applied in causality and cointegration tests that we discuss later.

Table 10: Pesaran's Test of Cross Sectional Independence for three Models

| | **Chi2 score** | **P-value** | **Off-diagonal element** |
|---|---|---|---|
| Model 1 with CPS | 33.407 | 0.000*** | 0.471 |
| Model 2 with CAP | 42.687 | 0.000*** | 0.491 |
| Model 3 with FDE | 40.516 | 0.000*** | 0.500 |

Table 11: Breusch-Pagan LM Test of Independence for Three Models

| | **Chi2 score** | **P-value** |
|---|---|---|
| Model 1 with CPS | 2761.893 | 0.000*** |
| Model 2 with CAP | 2983.607 | 0.000*** |
| Model 3 with FDE | 3110.998 | 0.000*** |

*C. Robust Regression Models Interpretations*

Initially, general significance of all three models are appropriately high indicating $R^2$ equal to 53%, 44%, and 52% respectively which means that chosen independent parameters properly explain the variations in the dependent variable. The parameters of expenditure on education, foreign direct investment, and inflation rate are statistically significant in all three models even after robust option. Starting with expenditure on education, it showed highest results in second model with market capitalization depicting positive 0.17 slope. It can be implied that 1% increase in expenditure on general education rises the GDP per capita by 0.17%. Other variables can be interpreted in the similar way too. The findings are consistent with the theory and prior expectations but the parameter of EDU is comparatively lower than the results of Barro (1997) and Waheed and Najia (2009).

Table 12: All Three Robust Fixed Effects Model

| | **Fixed Effects Model 1** | | **Fixed Effects Model 2** | | **Fixed Effects Model 3** | |
|---|---|---|---|---|---|---|
| | Slope | Robust SE | Slope | Robust SE | Slope | Robust SE |
| CPS | 0.006 | 0.0016*** | --- | --- | --- | --- |
| CAP | --- | --- | **-0.0003** | **0.0011** | --- | --- |
| FDE | --- | --- | --- | --- | 1.9183 | 0..2848*** |
| EDU | 0.1093 | 0.0488** | 0.1761 | 0.0476*** | 0.1319 | 0.0551** |
| FDI | 0.1653 | 0.0206*** | 0.1929 | 0.0238*** | 0.1179 | 0.0223*** |
| INF | -0.0009 | 0.0002*** | -0.0007 | 0.0002*** | -0.0006 | 0.0002*** |
| UNE | **-0.0150** | **0.0101** | **-0.0133** | **0.0115** | **-0.0087** | **0.0109** |
| Constant | 5.1572 | 0.5275*** | 4.7354 | 0.2482*** | 5.5642 | 0.6048*** |
| $R^2$ – within | | 0.53 | | 0.44 | | 0.52 |
| $R^2$ – between | | 0.34 | | 0.44 | | 0.36 |
| $R^2$ – overall | | 0.39 | | 0.43 | | 0.41 |
| individual specific u | | 0.68 | | 0.643 | | 0.663 |
| idiosyncratic term e | | 0.362 | | 0.392 | | 0.365 |
| fraction of variance u | | 0.779 | | 0.729 | | 0.768 |
| F-score | | 160*** | | 115*** | | 155*** |
| correlation(u, X) | | 0.066 | | 0.193 | | 0.0272 |

*significant at 10%, **significant at 5%, ***significant at 1%. Sample size = 756

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

In the instance, influence factor of inflation rate on economic growth found to be negatively correlated in all three models contradicting to the findings of Rousseau and Yilmazkuday (2009). It is opposing to our priorcausal expectations as well, however, it may be because during the chosen years EU created strong policies targeted to decrease unemployment and inflation rates in the region while they are tying to decrease the rates the economy on the other hand continued to grow (World Bank report, 2010). Nevertheless, regarding the results, inflation in not strong variable effecting economic growth with only negative 0.0009% margin effect (highest value from Model 1 with CPS). In generall, results are considerably lower from those obtained by other researchers like Raddatz (2006), and Rousseau and Yilmazkuday (2009). The possible explanation for this can be fill missing values in the data, that were replace with available values that come after or before them. Since that, for some period, inflation, expenditure on education and market capitalisation values remained constant while GDP per capita rose steadily. Consequently, the regression models underestimated slopes of parameters and processed relatively lower significance results. The underestimation is probably more significant in inflation and market capitalization since there were more missing values in these two parameters.

Consistent with previous studies by Falcetti (2006) and Omran and Bolbol (2005) the parameters of FDI shows positive correlation with growth that are 0.16%, 0.19%, and 0.11% in three models respectively and all are statistically significant at 99% confidence level. Here we can conclude that relatively bigger part of investments were directed to manufacturing part, also it implies that one percent increase in the foreign direct investment fosters the growth by 0.16%. Moving to the unemployment parameter it must be noted that its parameters were highly significant in all three models, however, after robust standard errors unemployment parameter become statistically insignificant in our models. Before robust standard error, its parameters were negatively correlated but they did not confirm the Okun's law theory anyway with minor percentage margins in all three models (0.015%, 0.013%, and 0.008% respectively).

In terms of our primary variables of interest, finance proxy variables, two of them credit to the private sector and financial deepening illustrates statistically significant correlation with growth even after robust standard error while market capitalization does not. Firstly, Market capitalization showed very statistically insignificant p-values so it was thought due to outliers in the data and outliers were dropped and regression was run again. However, except slight improvement in significance level data is still statistically insignificant even at 10% significance level. This finding is not consistent with analysis of Raddatz (2006) what found significant positive correlation between growth and market capitalization. It may be because the financial market structure of each county is developed in different level and since these all countries are in economic union capitalization of one country's companies is considered in different second country and calculated in favour of second country. Secondly, in line with Levine (1997), Bertrand (2007), Jayarathe and Strahan (1995), Koivu (2002), and Cottarelli (2003) our results of credit to the private sector illustrates statistically significant positive results. However, it can not be considered as the strongest engine that drives the economic growth since it boosts the economic growth only by 0.006% for every a percentage change in credit to privately owned enterprises. However, this figure could be slightly underestimated due to the reason explained above, as with the inflation case and/or regarding to the Levine theory (1997) it can be a result of not efficient banking system that is not fully facilitating aforementioned five financial functions. Lastly, financial deepening can be recognized as a dominant factor fostering economic growth since one point increase in financial deepening boosts economic growth nearly by 2%. Findings are in the same line with expected results of scholars Khan and Senhadji (2000) and Christopoulos and Tsionas (2004). This results imply that measurement of effect of finance on growth depends on through which channel finance is considered to effect growth, dissimilar to other two channels financial deepening has strong direct effect on economic growth.

### *D. Granger Causality*

Regression is the statistical tool that always leads to reasonably significant results when explanatory variables and response variables are correlated. Nevertheless, correlation does not mean causation. In order to get conclusive evidence about if finance, notably, credit to privates sector, market capitalization, and financial deepening truly cause economic growth (including other explanatory variables), a causality test that inspects the lags of independent variables to detect causality should be implemented. Thus, the commonly used Granger causality test was performed. Test holds the null hypothesis that is a change in an independent variable does not cause a change in GDP per capita for all countries, whereas alternative one states that for at least one country a change in independent variable causes a change in GDP per capita. The test must be performed separately for each explanatory variable and I choose to examine it up to three lags to determinate causality (see appendix 6 for all results). Regarding the results, selected all variables, including finance proxies, reasonably hold strong causality to economic growth except the inflation parameter. Bidirectional causality was also checked and it appears that credit to the private sector and financial deepening do have bidirectional causality with economic growth. That means economic growth also can cause financial improvement as well. This result is consistent with the findings of Calderon and Liu (2003). A cointegration test was implemented to further investigate this relationship.

### *E. Cointegration Test*

A cointegration test is a statistical tool that allows identifying if the regression is spurious or if there a long-term relationship between parameters. The results of regression would be simply because of the correlation between them if no statistically significant proof of cointegration is found. Firstly, an integrated order of parameters should be identified. Thus, Levin, Lin, Chu (2002) unit root test is implied. In order to decrease cross-sectional correlation the parameters are demeaned and up to three lags are added in order to decrease serial correlation. The trend line is also added to GDP per capita, expenditure on education, market capitalization, and financial deepening. Because as time passes, GDP per capita goes upward, population growth and results in higher demand on education with upward trend, and as counties become more developed capitalization and financial deepening will improve following

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

an upward trend. Unit Root test revealed that all parameters except credit to the private sector appear to be non-stationary and their differences are stationary that means all parameters are integrated on order one I(1) (see appendix 5 for results). If residuals acquired from regression is I(0), then it stands that GDP per capita and independent variables in all three models are cointegrated, indicating to the existence of a long-term relationship between parameters. To put it differently, there is statistical proof of cointegration if non-stationarity in GDP per capita is purely because of nonstationary in independent variables and error term does not systematically effect GDP per capita. In order to check for cointegration, three different tests were performed, for all three models and each of these tests is based on multiple tests (see appendixes 7,8 and 9). Fortunately, all our three models showed positive results, two out of three cointegration tests found evidence of cointegration in all models. These results are consistent with the findings of Waheed and Najia (2009) who found long term relationship finance and growth and with the findings of Christopoulos and Tizianos (2004) who found unique cointegration in finance modes. Based on the results of cointegration and causality tests, we can conclude that each of our three models reasonably explains the growth of GDP per capita in chosen countries.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

# CHAPTER FIVE
# CONCLUSION

## *A. Final Remarks*

This study examines one of the key topics, the linkage of the financial system and economic growth, and tries to provide an in-depth analysis of empirical and theoretical discussions and assess the level of financial sector correlation to economic growth through different channels. To examine the finance-growth relationship endogenous growth model was chosen and after comprehensive analysis and literature review, three proxy variables for the financial sector were selected and three separate fixed effect models were constructed. To further investigate the directional causality, I also performed Granger causality and cointegration tests. Proper post- estimation tests including the Unit root test were performed in order to asses the validity of the regression estimates and significance of the variables I accepted only after robust standard error.

The main findings of the research are as follows. The dynamic regression model revealed that finance does have an effect on economic growth and this effect is positive. Also, all three models showed a reasonably high overall significance level with consistent results. Initially, it was intended to analyze the effect of each three channels through with theoretically it was assumed that finance affects the economic growth, however, the three proxies illustrated different results. Firstly, regarding our model, market capitalization appear to have no statistically significant effect on economic growth which means it is not a good proxy to analyze the finance-growth nexus or/and our model underestimates this parameter. Secondly, credit to the private sector indicated a positive statistically significant correlation with growth but still, it can not be selected as the strongest driver of growth since its margin of effect is considerably low. However, the finance-proxy variable financial deepening is considered to be a very strong financial variable that fosters economic growth by about two folds for every point increase in the financial deepening level. The findings indicate that most of the chosen countries have reached a certain point at which the financial sector is an effective determinant of growth. Nevertheless, the effect of different financial institutions, including the capital markets, banks, and the necessary regulation and legal environment differs notably between these countries and the most efficient one can be said financial deepening. Furthermore, causality and cointegration tests also revealed positive results indicating that all selected variables do granger cause growth. Except for the variables market capitalization, finance variables indicated bidirectional causality that still consistent with the theory discussed in the literature part. As the economy develops, it creates a good chance for many businesses to flourish, increases a confidence level of people, the uncertainty level decreases, et cetera, that all leads to the improvement of the financial system. Cointegration tests also showed positive results for each of the three models. So we are confident that our models are free from spurious regression and can reasonably define growth, also, a log-run strong relationship between the financial system and economic growth can be surely observed. Finally, even all models are proper, however, considering all above, Model 3 with a financial deepening financial-proxy variable can be selected among other two models since this variable appears to have a more stronger correlation than others.

## *B. Limitations*

This paper possesses a few limitations that need to me mentioned. Initially, the sample is relatively small as compared to those of the other professional scholars and a longer period of time span was planned to be chosen, however, due to missing variables in the dataset shorter period of time is applied. Secondly, the majority of the chosen countries are considered as already developed countries so the research lacks to analyze finance-growth nexus in the other groups of countries like transition or developing countries. Moreover, due to lack of knowledge, some advanced models that were found in the literatures were not considered as the I lack both expertise and theoretical knowledge about other models as VAR or 2SLS models. Furthermore, some more control variables like political stability in the region/country or natural resources level were not considered in our models due to some scope limitations and these variables are suggest to be checked in further researches. Some more recommendations for further research are as follows: research paper can be extended by presenting banking and financial crises since it is recently debated to have a negative impact on the development of the financial system and economic development. Secondly, it is suggested to choose a longer period and sample of countries and analyze them separately according to their respective groups or income levels. Thirdly, other developed models such as simultaneous effect models that I couldn't implement in this paper are suggested to perform to analyze the finance-growth correlation. Lastly, this empirical paper or others do not attempt to provide the answer to the question "What will happen in the future?" Rather, they state us "what has happened in the past." In other words, the question of whether the finance system fosters economic growth will still be the subject to debate.

## *C. Policy Suggestions*

An efficient financial system provides better financial services that enable the economy to grow at a high pace while a weak financial system brings unfavourableness into the economy and even can lead to crisis. Since that and as it is found by findings, the financial system requires a distinct attention of the policymakers. Some suggested policy implications are as follows: to maintain sustainable economic growth, all economies have to undertake essential measures to improve the relationship between the real and financial sector and deepen the financial system. Financial governance and banking sectors must be strengthened in all these countries since the well-functioning financial sector promote economic growth in both developing and developed countries. Credit to the private sector analysis in these countries shows that most part of it goes to the manufacturing sectors that do not highly contribute to the economic growth since that it is suggested to diversify these credits and direct them more appropriately to the sectors with higher contribution t the economic growth. In some countries, the shares of the service and agriculture sectors in banks' credits should be increased as these sectors contribute to the economic growth comparatively high favorableness.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

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ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

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ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

# APPENDIXES

## APPENDIX 1

List of Countries

| |
|---|
| 1. Austria |
| 2. Belgium |
| 3. Bulgaria |
| 4. Croatia |
| 5. Cyprus |
| 6. Czech Republic |
| 7. Denmark |
| 8. Estonia |
| 9. Finland |
| 10. France |
| 11. Germany |
| 12. Greece |
| 13. Hungary |
| 14. Ireland |
| 15. Italy |
| 16. Latvia |
| 17. Lithuania |
| 18. Luxembourg |
| 19. Malta |
| 20. Netherlands |
| 21. Poland |
| 22. Portugal |
| 23. Romania |
| 24. Slovakia |
| 25. Slovenia |
| 26. Spain |
| 27. Sweden |

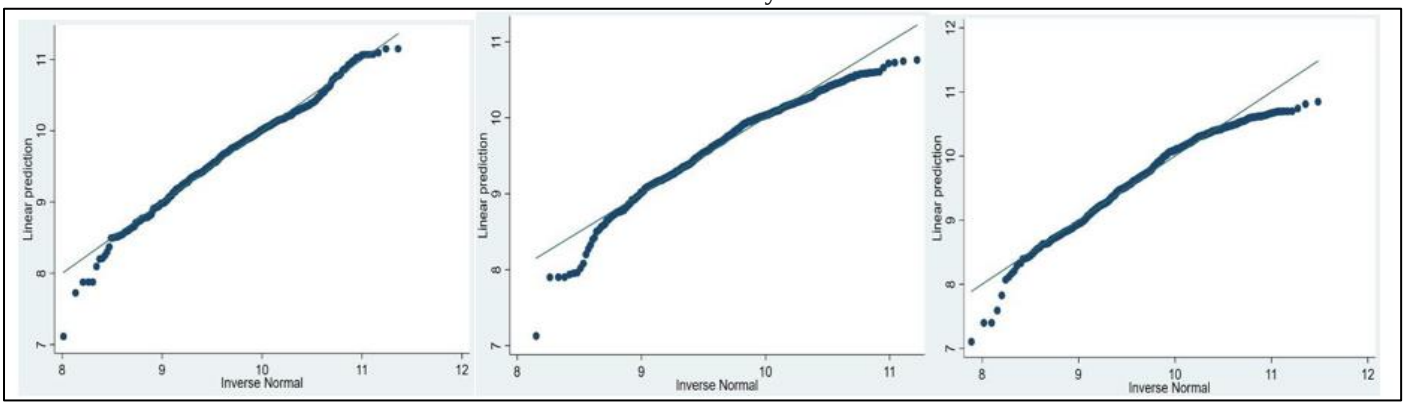
## APPENDIX 2

Shapiro-Wilk W test for normal data

| Variables | Obs | W | V | Z | Prob>z |
|---|---|---|---|---|---|
| Model 1 e | 756 | 0.98806 | 5.839 | 4.319 | 0.554 |
| Model 2 e | 756 | 0.96749 | 15.898 | 6.771 | 0.438 |
| Model 3 e | 756 | 0.97095 | 14.204 | 6.495 | 0.226 |

## APPENDIX 3

Residual Normality Test

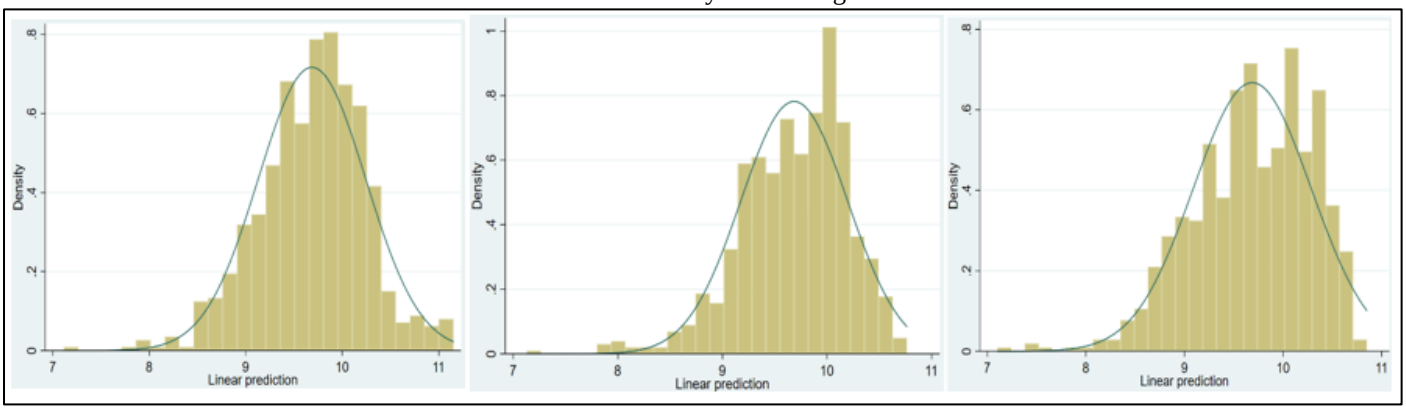



Model1 residuals Model 2 residuals Model 3 residuals

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

## APPENDIX 4

Residual Normality Test Histogram




Model 1 Residuals Model 2 Residuals Model 3 Residuals

## APPENDIX 5

**Unit Root Tests**

Unit Root Test 1 For **GDP per capita**

H0: Panels contain unit roots Ha: Panels are stationary Panel means: included

Time trend: included ADF regressions: 3 lags

| | | **P-value** |
|---|---|---|
| Unadjusted t-statistic | -13.1719 | |
| Adjusted t-statistic | 1.5617 | 0.9408 |

Unit Root Test 2 **For** Credit to Private Sector

| | | **P-value** |
|---|---|---|
| Unadjusted t-statistic | -11.2919 | |
| Adjusted t-statistic | -6.6394 | 0.0000 |

Unit Root Test 3 For Expenditure on Education

| | | **P-value** |
|---|---|---|
| Unadjusted t-statistic | -13.6267 | |
| Adjusted t-statistic | -0.6577 | 0.2554 |

Unit Root Test 4 For FDI

| | | **P-value** |
|---|---|---|
| Unadjusted t-statistic | -11.6733 | |
| Adjusted t-statistic | -0.7598 | 0.2237 |

Unit Root Test 5 For inflation

| | | **P-value** |
|---|---|---|
| Unadjusted t-statistic | -27.2884 | |
| Adjusted t-statistic | 8.7902 | 1.0000 |

Unit Root Test 6 For unemployment

| | | **P-value** |
|---|---|---|
| Unadjusted t-statistic | -10.4524 | |
| Adjusted t-statistic | -2.0684 | 0.0689 |

Unit Root Test 7 For Market Capitalization

| | | **P-value** |
|---|---|---|
| Unadjusted t-statistic | -12.2818 | |
| Adjusted t-statistic | -1.3289 | 0.0919 |

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

Unit Root Test 8 For Financial Deepening

| | | **P-value** |
|---|---|---|
| Unadjusted t-statistic | -10.4911 | |
| Adjusted t-statistic | 0.9508 | 0.8291 |

## APPENDIX 6

### Granger Causality

GDP per capita and credit to private sector
Dumitrescu & Hurlin (2012) Granger non-causality test results:

| **Lag order: 3** | | **P-value** |
|---|---|---|
| W-bar | 5.0840 | |
| Z-bar | 4.4209 | 0.0000 |
| Z-tilde | 2.7662 | 0.0057 |

- H0: Credit to private sector does not Granger-cause GDP per capita
- Ha: Credit to private sector does Granger-cause GDP per capita for at least one country

GDP per capita and **expenditure on education**

| **Lag order: 3** | | **P-value** |
|---|---|---|
| W-bar | 5.6147 | |
| Z-bar | 5.5466 | 0.0000 |
| Z-tilde | 3.6252 | 0.0003 |

- H0: Expenditure on education does not Granger-cause GDP per capita
- Ha: Expenditure on education does Granger-cause GDP per capita for at least one country

GDP per capita and **FDI**

| **Lag order: 3** | | **P-value** |
|---|---|---|
| W-bar | 5.0578 | |
| Z-bar | 4.3653 | 0.0000 |
| Z-tilde | 2.7238 | 0.0065 |

- H0: FDI does not Granger-cause GDP per capita
- Ha: FDI does Granger-cause GDP per capita for at least one country

GDP per capita and **Inflation**

| Lag order: 3 | | P-value |
|---|---|---|
| W-bar | 2.2160 | |
| Z-bar | -1.6632 | 0.0963 |
| Z-tilde | -1.8760 | 0.0607 |

- H0: Inflation does not Granger-cause GDP per capita
- Ha: Inflation does Granger-cause GDP per capita for at least one country

GDP per capita and **Unemployment**

| **Lag order: 3** | | **P-value** |
|---|---|---|
| W-bar | 4.9352 | |
| Z-bar | 4.1052 | 0.0000 |
| Z-tilde | 2.5254 | 0.0116 |

- H0: Unemployment does not Granger-cause GDP per capita
- Ha: Unemployment does Granger-cause GDP per capita for at least one country

GDP per capita and **Market capitalization**

| **Lag order: 3** | | **P-value** |
|---|---|---|
| W-bar | 7.5791 | |
| Z-bar | 9.7137 | 0.0000 |
| Z-tilde | 6.8047 | 0.0000 |

- H0: Market capitalization does not Granger-cause GDP per capita
- Ha: Market capitalization does Granger-cause GDP per capita for at least one country

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GDP per Capita and **Financial Deepening**

| **Lag order: 3** | | **P-value** |
|---|---|---|
| W-bar | 5.1069 | |
| Z-bar | 4.4694 | 0.0000 |
| Z-tilde | 2.8032 | 0.0051 |

- H0: Financial deepening does not Granger-cause GDP per capita
- Ha: Financial deepening does Granger-cause GDP per capita for at least one country

Financial Deepening and **GDP Per Capita**

| **Lag order: 3** | | **P-value** |
|---|---|---|
| W-bar | 5.7897 | |
| Z-bar | 5.9178 | 0.0000 |
| Z-tilde | 3.9084 | 0.0001 |

- H0: GDP per capita does not Granger-cause Financial deepening
- Ha: GDP per capita does Granger-cause Financial deepening for at least one country

Credit to private sector **and GDP Per Capita**

| **Lag order: 3** | | **P-value** |
|---|---|---|
| W-bar | 15.6938 | |
| Z-bar | 26.9275 | 0.0000 |
| Z-tilde | 19.9392 | 0.0000 |

- H0: GDP per capita does not Granger-cause Credit to private
- Ha: GDP per capita does Granger-cause Credit to private for at least one country

Market Capitalization and **GDP per Capita**

| **Lag order: 3** | | **P-value** |
|---|---|---|
| W-bar | 2.8600 | |
| Z-bar | -0.2970 | 0.7664 |
| Z-tilde | -0.8336 | 0.4045 |

- H0: GDP per capita does not Granger-cause Credit to private
- Ha: GDP per capita does Granger-cause Credit to private for at least one country

## APPENDIX 7

Cointegration Tests for Model 1 with CPS
Kao test for Cointegration Ho: No Cointegration
Ha: All Panels are Cointegrated

| | **Statistics** | **P-value** |
|---|---|---|
| Modified Dickey-Fuller t-stat | 1.9031 | 0.0285 |
| Dickey-Fuller t-stat | 1.3469 | 0.0890 |
| Augmented Dickey-Fuller t-stat | 1.5130 | 0.0651 |
| Unadjusted modified Dickey-Fuller t-stat | 1.5581 | 0.0596 |
| Unadjusted Dickey-Fuller t-stat | 0.9935 | 0.1602 |

Pedroni test for cointegration
Ho: No cointegration
Ha: All panels are cointegrated

| | **Statistics** | **P-value** |
|---|---|---|
| Modified Phillips-Perron t-stat | 4.6297 | 0.0000 |
| Phillips-Perron t-stat | 1.1666 | 0.1217 |
| Augmented Dickey-Fuller t-stat | 2.3256 | 0.0000 |

Westerlund Test for Cointegration Ho: No cointegration
Ha: Some panels are cointegrated

| | **Statistics** | **P-value** |
|---|---|---|
| Variance ratio | 7.3818 | 0.0000 |

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/25apr1519

## APPENDIX 8

Cointegration Tests for Model 2 with CAP
Kao test for cointegration Ho: No cointegration
Ha: All panels are cointegrated

| | Statistics | P-value |
|---|---|---|
| Modified Dickey-Fuller t-stat | 1.6739 | 0.0471 |
| Dickey-Fuller t-stat | 1.0599 | 0.1446 |
| Augmented Dickey-Fuller t-stat | 1.1988 | 0.1153 |
| Unadjusted modified Dickey-Fuller t-stat | 1.3166 | 0.0940 |
| Unadjusted Dickey-Fuller t-stat | 0.7128 | 0.2380 |

Pedroni test for cointegration
Ho: No cointegration
Ha: All panels are cointegrated

| | Statistics | P-value |
|---|---|---|
| Modified Phillips-Perron t-stat | 5.2973 | 0.0000 |
| Phillips-Perron t-stat | 2.3936 | 0.0083 |
| Augmented Dickey-Fuller t-stat | 2.9037 | 0.0018 |

Westerlund test for cointegration
Ho: No cointegration
Ha: Some panels are cointegrated

| | Statistics | P-value |
|---|---|---|
| Variance ratio | 13.7778 | 0.0000 |

## APPENDIX 9

Cointegration Tests for Model 3 with FDE
Kao test for cointegration Ho: No cointegration
Ha: All panels are cointegrated

| | Statistics | P-value |
|---|---|---|
| Modified Dickey-Fuller t-stat | 2.0393 | 0.0207 |
| Dickey-Fuller t-stat | 1.4569 | 0.0726 |
| Augmented Dickey-Fuller t-stat | 1.6078 | 0.0539 |
| Unadjusted modified Dickey-Fuller t-stat | 1.6406 | 0.0504 |
| Unadjusted Dickey-Fuller t-stat | 1.0376 | 0.1497 |

Pedroni test for cointegration
Ho: No cointegration
Ha: All panels are cointegrated

| | Statistics | P-value |
|---|---|---|
| Modified Phillips-Perron t-stat | 5.0590 | 0.0000 |
| Phillips-Perron t-stat | 1.9027 | 0.0285 |
| Augmented Dickey-Fuller t-stat | 3.7986 | 0.0001 |

Westerlund test for cointegration Ho: No cointegration
Ha: Some panels are cointegrated

| | Statistics | P-value |
|---|---|---|
| Variance ratio | 12.1883 | 0.0000 |

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## APPENDIX 10

**STATA used do file codes**

clear all import excel xtset id time

replace fdi_iflow = -fdi_iflow if fdi_iflow<0 gen gdp_p_ln = log(gdp_c_p_m)

gen fdi_ln = log(fdi_iflow)

****Summary Stats**

xtsum gdp_p_ln
xtsum credit_p xtsum m_capital xtsum unemployment xtsum ex_edu

xtsum inflation_cpi xtsum fdi_ln xtsum fd_fd_ix

sum gdp_p_ln credit_p m_capital unemployment ex_edu inflation_cpi fdi_ln fd_fd_ix

****Correlation**

pwcorr gdp_p_ln m_capital ex_edu fdi_ln inflation_cpi unemployment fd_fd_ix credit_p

****Granger Causality**

ssc install xtgcause

xtgcause gdp_p_ln credit_p, lags(3) mat Wi_PVi_c = r(Wi), r(PVi)

mat li Wi_PVi_c
xtgcause gdp_p_ln ex_edu, lags(3) mat Wi_PVi_h = r(Wi), r(PVi) mat li Wi_PVi_h

xtgcause gdp_p_ln fdi_ln, lags(3) mat Wi_PVi_h = r(Wi), r(PVi) mat li Wi_PVi_h

xtgcause gdp_p_ln inflation_cpi, lags(3) mat Wi_PVi_h = r(Wi), r(PVi)

mat li Wi_PVi_h
xtgcause gdp_p_ln unemployment, lags(3) mat Wi_PVi_h = r(Wi), r(PVi)

mat li Wi_PVi_h
xtgcause gdp_p_ln m_capital, lags(3) mat Wi_PVi_h = r(Wi), r(PVi)

mat li Wi_PVi_h
xtgcause gdp_p_ln fd_fd_ix, lags(3) mat Wi_PVi_h = r(Wi), r(PVi)

mat li Wi_PVi_h

****vice direction**

xtgcause credit_p gdp_p_ln, lags(3) mat Wi_PVi_h = r(Wi), r(PVi)

mat li Wi_PVi_h
xtgcause m_capital gdp_p_ln, lags(3) mat Wi_PVi_h = r(Wi), r(PVi)

mat li Wi_PVi_h

xtgcause fd_fd_ix gdp_p_ln, lags(3) mat Wi_PVi_h = r(Wi), r(PVi)

mat li Wi_PVi_h

****Multicolliniarity analysis**

quietly reg gdp_p_ln credit_p fd_fd_ix m_capital ex_edu fdi_ln inflation_cpi unemployment

**vif**

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****Homoscedasticity analysis**

quietly reg gdp_p_ln credit_p ex_edu fdi_ln inflation_cpi unemployment

imtest, white hettest

quietly reg gdp_p_ln m_capital ex_edu fdi_ln inflation_cpi unemployment

imtest, white hettest

quietly reg gdp_p_ln fd_fd_ix ex_edu fdi_ln inflation_cpi unemployment

imtest, white hettest

****First model**

xtreg gdp_p_ln credit_p ex_edu fdi_ln inflation_cpi unemployment,fe

****Normality check**

predict e1

swilk e1 qnorm e1

hist e1, normal

estimates store fixed_u_1

xtreg gdp_p_ln credit_p ex_edu fdi_ln inflation_cpi unemployment,re

****Normality check**

predict e2 swilk e2 qnorm e2

hist e2, normal

estimates store random_u_1

****Hausman test**

hausman fixed_u_1 random_u_1 estat vce, corr

****Autocorrelation check**

xtserial gdp_p_ln credit_p unemployment ex_edu inflation_cpi fdi_ln, output

****breusch and pagan lagrangian multiplier test for random effects test**

xttest0

****Cointegration Test**

ssc install xtcointtest

xtcointtest kao gdp_p_ln credit_p ex_edu fdi_ln inflation_cpi unemployment, demean lags(3)

xtcointtest pedroni gdp_p_ln credit_p ex_edu fdi_ln inflation_cpi unemployment, demean lags(3)

xtcointtest westerlund gdp_p_ln credit_p ex_edu fdi_ln inflation_cpi unemployment, demean

****Unit Root Test**

xtunitroot llc gdp_p_ln, trend lags(3) demean xtunitroot llc d.gdp_p_ln

xtunitroot llc credit_p, lags(3) demean

xtunitroot llc d.credit_p

xtunitroot llc ex_edu, trend lags(3) demean xtunitroot llc d.ex_edu

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xtunitroot llc fdi_ln, lags(3) demean xtunitroot llc d.fdi_ln

xtunitroot llc inflation_cpi,lags(3) demean xtunitroot llc d.inflation_cpi

xtunitroot llc unemployment, lags(3) demean xtunitroot llc d.unemployment

xtunitroot llc m_capital, trend lags(3) demean xtunitroot llc d.m_capital

xtunitroot llc fd_fd_ix, trend lags(3) demean xtunitroot llc d.fd_fd_ix

****Pearse groupwise independence**

ssc install xttest2 ssc install xttest3 ssc install xtcsd xtcsd, pesaran abs xttest2

xttest3

****Robust models**

xtreg gdp_p_ln credit_p ex_edu fdi_ln inflation_cpi unemployment,fe robust

****Second model**

xtreg gdp_p_ln m_capital ex_edu fdi_ln inflation_cpi unemployment,fe

****Since the results of Market capitalization was not significat I droped some outliers in the data but the significance level increased but it is still not enough**

drop in 477/504

****Normality check**

predict e3 swilk e3 qnorm e3

hist e3, normal

estimates store fixed_u_2

xtreg gdp_p_ln m_capital ex_edu fdi_ln inflation_cpi unemployment,re

****Normality check**

predict e4 swilk e4 qnorm e4

hist e4, normal

estimates store random_u_2 hausman fixed_u_2 random_u_2 estat vce, corr

****Autocorrelation check**

xtserial gdp_p_ln m_capital unemployment ex_edu inflation_cpi fdi_ln, output

****breusch and pagan lagrangian multiplier test for random effects test**

xttest0

****Pearse groupwise independence**

xtcsd, pesaran abs xttest2

xttest3

****Cointegration Test**

xtcointtest kao gdp_p_ln m_capital ex_edu fdi_ln inflation_cpi unemployment, demean lags(3)

xtcointtest pedroni gdp_p_ln m_capital ex_edu fdi_ln inflation_cpi unemployment, demean lags(3)

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xtcointtest westerlund gdp_p_ln m_capital ex_edu fdi_ln inflation_cpi unemployment, demean

****Robust models**

xtreg gdp_p_ln m_capital ex_edu fdi_ln inflation_cpi unemployment,fe robust

****Third model**

xtreg gdp_p_ln fd_fd_ix ex_edu fdi_ln inflation_cpi unemployment,fe

****Normality check**

predict e5 swilk e5 qnorm e5

hist e5, normal

estimates store fixed_u_3

xtreg gdp_p_ln fd_fd_ix ex_edu fdi_ln inflation_cpi unemployment,re

****Normality check**

predict e6 swilk e6 qnorm e6

hist e6, normal

estimates store random_u_3 hausman fixed_u_3 random_u_3 estat vce, corr

****Pearse groupwise independence**

xtcsd, pesaran abs xttest2

xttest3

****Autocorrelation check**

xtserial gdp_p_ln fd_fd_ix unemployment ex_edu inflation_cpi fdi_ln, output

****breusch and pagan lagrangian multiplier test for random effects test**

xttest0

****Cointegration Test**

xtcointtest kao gdp_p_ln fd_fd_ix ex_edu fdi_ln inflation_cpi unemployment, demean lags(3)

xtcointtest pedroni gdp_p_ln fd_fd_ix ex_edu fdi_ln inflation_cpi unemployment, demean lags(3)

xtcointtest westerlund gdp_p_ln fd_fd_ix ex_edu fdi_ln inflation_cpi unemployment, demean

****Robust models**

xtreg gdp_p_ln fd_fd_ix ex_edu fdi_ln inflation_cpi unemployment,fe robust