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NEKN01
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Date of seminar: 2017-05-31

Giving Credit to Credit

Financial & Economic Development

Short- and Long-Run Analysis

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Abstract

Financial intermediaries are ubiquitous in modern society and its impact have been exhaustively studied. A particularly vibrant field of research concerns the interrelationship between financial and economic development. While much research has been carried out on this topic, most only focus on narrow measures of both economic and financial development. Hence, this study assumes a wider approach by constructing more refined conceptions of financial and economic development. Since the field is also divided along methodological lines, we attempt to arbitrate the differences by employing both long and short-run econometric models. Since some research indicates an income-based response to financial development we also fracture our sample according to income. Our results support that there is causality between financial development and economic development, but that the direction of causality varies with different measures of financial development and with income. We also find support for a pronounced effect of financial development for lower income-countries. The effects of financial intermediation on the growth of RGDP appears to be channelled through capital accumulation and the growth of technological innovation.

Key words: financial development, economic development, Panel-data, Granger-causality, long-run multiplier
Words: 17137

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1 Introduction

1.1 Background

> *Where there is no direct power of disposal by leaders over means of production, development is in principle impossible without credit (Schumpeter, 2002, p. 106)*

Although dramatized, the quote by Schumpeter poignantly evokes the indispensability of the infrastructure of finance to the capitalist economy. Financial markets serve to substantially magnify the opportunities for individuals and firms to dynamically optimize consumption and investment. As noted by Goldsmith (1969, p. 391), a chief function of a mature credit market is the separation of individual savings from investment which liberates the individual from her first-period budget constraint and allows her to borrow on the present value of her future income. Additionally, the existence of financial instruments has the virtue that it "vastly enlarges the circle of potential buyers and of potential transactions" (Goldsmith, 1969, p. 392) through the elimination of physical inter-personal transactions.

When Schumpeter (2002, p. 107) issued the quote retold above, he did it as part of a treatise on the importance of credit and the transfer of "purchasing power", that is, "the method by which development is carried out in a system with private property and division of labor". It was not until the late 1960's, however, that Schumpeter's theories underwent more rigorous scientific inquiry and empirical testing. Goldsmith's pivotal 1969-study traced the beneficial effect of financial development on growth to its capacity to increase the efficiency of investment by maximizing marginal rates of return and facilitating higher rates of capital accumulation. Financial instruments also serve to remedy the "indivisibility" (Goldsmith, 1969, p. 393) of certain investments that plague many entrepreneurs with diminutive initial endowments. Many such entrepreneurs are faced with prohibitively high initial investment costs, making lucrative production processes unrealizable, despite the promise of high future returns. Indeed, as McKinnon shows, in the case of underdeveloped statist economies with virtually no capital market integration and thus non-existent opportunities for external financing, self-financing is

the sole resort for these entrepreneurs. Consequently, entrepreneurs deprived of financing are caught in “a low-level equilibrium trap, where innovation is completely blocked” (McKinnon, 1973, p. 13) which renders an economy unable to fully harness its productive capabilities. Financial systems also add tremendously to reducing information and transaction costs, spur technological innovation, exert corporate control and diversify risk (Levine, 1997, pp. 690-91).

Naturally, a possibility is for the direction of causality to be reversed or simultaneous. The issue of causality was tackled by Joan Robinson as early as 1952 where she reverses the direction of causality, embodied neatly in the quote “Where enterprise leads, finance follows” (Robinson, 1952, p. 86). While Goldsmith was non-committal on the issue (Goldsmith, 1969, p. 48), Levine forcefully defends the unidirectional direction of causality from financial development to economic development (Levine & King, 1993, p. 730) but others have found differing results (as will be discussed in the literature review). Not only issues of causality have emerged to complicate the picture, but also different degree of development. As countries climb from underdeveloped to developed evidence indicates that the gain of financial development diminishes (De Gregorio & Guidotti 1995), (Hansson & Jonung 1997) etc. What is uncontested, however, is that the topic of finance and growth has grown ever more complex as increasingly advanced econometric techniques are used to explore a wider variety of mechanisms and a broader selection of samples.

1.2 Purpose & Research Question

While the relationship between financial development and economic growth has been subjected to wide scrutiny, most studies have been conducted with varying methodologies, samples and variables. The plethora of approaches renders difficult any comparison and ultimately arbitration between contradictory results. By basing results on associations between one or two operationalizations of a phenomenon that may be more fractured and complex, these proxies may assume the effects of variables omitted from the specification. Furthermore, the samples employed in many of the studies are sparsely motivated and, in some cases, may be too short for reliable inference. This study aims to redress these shortcomings by carefully surveying the field of research to combine existing measures of financial development and economic development. Furthermore, by offering a fine-grained conception of financial development and

isolating those aspects of the financial system that are more relevant for growth, decisionmakers are better equipped to devise targeted measures to induce growth and prevent stagnation.

The study starts from Ross Levine's model of the economy but is by no means limited to his selection of variables, sample or methodology but since his studies are comprehensive and extensively quoted, his work represents an appropriate starting point. Furthermore, to delineate the focus of our study we need to declare what is meant by financial intermediaries. For that purpose, we make common cause with Levine with the definition of financial intermediaries as: "coalition of agents that combine to provide financial services" (Levine, 1997, p. 693).
Furthermore, while previous studies remain inconclusive as to the effect of financial development and economic growth and its direction of causality, the differences can be largely divided along methodological lines. With one exception, the studies employing panel data-regression techniques find a positive relationship between financial development and economic growth (with the direction of causality more disputed). Conversely, the studies attempting to model cointegration between financial development and economic growth through error-correction-models are more prone to reject any effect between the variables. Some studies that find a positive relationship tends to emphasize how the effect is mediated by income status, where lower income is more conducive to a positive relationship. Since an important difference between Vector Error-Correction Models (VECM) and panel-regressions is that VECM is able to account for any long-term relationship between variables while panel-regressions only estimate the short-term relationship, a possibility is that the inconclusive results are due to a fading effect of financial development on economic development over time. This pattern of methodological bifurcation prompts us to employ a mixed-methods approach to accurately model the long - and short-run dynamics. While the short-run dynamics are captured by panel-data regressions, we capture the long-run dynamics through an alternative approach to VEC that models long-term relationships without exploiting cointegration. This approach allows us to isolate both the effects of income and methodology. These techniques will be applied to a sample consisting of the 28 member-states of the European Union to ensure as little variability as possible on aspects other than the variables examined. Data availability limits the period considered to range from the years 1995-2014.

As alluded to initially, the direction of causality between financial development and economic development may well be reversed. It is conceivable that financial intermediation emerges as the result of the necessities of economic development, along the same lines as recounted above.

In Robert Lucas' treatise on the factors of economic development he declares the significance of financial development on economic growth to be "very badly over-stressed" (Lucas, 1988, p. 6) and aligns himself with the neoclassical dichotomy between monetary and real variables. Even so, theory on the mechanisms of reverse causality are hard-found and sparsely developed and Lucas and Robinson do not convert their convictions into empirical testing or concrete hypotheses. Nonetheless, as revealed by the literature review, the considerable number of findings of bi-directional or reverse causality merits thorough investigation.
The limited theoretical exploration of the causality running from economic development to financial development leads us to formulate the following hypothesis:

Hypotbesis: Financial development causes economic development.

Generating the following research questions by which the study will abide:

1. *Does financial development cause economic development?*

2. *How does financial development cause economic development?*

Where the first addresses causality and the second concerns the mechanism through which the causality is channeled. The definitions of economic and financial development will be thoroughly defined in chapter 3.

The organization of the study proceeds as follows: In the following chapter, chapter 2, a survey of previous research is conducted with the purpose of highlighting the plurality and deficiencies of the field. The survey is then used to inform the construction of our theoretical model found in chapter 3. Apart from the presentation of our theoretical model and variable definitions, chapter 3 includes the theoretical mechanisms linking financial and economic development. The theoretical construct guides the practical data collection process that gives rise to chapter 4 where the data is presented and discussed. Chapter 5 presents the empirical model and conducts the necessary tests and specifications but also contains results and analysis. Finally, chapter 6 concludes the study by revisiting the research questions and presenting wider implications of the study and suggests sources of further research.

2 Literature Review

Ever since McKinnon, Shaw and Goldsmith trained focus on the linkage between financial infrastructure and economic prosperity, scores of researchers have followed in their footsteps, experimenting with wide arrays of methodologies and measurements. Notably, Ross Levine's work has contributed immensely to both the theoretical and empirical understanding of finance and growth. In his seminal study with King (King & Levine, 1993) and further studies some years later Levine (1997) and Levine & Zervos (1998) offer a comprehensive and fine-grained exposition on the channels through which financial development stimulates GDP-growth and other macroeconomic variables. More specifically, King & Levine proxies financial development by the magnitude of outstanding credit to the private sector which they measure as the ratio of liquid liabilities to GDP. They also employ the ratio of money bank deposit assets/ deposit assets plus central bank domestic assets as well as different measures of liquidity to measure financial sophistication. Their fracturing of the dependent variable into three channels of growth in the form of GDP-growth per capita, domestic investment to GDP and the rate of physical capital accumulation contrasts with Goldsmith's simple use of GNP per capita. In the 1998-study Levine & Zervos expand the measurements of financial development to include stock market variables to further operationalize liquidity and slightly modifies the dependent variables by substituting investment to GDP and the rate of physical accumulation for the growth-rate of the per capita capital-stock and total factor productivity growth. Employing both cross-section and pooled time-series, separate cross-section regressions and initial-value regressions they are able to produce strongly positive associations between the financial variables and their dependent variables as well as infer that "finance does not only follow growth; finance seems importantly to lead growth" (King & Levine, 1993, p. 730).

Contemporaneous to Levine's studies, De Gregorio & Guidotti (1995), considered how regional and income-related aspects mediate the effects of financial development on average RGDP per capita-growth in an examination of 100 countries over a 20-year period. They find evidence consistent with Levine's results albeit to varying degrees "according to regions, time periods and levels of income" (De Gregorio & Guidotti, 1995, p. 434). The effect appears most pronounced in low and middle-income countries with diminished effect for high-income

countries. They point out, however that since their operationalization of the magnitude of financial intermediation consists of credit granted to the private sector by commercial banks and the central bank, they will be unable to register effects for countries whose financial development is concentrated largely outside the banking system, as is largely the case for high-income countries. A notable outlier to this result is that of Latin America, which in fact displays a significant negative relationship between financial development and growth. Coupled with the result for high-income countries these results emphasize important limitations to Levine's positive findings. The case of Latin America, the authors argue, illustrates how the quality of financial intermediation may interact with growth as opposed to merely its size. Another important contrast with Levine's work is their dismissal of measurements of money-supply (such as M1/M2) as proxies for financial development. Their skepticism stems from the possibility that since M2 includes the more liquid components of M1, factors other than financial depth may influence its size. Their concern is shared and articulated more thoroughly by Demetriades & Hussein (Demetriades & Hussein 1996) since an increase in M2 "may reflect more extensive use of currency rather than an increase in the volume of bank deposits" (Demetriades & Hussein, 1996, p. 395). Their critique, however, does not serve to invalidate Levine's results since their proxy for financial intermediation is indeed included among Levine's lineup, but it does suggest a need for the elimination of measures of monetary variables in further studies.

The study by the aforementioned Demetriades & Hussein differs mainly in its methodological approach. Instead of panel-data regressions they draw on models exploiting cointegration relationships, namely the VECM within the general Vector Auto-regression (VAR) framework. Their study employs time-series data over 16 countries regressing RGDP per capita onto financial development, operationalized as the ratio of bank deposit liabilities to nominal GDP and as the ratio of bank claims on the private sector to nominal GDP. The first measure is accounted for earlier, but the second measure of financial development is introduced to control for macroprudential actions from the central bank (such as altering reserve requirements). Such actions could leave the supply of credit unaffected while impacting bank deposit liabilities. Despite the shortcomings of bank deposit liabilities they defend its inclusion by arguing that together the measures serve to "provide some more refined information regarding competing theoretical explanations" (Demetriades & Hussein, 1996, p. 395). Their findings rebuff Levine's results in reversing the causality between financial development and RGPD or can be found to be bi-directional.

The mid 1990's popularized the use of VEC-models, not only for larger samples but for more involved case studies of a single observation. In their 1997 article "Finance and Economic Growth: The Case of Sweden 1834-1991" Hansson & Jonung use the VECM to study the long-term relationship between RGDP per capita and total domestic credit per capita. Their results corroborate the notion of the response of economic growth to financial development as varying with income. By fracturing the sample period into three periods, the authors are able study the interrelationship between financial development and economic growth in the transition between different levels of income. While they find a positive effect of financial development on growth, they also find that it diminishes with income as Sweden attains high-income status. Since their measure of financial development is based on commercial bank credit their results parallel those of De Gregorio & Guidotti in finding a weaker effect of financial development on growth as income increases.

By comparison, two studies on comparatively low or middle-income countries seem to confirm the hypothesis of a response conditioned on income. Ghildiyal, Pokhriyal & Mohan (2015) use an ARDL-model to study the evolution of the relationship between financial development and RGDP per capita. Echoing Levine & Zervos they proxy financial development as stock-market and banking sector development and find unidirectional positive causality from financial development to economic growth (Ghildiyal et al, 2015). Mirdala shows that the effect may extend to middle-income economies in his study of ten European transition economies over an eleven-year period (Mirdala, 2012). Opting for a multiequation VEC-model and the broad money stock (M3) to GDP as well as domestic bank deposits to GDP and domestic bank loans to GDP he tries to model the long-term relationship with RGDP per Capita. The study enables him to conclude that "Especially countries with lower GDP per capita seem to benefit from financial deepening as the financial deepening indicators affects real economic activity with higher intensity in the short-run and Granger cause real output in the long-run" (Mirdala, 2012, p. 192-93).

However, the result that the relationship between financial development and economic growth for low-income countries is unambiguously positive is far from disputed. For example, Ahmed, Horner & Rafiq use panel-data on a selection of developing economies over 30 years and in contrast with earlier findings, they are not able to prove any significant positive effect on either RGDP or RGDP per capita, in fact, domestic credit expansion impacts both variables negatively.

Not only for low-income countries has the relationship between financial development and growth has been closely scrutinized but also for high-income countries. Cecchetti & Kharroubi explore potential channels through which income mediates the effects of financial development on growth and conceive of it as an "inverted U-shaped effect" (Cecchetti & Kharroubi, 2012, p. 14). There comes a point, they argue, where "more banking and more credit are associated with lower growth" (Cecchetti & Kharroubi, 2012, p. 1) and the financial sector crowds out more productive investment in the struggle for scarce resources. Using panel-data regression techniques on a sample of 50 emerging and advanced economies over 30 years they are able to compute turning points for when the relationship transitions from positive to negative. Their measures of financial development are private credit to GDP for which they estimate a turning point of 100% and financial sector employment share out of total employment for which they compute a turning point of 3.5%. After having exceeded that percentage, they estimate that a 1.6% growth in employment share is responsible for roughly one half of a percentage point decrease in RGDP per worker.

Apart from the more comprehensive studies, individual studies have focused on developing appropriate measures for the efficiency of the financial system. Notably, Candida Ferreira's 2012 article "Bank Performance and Economic Growth: Evidence from Granger Panel Causality Estimations" (Candida Ferreira 2012) link measures of bank performance and efficiency to financial development and prove bi-directional causality using a panel-data approach with reference to RGDP per capita and the gross fixed capital formation. Additionally, Greenwood, Sanchez & Wang argue along the lines of De Gregorio & Guidotti that the magnitude of available credit may be misleading if the services of financial intermediaries are of poor quality. Thus, they propose that the relationship between financial development and growth is lacking without a measure of the efficiency of financial intermediaries. As a proxy for efficiency they propose to use the interest rate spread between the interest rate charged to borrowers and that offered to savers. Since the interest-spread represents the profit-margin for financial intermediaries, its magnitude has the same implication as ordinary prices, with a lower margin indicating a more efficient intermediary (Greenwood et al, 2012, p. 1).

For purposes of clarity, the findings described above have been summarized into a table found below. The table lists the most important properties of each article, such as methodology and since one of the objectives of this study is to synthesize the operationalisations of financial development employed in previous research and mediate

between them, key dependent and independent variables are also included as categories in the table.

Table 1 – Selection of previous research with variables estimated, method and sample

Author	Measure of Financial Development	Dependent variable	Methodology	Sample
Cechetti & Kharroubi (2012)	Private credit/GDP & Financial sector share of employment	GDP/Worker-growth	Panel data regression	50 countries from 1980-2009
Candida Ferreira (2013)	Bank Performance: Bank Return on Assets Bank efficiency: Return on Equity	RGDP/Capita Gross fixed capital formation growth	Panel data regression with granger causality tests	27 EU-member states from 1996-2008
Greenwood Sanchez & Wang (2012)	Financial intermediation efficiency: Interest Rate Spread	RGDP/capita	Cross-section & Panel regressions	45 countries From 1974-2004
Levine (1997)	Financial Depth: 1) liquid liabilities of the financial system (currency plus demand and interest-bearing liabilities of banks and nonbank financial intermediaries/GDP 2) Credit allocated to private enterprises/total domestic credit 3) Credit to private enterprises/GDP 4) total value of shares traded on a country's exchanges/stock markets 5) total value of shares traded on a country's exchanges/total stock market capitalization	RGPD/Capita-growth Average rate of growth in the capital stock/person Total productivity growth	Cross-Section and Panel data	80 countries from 1960-1989
De Gregorio & Guidotti (1995)	Domestic credit to the private sector/GDP	Average GDP/capita-growth	Cross section and Panel data regressions	100 countries 1960-1985
Levine & King (1993)	Same as 1997 article by Levin	RGDP-growth/capita Rate of physical capital accumulation Ratio of domestic investment/GDP	Cross-section and panel data	80 countries from 1960-1989

Demetriades & Hussein (1996)	Ratio of bank deposits/Nominal GDP Ratio of bank claims on the private sector/Nominal GDP	RGDP/Capita In domestic currencies	VECM	16 countries
Mirdala (2012)	Broad money stock/GDP Domestic bank deposits/GDP Domestic bank loans/GDP	RGDP/capita	Multiequation VECM	10 European countries from 2000-2011
Syed Ahmed, James Horner & Rafiqul Bhuyan Rafiq (2008)	Quasi-money (M1/bank deposits) Ratio of M2/GDP Ratio of private domestic credit/nominal GDP	RGDP-growth	Panel data regressions	Case Studies on three countries from 1970-2000
Ghildiyal, Pokhriyal & Mohan (2015)	M2/GDP Stock Market Development (Ratio of stock market capitalization/GDP) Banking Sector Development (Ratio of domestic credit/GDP)	RGDP/capita	Autoregressive Distributed Lag Model Bound Testing Technique	Case Study of one country from 1990-2014
Pontus Hansson & Lars Jonung (1997)	Bank loans/GDP	RGDP/capita	VECM	Case study of one country from 1834-1991
Ross Levine & Sara Zervos (1998)	Value-traded ratio and the turnover-ratio	RGDP/capita growth Growth of the capital stock Productivity growth	Panel-data regressions	32 countries from 1976-1993

3 Theoretical Framework

3.1 Financial development & Growth

As discussed briefly in the introduction, Goldsmith's and McKinnon's work showed how fragmented capital markets and efficient provision of credit limits the opportunity of entrepreneurs to realize projects with high future profitability. Absent unified capital markets, competition between issuers of credit is unlikely to drive lending rates to equilibrium levels and ensure the efficient allocation of land and capital (McKinnon, 1973, p. 8). The theory of capital fragmentation represents a cornerstone in the challenge of neoclassical theories of finance and the neat division between monetary and real variables. Most importantly the theory of capital fragmentation challenges three vital assumptions of neoclassical theory:

1) Capital markets are fully competitive and lack transaction costs.
2) "Inputs and outputs are perfectly divisible" (McKinnon, 1973, p. 43), that is, investment costs are continuous rather than discrete.
3) "Money plays no direct role in capital accumulation"(ibid)

Thus, capital market inefficiencies arise to disturb several key functions of financial systems. Ross Levine codifies and extends the thoughts of Goldsmith, McKinnon and others in issuing four functions of efficient financial systems that impact economic development:

Facilitating Risk Diversification

Financial institutions serve to ameliorate two sources of risk; liquidity risk and idiosyncratic risk. By reducing information and transaction costs financial institutions eliminate the risk that illiquid assets are not readily convertible into more liquid assets (Levine, 1997, p. 692). Savers that are exposed to idiosyncratic shocks are less prone to commit to investing in the long-term projects that are required by most entrepreneurs. Financial institutions, and banks in particular, shield savers against liquidity risk by offering a mixture of high and low-return with

respectively low and high liquidity. By facilitating investment in high-return projects, an economy is able to further harness its productive capabilities and increase capital accumulation and thus increase growth. Furthermore, the rate of technological innovation is also likely to benefit from increased investment. In competing for credit, entrepreneurs continuously work to gain advantages and produce externalities that contribute to the acceleration of overall technological change (Levine, 1997, p. 694).

Information acquisition, Corporate Control and Allocation

Absent financial institutions, ordinary savers when contemplating firms to invest in would have to ascertain the profitability of the firm. However, most savers are unlikely to have the time or capacity to collect and process enough information to make a meaningful assessment and even if they could, savers would have to incur a perhaps prohibitively high fixed cost. Financial institutions thus emerge to consolidate information acquisition and by aggregation, reduce the costs of monitoring individual firms. The aggregation of information acquisition and processing has the added effect of endowing institutions with the expertise to properly evaluate firm credit applications. Firms, being aware that credit is contingent on firm profitability, will strive toward greatest possible efficiency and capital will flow to the most efficient firms and with the most profitable production technology, improving resource allocation (Levine, 1997, p. 695). Since creditors are unable to monitor day-to-day business, financial institutions make arrangements that compel managers to accommodate the interests of creditors (Levine, 1997, p. 696).

Mobilizing Savings

In keeping with Goldsmith and McKinnon, financial institutions arise to pool individual saving surpluses and pair them with entrepreneurs unable to self-finance their investment-projects. By pooling savings, risk-averse savers are able to diversify their portfolios by owning smaller fractions in multiple investment-projects. Through the creation of small denomination-instruments financial institutions enable savers to purchase shares of firms instead of entire firms (Levine, 1997, p. 699). By improving resource allocation and capital accumulation, the pooling of savings influences growth positively.

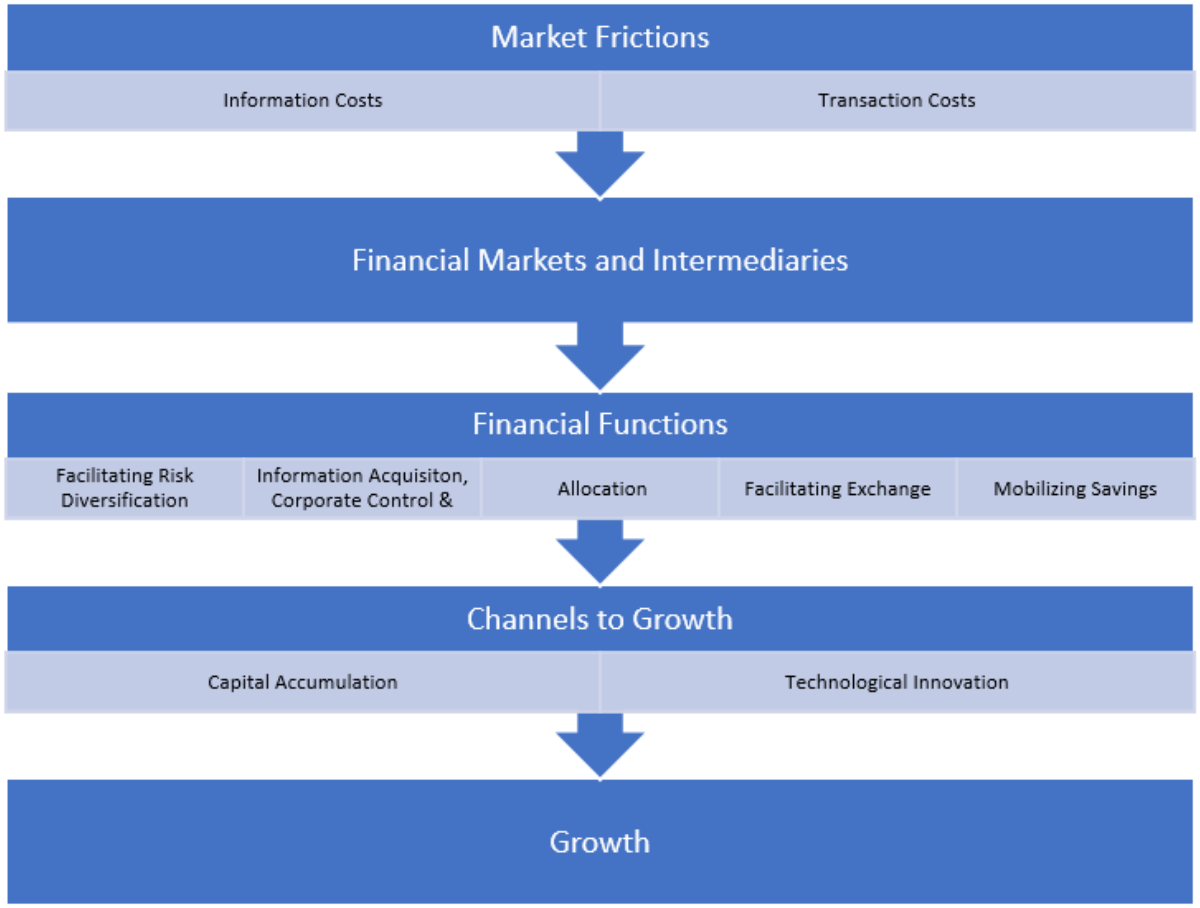
Facilitating Exchange

Another significant function of the financial system is to allow for greater specialization. If firms and entrepreneurs can dedicate themselves to a limited number of products or production processes, innovative practices are more likely to ensue (Levine, 1997, p. 700). Complete

specialization requires a large number of transactions, however, and with non-negligible transaction costs, trade between specialized agents would be limited or non-existent. Furthermore, informational asymmetries in the trade of goods and services are mitigated significantly by the ability of "recognizable mediums" (Levine, 1997, p. 700) such as financial institutions to evaluate attributes and ensure the quality of the good or service under transaction. Consequently, a vital precondition for innovation and growth is the existence of an efficient financial system to service the transactional and informational requirements of a specialized economy.

The flowchart below illustrates the channel through which financial intermediaries resolve market inefficiencies and how that promotes growth. The flowchart is borrowed largely from Levine but is presented with slight modifications (Levine, 1997, p. 691).

Figure 1 – Flowchart illustrating the role of financial intermediaries



3.2 Theoretical Model

In constructing our model of the economy, we draw from Levine & King's model where growth is decomposed into capital accumulation and a residual (Levine & King, 1993, p.722). Our hypothesis is that if financial development impacts economic development, it does so through the mechanisms of capital accumulation and technological innovation. Consequently, fracturing economic development into three components serves not only to investigate the association between financial and economic development in general but also to propose and isolate causal mechanisms. Thus, the economy can be described by the following production function:

$$y = k^{\alpha} x$$

Where in contrast to Levine & King who use RGDP per capita, y represents RGDP per hours (or labor productivity) As it turns out, substituting RGDP per capita for RGDP per hours worked per worker[1] maintains the ability to measure the productive capacity of an economy with the added benefit of controlling for shifts in the composition of the workforce (Fregert & Jonung, 2012, p. 155) (an approach also assumed by Cecchetti & Kharroubi). This study takes the cue of Levine & King and defines k^{α} as the capital stock deflated by worked hours, weighted by the share of capital in production. The variable x contains several variables and is intended as a residual in Levine & King's study. They include among others: human capital accumulation, increases in the number of hours worked. We side with Levine's later study (Levine 1997) in defining the residual as total factor productivity growth (TFPG) and will act as a proxy for technological innovation (comparable to the Solow-residual (Jones & Vollrath, 2013, p. 46)) and subsequently control for the effects of the quality human capital by including school enrolment rates as a control variable.

To accurately model financial development, quite a substantial number of aspects need to be accounted for. A fruitful starting point is to consider the extent to which financial intermediaries allocate credit to the wide economy. To this end, we follow in the footsteps of Levine & King, Demetriades & Hussein etc, and proxy domestic credit with domestic assets held by deposit money banks to total domestic credit. Furthermore, since growth hinges on the ability of private

[1] Technical definitions are available in the data-section.

enterprise and entrepreneurs to secure credit, financial development can be captured by the degree to which credit is allocated to private enterprise as a share of total domestic credit. Levine & King argue that high values of this ratio signal a more diligent and efficient financial system (Levine & King, 1993, p. 705). To control for size of the economy we also include private domestic credit as a fraction of RGDP on the advice of De Gregorio & Guidotti, Syed Ahmed et al, Ghildiyal et al, Demetriades & Hussein[2] and Cecchetti & Kharroubi).

A few authors (Levine & King, Mirdala and Syed Ahmed etc) employ measures of the monetary stock such as liquid liabilities of the financial system (currency plus demand deposits) to measure the ability of the financial system to provide liquidity. However, as a measure of financial development, this measure may be misleading. As noted by both Demetriades & Hussein and De Gregorio & Guidotti, measures of the money stock are more relevant in measuring "the extent to which transactions are monetized than with the degree of financial intermedation" (Demetriades & Hussein, 1996, p. 395) since it includes currency and where many financially underdeveloped economies rely disproportionately on currency, high values may be construed as financial sophistication when it is in fact indicative of the opposite. The capacity to provide highly liquid assets is still a key function of the financial system, however, and omission of a liquidity measure is likely to neglect a potentially important determinant of economic development. Fortunately, Levine & Zervos (1998) does provide alternative measures of liquidity. Both variables are derived from the stock market with the first being the value traded ratio (total value of shares traded on a country's exchanges to GDP) with the second being the turnover ratio (total value of shares traded on a country's stock exchanges to stock market capitalization) (Levine, 1997, p. 712). Both variables measure the presence of transaction costs in equity markets where higher values signal lower transaction costs and, consequently, higher liquidity. They differ in that the turnover ratio controls for the size of the stock market. The turnover ratio is thus a helpful indicator of the liquidity of smaller markets (in absolute value terms). While we expect both liquidity indicators to be positively associated with economic development, the turnover ratio should have a more pronounced effect for the low-income group and vice-versa for the value traded ratio.

[2] Syed Ahmed et al and Demetriades & Hussein actually deflate by nominal GDP, but to control for differing price levels we use real GDP.

Apart from the magnitude of private credit, De Gregorio & Guidotti (De Gregorio & Guidotti, 1995, p. 434) and Greenwood et al note that economic development is also contingent on the efficiency of the financial system. In devising our first proxy for financial intermediary efficiency we proceed on the advice of Greenwood et al and introduce the interest-rate spread. The difference between the deposit and lend-rate is a useful indicator of efficiency since it measures the costs of financial intermediacy. Efficiency implies lower interest-rate margins and, consequently, a negative relationship with economic development.

Efficiency can also be measured from the vantage point of specific intermediaries. While the importance of banks in providing credit to the private sector has been shown to vary with income (see Jonung & Hansson and De Gregorio & Guidotti), they are still a staple of many economies. Nonetheless, the relationship is expected to diminish with income. As suggested by Candida Ferreira, we include two variables related to bank performance and efficiency, namely the return on individual bank assets (ROA) and the return on equity for the entire banking sector (ROE). The ROA is defined as the ratio of net income to total bank assets and the ROE is defined as net income to bank equity. Measuring the ROA is a straightforward way of evaluating the profitability of individual banks as well as the quality of their management (Candida Ferreira, 2013, p. 11). Return on equity is an indicator not only of the efficiency of individual banks but of the entire banking sector. Since shareholders are interested in maximizing share value, a large value of the ratio indicates successful corporate control, an aspect enumerated as growth-inducing by Levine (Levine 1997).

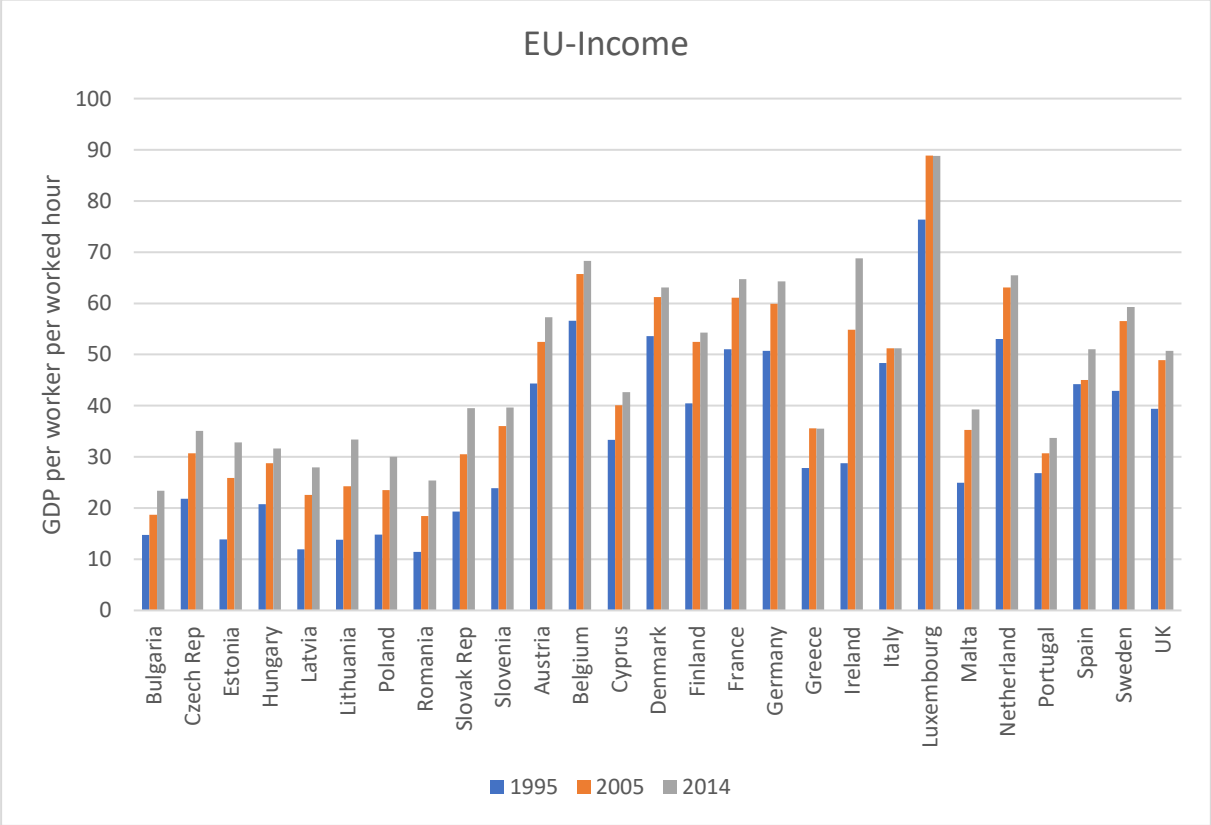
Our model of the economy also includes control variables to account for non-financial components of RGDP. Our choices are guided largely by Levine & King as well as Jonung & Hansson and includes a proxy for human capital (school enrollment), inflation and foreign trade (described more thoroughly below).

3.2.1 Income & Financial Development

Absolute levels of RGDP (or income) have tentatively been shown to be a key factor in analyzing the relationship between financial and economic development. Since previous research has found that financial development exhibits a diminishing or negative effect on economic development as income increases, a suitable division is between high and low-income countries. Bracketing income is nettlesome both generally; any classification tends to be

somewhat arbitrary and in particular to this study; it can be argued that the EU-members share largely similar income levels. However, an objection to this assessment may be constructed from the findings of Rajmund Mirdala. As mentioned earlier, Mirdala finds positive effects of financial development on RGDP per-capita using the VEC-model on 10 European transition economies[3] (ETE) (Mirdala, 2012, p.1). In light of the fact that he is alone in reaching these findings by means of a VEC-model, this might indicate that the income status of his sample conspired to yield the positive results. However, upon examination of actual GDP-data presented in figure 2, this storyline is not beyond scrutiny. The values reported at the start of the sample (i.e. 1995) confirm that GDP-numbers for the ETE-economies are all indeed below the rest of the sample. However, as time progresses, the inadequacies of the ETE as a low-income segment is revealed as three countries (Slovenia, Slovakia and the Czech Republic) overtake the countries with lowest income in the rest of the sample. These three countries notwithstanding, however, the GDP-numbers for the ETE do consistently linger at the bottom of the sample.

Figure 2 – Growth of GDP per worker in Europe



[3] The European transition economies are Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic and Slovenia.

Nevertheless, the fact is that even if the ETE-income levels would remain consistently below the rest of the sample, the division would remain somewhat arbitrary. Common to the ETE, however, is their transition from centrally-planned economies to market economies at the outset of the 1990's. Consequently, Mirdala labels them "financially underdeveloped economies" (ibid) on account of their immature financial infrastructure. To segment the EU into two brackets can arguably be warranted based on, if not income disparities, the discrepancy in relative degrees of financial development. Since our empirical model relies on homogenous samples, this division would appear sensible. From here on the ETE-economies will be referred to as the emerging segment, while the other segment will be identified as the developed segment.

4 Data & Restrictions

4.1 Sources of data

This study uses two separate datasets that consists of a panel of 17 respectively 10 European countries with yearly observations of fifteen different variables stretching from 1995 up until 2014. The final sets used in the different regression analyses where compiled using two main sources. Those are the Total Economic Database (TED) produced and published by The Conference Board and the World Bank's Global Financial Development Database (GFDD). In addition to those two main sources we also collected data from the World Bank's World Development indicators and the Barro-Lee dataset on educational attainment, also distributed by the World bank. All datasets are available from the webpages of the individual organizations.

4.2 Variables

The full datasets consist of fifteen different variables which are described below, with the variable shorthand in parenthesis. Of those fifteen, three are dependent variables and twelve are independent variables. Three of the independent variables are used to control for other potential sources of economic growth. The three dependent variables are real GDP per hours worked, gross fixed capital formation per hours worked and total factor productivity growth. Real GDP per hours worked (GDP_AVGHR) is calculated by using real GDP per employed person divided by average hours worked and the number of people employed. The variable is normalized across the different countries in the sense that national GDP and employment statistics are collected using a set of international guidelines given by the UN (Vries and Erumban, 2016, p. 5).

Total factor productivity growth (TFPG) considers labour as well as all kinds of capital, both physical and other, as inputs that create production of both products and services. However, TFPG is not a variable that is calculated directly but rather obtained as a residual when measuring all factors that contribute to growth in output (Vries and Erumban, 2016, p 16).

The final dependent variable, gross fixed capital formation per hours worked (K_AVGHR) is defined as all capital investments divided by average hours worked and the number of people employed. Gross fixed capital formation includes, amongst other things, land improvements, machinery purchases and the construction of roads (UN data 2016).
The explanatory variables, excluding control variables, are before tax return on assets (ROA), before tax return on equity (ROE), net interest margin (NIM), deposit money bank assets to total bank assets (DEP_TOT), private credit by deposit money banks and other financial institutions to GDP (DEP_GDP), stock market total value traded to GDP (STOCK_TOT) and stock market turnover ratio (TURNOVER_RATIO). Return on assets, return on equity and net interest margin are measures of the efficiency of financial intermediaries, i.e. banks. The ROA is measured as the percentage of bank income to yearly assets while the ROE is measured as the percentage of income to yearly equity (World Bank 2015).

The two credit measures, private credit by deposit money banks to total bank assets and private credit by deposit money banks and other financial institutions, net interest margin as well as the two stock-market measures, stock market total value traded and stock market turnover ratio, are all measures of financial depth, that is, measures of the financial sector relative to the size of the economy. Deposit money bank assets to total bank assets is expressed as the ratio between claims on the domestic sector by deposit money banks to the total claims on the domestic sector by both commercial banks and the central bank. Private credit by deposit money banks and other financial institutions is the total amount of credit by banks and other financial entities to GDP. Net interest margin is the interest revenue as a share of average interest bearing assets. Stock market total value traded is the value of all stocks traded on the stock market to GDP while stock market turnover ratio is the total value of shares traded over the one-year period divided by average market capitalization (World Bank 2015).

The three control variables (ibid) are average yearly inflation ratio (INF_A) average years of total schooling ages fifteen and up (SCHOOLING) and trade as a share of GDP (TRADE).

4.3 Issues and restrictions

The availability of reliable data for the variables of concern is limited for some of the current member states of the European union, thus restricting the scope of this paper. It is most apparent in the case of Croatia where some variables are entirely unavailable, thus forcing us to omit the country from the study. Overall, financial data for eastern European countries is almost or entirely unavailable before the mid-90s whereas it exists from 1980 for most other countries. To create datasets with comparable groups of countries any observation before 1995 is therefore disregarded.

Despite limiting the dataset there are still some issues with missing variables. Average educational attainment (SCHOOLING) is, to our knowledge, only available as a five-year average. In order to create a balanced dataset those five-year averages have been allowed to represent average education attainment for each year of the respective five-year periods.

5 Results & Discussion

5.1 Econometric Approach

In determining how to approach the study empirically, it is useful to consult previous research. As noted earlier, the field is neatly divided between practitioners of panel-data regression approaches and VAR-based VEC-models. Panel-data regressions are indeed what enabled Levine & King to reach their seminal results and appear to be the self-evident resort when considering both cross-section and time-series data. In contrast to Levine & King we instead fit a dynamic model without contemporary variables, not on the grounds that contemporary realizations are not necessarily interesting but because this elides the problem of simultaneity. Lagged realizations of a variable could well have an impact on the dependent variable one period ahead, but the reverse is highly unlikely and have the convenient property of being correlated with its contemporary realizations, making them ideal instruments.

Another attractive feature of panel-data regressions is that the researcher is able to control for factors that are omitted from the specified equation, thus solving any simultaneity issues. This is accomplished by replacing the intercept with an individual-specific intercept that varies over cross-sections. Fixed effects (FE) are common when the cross-sections come in the form of countries, or more generally as “one of a kind” (Verbeek, 2012, p. 384) and the decision to apply FE is often justified in comparison with random effects (RV) where the RV-specification means treating the intercept as a random-variable. In determining whether to opt for RV or FE, a central criterion is whether any of the explanatory variables are correlated with the error-term where such correlation disqualifies the use of RV (Verbeek, 2012, p. 385). As mentioned earlier, however, the problem of endogeneity is skirted by the FE-specification and since it is unlikely that economic development is governed solely by financial development and that the measures of financial development are uncorrelated with any omitted determinants of economic development, the FE-specification is favoured. While the typical method when discriminating between fixed and random effects is to apply the Hausman-test the ratio of cross-sections to

coefficients in our estimation makes such a test impossible to perform. In addition, despite that the Hausman-test is often applied it is not a tool without fault. The procedure is prone to having low power, circumscribing its benefit as results may be severely biased (Verbeek, 2012, p. 386). The choice of including fixed effects is also supported by running a simple F-test that checks if the FE-dummies are insignificant or not. Testing reveals that the country specific effects are significant for all test-specifications. Given the amount of observations that the panel data approach allows for it also means that the assumption of normality, in this large sample, becomes a non-issue (Lumley et al, 2002).

Having said that, we are now able to convert the model conceived in the theory-section into mathematical equations suitable for empirical estimation. Note that since there is good reason to suspect the presence of unit roots in some of the variables[4], they are defined in differences (with the exception of ROA, ROE, TFPG, NIM and INF_A, since they are percentages). Indeed, Levine & King (Levine & King 1993) explicitly difference their data while others (Syed Ahmed et al, Cechetti & Kharroubi etc..) make a point of substituting level-variables for growth-variables.

$$
\begin{aligned}
y_{it} = \alpha_i + a_1 y_{it-1} &+ \beta_1 DEP\_TOT_{it-1} + \beta_2 DEP\_TOT_{it-2} + \beta_3 DEP\_GDP_{it-1} \\
&+ \beta_4 DEP\_GDP_{it-2} + \beta_5 STOCK\_TOT_{it-1} + \beta_6 STOCK\_TOT_{it-2} \\
&+ \beta_7 TURNOVER\_RATIO_{it-1} + \beta_8 TURNOVER\_RATIO_{it-2} + \beta_9 NIM_{it-1} \\
&+ \beta_{10} NIM_{it-2} + \beta_{11} ROA_{it-1} + \beta_{12} ROA_{it-2} + \beta_{13} ROE_{it-1} + \beta_{14} ROE_{it-2} \\
&+ \beta_{15} INF\_A_{it-1} + \beta_{16} INF\_A_{it-2} + \beta_{17} SCHOOLING_{it-1} \\
&+ \beta_{18} SCHOOLING_{it-2} + \beta_{19} TRADE_{it-1} + \beta_{20} TRADE_{it-2} + u_{it}
\end{aligned}
$$

Where β_n are coefficients, u_{it} is the error-term and y_{it} represents each dependent variable. The superscript it denotes observations across individual countries over time. It is commonly assumed that the error-term is iid (individually and independently distributed) with a constant variance. However, this assumption is not innocuous. It is highly likely that the variance is not homogenous across observations, or heteroskedastic. Since it is difficult to identify the true structure of the variance we apply White-standard-errors. As revealed by figure 2 there are notable income disparities in the EU, even within the segments and as a result, it is likely that the heteroskedasticity springs from individual countries. Consequently, we apply the cross-section version of White-standard-errors to control for heteroskedasticity.

[4] This is tested formally below.

Estimating these equations would yield the short-run relationship between contemporary values of financial and economic development. As discussed initially, it is possible that short and - long-run relationships differ. Indulging that suspicion, some researchers have chosen to model the long-run relationship between financial - and economic development through VEC-models. While a suitable option, particularly when dealing with non-stationary variables, the analysis is complicated when modelling cointegration between several variables (Hansson & Jonung, 1997, p. 288). Fortunately, there exists a method that can be used to investigate long-run relationships without employing VECM. Pesaran (1997) has developed an extension of the Phillips-Hansen Procedure described as a "fully modified OLS procedure" (Pesaran, 1997, p. 17) that approaches long run relationships not through cointegration but through evaluation of the sum of the lag coefficients extracted from the ARDL-model. By aggregating the effect of the same variable over time, the sum should correspond to the long-run effect. This approach has also been used by Ghildiyal et al to study financial and economic development in India. In a subsequent study, Pesaran, Shin & Smith (2001) introduce the concept of a long-run multiplier (Pesaran et al, 2001, p. 292). This technique is also referred to as the "bounds-testing technique" (Pesaran et al, 2001, p. 290). The general definition of the long-run multiplier is as follows:

$$\theta = \frac{\beta}{1 - \phi}$$

Where β represents the coefficient of any given explanatory variable, ϕ is the coefficient of the lagged dependent variable and θ is the LR-multiplier. If we assume stationarity (in differences) we can express the multiplier in terms of our model as the following equation:

$$\theta = \frac{\Sigma\beta_t}{1 - \phi}$$

Where β_t is the coefficient on each of the lags of any given explanatory variable. Substituting VEC for the multiplier does come at a price however since it does not exploit the "superconsistency" (Enders, 2015, p. 361) that comes with cointegration (see Pesaran p.7).
Furthermore, it is important to note that since we estimate the ARDL-model in differences, the estimated long-run effects are on the growth rate rather than its level-variable or on the steady-state growth rate rather than its equilibrium-level value. While qualitatively similar since an effect on a level variable should also carry over to the growth rate of the very same variable, this modification should be kept in mind when the results from this model are compared with those from the VEC-model.

5.2 Testing for Stationarity

Before proceeding to dynamic specification and subsequent estimation, it is necessary to confirm whether our suspicion of the existence of unit roots can be confirmed. Several variables in the dataset, such as GDP per worker per hours worked, gross fixed capital formation or average years of schooling, can be assumed to display upwards trending behaviors. If variables are integrated of different orders any regressions based on them will give spurious and inconsistent results unfit for inference (Enders, 2015, p. 195). Furthermore, the ability to compute the long-run multiplier is contingent on the stationarity of the variables. To test for and ultimately control for such occurrences we apply unit-root tests for all variables. The results of said tests are presented in table 2, with the test statistics and level of significance reported, for the groups of developed and emerging countries respectively.

Table 2 – Unit root tests

	Level		First difference	
Group	Developed	Emerging	Developed	Emerging
GDP_AVGHR	-2.52220***	1.51619	-8.30154***	-7.65948***
TFPG	-8.96982***	-8.11523***	-16.7542***	-13.5199***
K_EMPAVGH	-1.75898**	0.17994	-7.52057***	-6.85985***
ROA	-5.37117***	-2.82006***	-15.2893***	-9.14077***
ROE	-4.94291***	-3.16435***	-13.8259***	-7.64653***
NIM	-5.33876***	-3.71686***	-15.7026***	-13.8445***
DEP_TOT	-7.23367***	-11.4552***	-2.08050***	-9.12391***
DEP_GDP	0.48733	-1.92725**	-3.86768***	-1.62682*
STOCK_TOT	-7.16458***	-3.99500***	-8.62092***	-7.96423***
TURNOVER_RATIO	-6.75699***	-6.60239***	-13.2547***	-15.0096***
SCHOOL	7.43183	-12.2146***	-17.4112***	-6.08748***
TRADE	1.04455	2.11035	-12.0176***	-7.95387***
INF_A	-7.70919***	-13.6296***	-13.6749***	-8.62930***

*Note: asterisks reflect the level of significance. ***, **, * is equivalent to significant results at the 10 %, 5 % and 1 % level.*

The test statistic reported is from the Im, Pesaran and Shin test (IPS) which assumes cross-section specific unit-root processes which are subsequently combined for an overall result for the entire panel. Additionally, tests were conducted using the Levin, Lin and Chu method (LLC) which differs from the IPS test in that it assumes a common unit-root process for the entire panel (Ferreira, 2013). Results of both tests where roughly similar. While the test statistics indicate that most variables are in fact stationary in levels there is reason to be suspicious of those results. An unavoidable property of panel unit-root tests is that the null can be rejected if the cross-sectional observation for just one of the countries is stationary (Verbeek, 2012, p 414).

As such there is a chance that nonstationary variables are mistakenly included, if the panel unit root tests are trusted too blindly, making inference and further testing more uncertain. To control for the possibility of non-stationarity we therefore estimate our models in first-differences for those variables that does not show percentage changes, which in a sense already are first-differentiated.

5.3 Dynamic Specification

Economic variables often display varying degrees of sluggishness and it is therefore common to model variables as autoregressive functions and lagged explanatory variables. Hence, we introduce lags for all regressors, including the dependent variable. By including an AR-term, the complication arises that we need to ensure that the residuals at least approximate white noise (specifically to rule out autocorrelation). This is achieved by experimenting with different lag-lengths for both the lagged dependent variable and the other explanatory variables. There is no silver bullet for identifying the true model specification but there exists a number of helpful rationales. A straightforward approach to begin with is to follow the so called "Box-Jenkins-procedure" (Enders, 2015, p. 76) which advices to begin by inspecting the autocorrelation-function and partial autocorrelation-functions (ACF and PACF respectively). The correlograms (see appendix) reveal upon inspection the standard pattern for the AR(1)-process with a geometrically decaying ACF and a PACF with a single spike at the first lag (less so for TFPG) (Enders, 2015, p. 66). For the independent variables we pursue the "general-to-specific" technique which means starting at relatively long lags and successively paring down the lags using significance tests (Enders ,2015, p. 290). Another common operation is to base lag-lengths on $T^{\frac{1}{3}}$ (Phillips & Xiao, 1998, p. 37). Both techniques lead us to a specification of two or three lags for each explanatory variable (apart from the lagged dependent variable) and since both techniques are mere shorthand-measures, our final definitive specification will be decided with the help of information criteria. The information criteria consulted are the Akaike Information Criterion (AIC) and the Schwartz-Bayesian Information Criterion (SBC) for each of the regressions estimated, as reported in table 3. We see that, with one exception, both criteria rule in favour of a two-lag specification for the explanatory variables for both segments. This conclusion is reinforced by noting that the outlier consists of a conflict between the AIC and

SBC in noting that the AIC is biased toward overparameterized models (Enders, 2015, p. 70) and that the SBC is more trustworthy as T exceeds 7.

Table 3 – Panel regression information criteria

	AIC				SBC			
Dependent variable	Developed		Emerging		Developed		Emerging	
	2 lag	3 lag	2 lags	3 lags	2 lag	3 lag	2 lags	3 lags
GDP_AVGHR	**2.420**	2.462	**2.420**	2.461	**2.958**	3.193	**2.958**	3.193
K_AVGHR	1.674	**1.632**	**0.984**	1.038	**2.217**	2.370	**1.621**	1.934
TFPG	**3.565**	3.593	**4.784**	4.793	**4.102**	4.324	**5.421**	5.688

However, as Enders counsels, scepticism is always healthy (particularly in larger samples) and to ascertain that we can at least suspect to have removed any serial correlation we close by comparing Durbin-Watson-statistics for both specifications. Since the complete absence of autocorrelation is achieved with a DW-value of 2, the table below indicates roughly equal results for both models with a slight nod for the two-lag specification for the developed segment. For the emerging segment the values are indeterminate. Coupled with the fact that casual inspection of the residual series for the two-lag model appear to approximate white noise, the definitive specification includes two lags on each explanatory variable.

Table 4 – Panel regression DW-statistics

	2 lags		3 lags	
	Developed	Emerging	Developed	Emerging
GDP	1.961797	2.126007	2.057191	2.097312
K	1.894661	2.101524	2.187649	1.917337
TFPG	1.964740	2.052392	2.191104	2.077893

5.4 Panel regression results

The results of the final panel data regressions are presented in table 5. Coefficient values are reported along with standard errors in parenthesis for each of the included variables. The results are contrasted to those of other relevant research and the Granger-causality tests in section 5.6, who act as a kind of robustness check against which we compare the results from the panel-regression.

Table 5 – Panel regression results

	Developed			Emerging		
Dependent variable	GDP_AVGHR	K_AVGHR	TFPG	GDP_AVGHR	K_AVGHR	TFPG
C	4.135 (3.584)	4.998*** (1.839)	8.155 (6.738)	0.618 (0.888)	-0.214 (0.534)	-1.916 (3.256)
Y (-1)	0.031 (0.087)	0.051 (0.103)	0.299*** (0.076)	-0.020 (0.093)	0.039 (0.112)	-0.041 (0.090)
ROA (-1)	-0.063 (0.056)	0.0912 (0.061)	-0.120 (0.095)	0.469*** (0.083)	0.145* (0.074)	1.778*** (0.322)
ROA (-2)	0.005 (0.050)	-0.073* (0.042)	0.069 (0.101)	0.029 (0.038)	-0.006 (0.019)	0.101 (0.155)
ROE (-1)	0.024*** (0.007)	0.006 (0.006)	0.040*** (0.012)	-0.035** (0.010)	-0.009 (0.007)	-0.156*** (0.032)
ROE (-2)	-0.004 (0.009)	0.002 (0.004)	-0.036*** (0.012)	-0.008 (0.005)	-0.008* (0.004)	-0.045* (0.025)
NIM (-1)	-0.166* (0.090)	-0.028 (0.104)	-0.304* (0.182)	-0.233** (0.072)	-0.079** (0.035)	-0.732*** (0.262)
NIM (-2)	0.030 (0.120)	0.083 (0.085)	0.221 (0.207)	-0.079 (0.053)	-0.020 (0.023)	-0.066 (0.181)
DEP_TOT (-1)	0.021 (0.158)	-0.192** (0.079)	0.085 (0.296)	0.050 (0.033)	0.017 (0.015)	0.333** (0.152)
DEP_TOT (-2)	-0.042 (0.139)	0.151** (0.070)	-0.146 (0.264)	-0.015 (0.027)	-0.001 (0.010)	-0.214* (0.127)
DEP_GDP (-1)	-0.010 (0.011)	-0.019*** (0.006)	-0.021 (0.017)	-0.008 (0.024)	-0.016* (0.015)	-0.138 (0.098)
DEP_GDP (-2)	0.007 (0.009)	0.013*** (0.005)	0.013 (0.014)	-0.010 (0.023)	0.005 (0.013)	0.069 (0.092)
STOCK_TOT (-1)	-0.007* (0.004)	-0.004* (0.002)	-0.010 (0.008)	-0.014 (0.025)	0.014 (0.013)	-0.049 (0.107)
STOCK_TOT (-2)	0.004 (0.003)	-0.001 (0.002)	0.001 (0.006)	0.025 (0.022)	-0.005 (0.013)	0.061 (0.085)
TURNOVER_RATIO (-1)	-0.001 (0.002)	0.001 (0.002)	0.001 (0.004)	0.004 (0.004)	0.002 (0.003)	0.013 (0.017)
TURNOVER_RATIO (-2)	0.002 (0.002)	0.001 (0.001)	0.008* (0.004)	-0.005* (0.003)	-0.003 (0.002)	-0.011 (0.012)
INF_A (-1)	-0.252*** (0.052)	-0.082** (0.068)	-0.681*** (0.121)	-0.026*** (0.006)	-0.008** (0.004)	-0.102*** (0.026)
INF_A (-2)	0.099* (0.058)	-0.007 (0.033)	0.172 (0.124)	0.054*** (0.011)	0.017** (0.010)	0.217*** (0.047)
SCHOOL (-1)	0.300* (0.167)	0.246* (0.087)	0.658* (0.401)	0.474*** (0.152)	0.155* (0.089)	1.945** (0.593)
SCHOOL (-2)	0.119 (0.335)	0.174 (0.162)	0.277 (0.598)	0.593* (0.327)	0.191 (0.163)	1.996** (1.200)
TRADE (-1)	-0.009 (0.010)	-0.006 (0.008)	-0.035* (0.020)	0.002 (0.011)	0.007* (0.004)	0.015 (0.042)
TRADE (-2)	0.002 (0.010)	0.004 (0.007)	0.032* (0.018)	-0.017* (0.011)	-0.012** (0.005)	-0.050 (0.042)
R-squared	0.336	0.275	0.448	0.157	0.201	0.362

*Note: asterisks reflect the level of significance. ***, **, * is equivalent to significant results at the 10 %, 5 % and 1 % level.*

Starting with those measures of financial development that turned out to Granger-cause economic growth, the first result that announces itself is the ROE. Achieving convincing results from the Granger-tests in table 7, the results for both lags are robust for TFPG, significant only for the first lag on GDP_AVGHR and not significant whatsoever for capital accumulation in table 5. The signs of the coefficients are largely consistent with theory with a one-percent increase in the return on equity of the banking sector one year prior indicates a 0.24 percent-increase in the growth of GDP_AVGHR and a 0.04 percent increase in the growth of total factor productivity. Somewhat surprising is the negative sign of the coefficient on the two-period lag in the TPFG-regression (although non-significant, the pattern extends to the same lag in the GDP-regression), which would suggest a time-variant response of both TFPG and GDP_AVGHR to ROE.

These results appear to somewhat vindicate Candida Ferreira's inclusion of the return on equity of the banking system. Since significant results are obtained irrespective of both deflations of GDP (per capita or hours) and for TFPG, ROE can safely be said to have an effect on the growth of labor productivity. Less conclusive are the magnitudes of the coefficients. Ferreira's result for the first lag of ROE indicates a larger effect on GDP_AVGHR (0.071>0.024) than our estimation. The results for both studies indicate that there may be reason to doubt the explanatory power of the second lag of ROE for GDP_AVGHR since our results determine it to be non-significant and her results only achieve significance at the 10-percent level. The coefficient values for the second lag are comparably marginal at -0.004 for us and 0.013 for Ferreira. Although the relevance of the second lags is questionable, they share with the first lags the tendency to overestimate the effect of the ROE. A possible explanation is that in neglecting to include other measures of financial development, the ROE assumes the effect of those omitted measures, in which case our initial guess would prove correct.

However, the most prominent divergence with Ferreira's results arises in the specification of the appropriate causal mechanism. Ferreira only allows for the link between financial development and economic development to be channeled through growth in the gross fixed capital formation. That approach only allows her to attain significance at the 10-percent level for the first lag, albeit with a greater effect than for GDP (0.11) while our results resoundingly reject ROE as a determinant of the rate of capital accumulation per hour. Rather, our robust results for TFPG indicate that the effect of ROE is channeled through the growth in total factor productivity. A surprising result is obtained when evaluating the effect of the ROE for the

emerging segment. Contrary to Ferreira's findings, the ROE is robustly negative for the first lag of GDP_AVGHR and TFPG although the non-significant effect on K_AVGHR is consistent with the developed segment and, thus, inconsistent with Ferreira's results. Notable is that the effect is at least as strong as for the developed segment but in the opposite direction, with a substantial negative effect on the TFPG.

If the inclusion of the ROE was deemed relevant, the inclusion of Ferreira's other measure of financial development, bank return on assets, is less convincing for the developed segment. In fact, the Granger-tests appear to hint at reverse causality between economic growth and ROA, at least at the second lag. Reverse causality gains support from the panel-regression which returns a weakly significant result only for the effect of ROA on K_AVGHR, also at the second lag. The unequivocality with which we deny the effects of ROA on any measure of economic development for the developed segment is puzzling when compared to Ferreira's results, particularly since her sample is essentially identical to ours. Although not significant for the growth of the gross fixed capital formation, both of her results for the first lags of ROA in both regressions are overwhelmingly positive (0.82 for GDP and 1.05 for capital). The judgment is altered when considering the results for the emerging segment. Here we obtain results that are closer to Ferreira's. For the first lag of ROA, the coefficients are robust for all three equations with quite sizable coefficients. Indeed, given the coefficient value of 1.778 for TFPG, which is closer to Ferreira's estimate for the growth of the effect of ROA on the growth of the capital stock, there is cause to believe that her results were colored by the effects of aggregating the entire EU in one sample. This line of argument is corroborated further when considering the robust results for both K_AVGHR and GDP_AVGHR as well as the sizable coefficients who report notably values larger than their developed segment equivalents.

Less robust (at least in terms of Granger-causality) is the effect of the turnover-ratio on economic growth. For this variable, we encounter the first contradiction between the Granger-test and the panel-regression. While the Granger-test returned significant results on the 10%, 5% and 1% -levels for the first lag and the first two levels for the second lag, the panel regression only achieves a marginal 10% - significance for the second lag in the TFPG-regression. The marginality extends to the value of the coefficient which indicates that a 0.008 percent increase in TPFG correlates with a 1-percent increase in the turnover-ratio. The marginal response is unsurprising since theory predicted this variable to have a larger effect for the emerging segment. Instead, the countries in the developed segment were predicted to have

a closer relationship with the value-traded-ratio. In analyzing STOCK_TOT, the first bi-directional result is obtained. Bi-directional Granger-causality is significant at all levels for the first lag and for the 10 and 5-percent levels for the second lag. The panel-regression is more hard-pressed to find a significant effect of STOCK_TOT. Only at the 10-percent level are the first lags of STOCK_TOT significant for GDP_AVGHR and K_AVGHR, respectively. Combined with the marginal results of -0.007 for GDP_AVGHR and -0.004 for K_AVGHR and the negativity of the coefficients, this result appears highly questionable. The results for the stock-market variables have even less bearing on the emerging segment, where no coefficients are found significant at any level for any of the dependent variables and across time.

The results for the stock-market variables gain wider significance when contrasted with the results of Levine & Zervos. Strikingly, their study achieves robust results for the relation between the turnover-ratio and all three dependent variables and returns significantly larger coefficients (between 0.02 and 0.027). Explaining the disparity between the results obtained and Levine's results are all but straightforward, however some leading candidates emerge. Levine & Zervos consider a sample with countries of varying income levels but since our results are reproduced almost identically for the emerging segment income seems to be inconsequential. A more compelling explanation would concern Levine & Zervos' use of contemporary variables as opposed to their lagged realizations. Levine & Zervos do not estimate a separate VAR-model to investigate causality but since they are able to prove causality running from the turnover-ratio to all measures of economic development and our results, with some exceptions, corroborate this, simultaneity appear unable to account for the disparity. It is possible, thus, that the effect has no persistence and vanishes almost completely after one period, which would explain the difference in results.

The pattern for the second stock-market variable, the value-traded ratio, is carried over from that of the turnover-ratio but with even greater discrepancies. While our results for STOCK_TOT are roughly equal to those for TURNOVER_RATIO, Levine & Zervos' results are significant at all conventional levels for all three dependents. Their coefficients range from 0.075 for productivity growth, 0.093 for the growth of the capital stock per capita and 0.098 for RGDP per capita which are substantially larger than those reported in the table above. The disparities could obviously be resolved by the same explanations offered for the turnover-ratio. Analogous to the interpretation of Ferreira's results, the size of Levine & Zervos' coefficients for both variables may be chalked up to their assuming the effects of other intermediary

variables not included in their equations. This explanation is less satisfactory in this case, however, since apart from an extensive array of control variables, they also include one measure of credit allocation. Nonetheless, the implications of omitted variables ought to be responsible for some of the disparities.

As for the credit-measures, the Granger-tests only find support for uni-directional causality running from credit to economic development in the effect running from deposit money bank assets to capital/hours per worker (at the 5-percent level). GDP_AVGHR, on the other hand, show tendencies of reverse or bi-directional Granger-causality for both DEP_TOT and domestic private credit to GDP. DEP_TOT is Granger-caused by GDP_AVHR at the 10-percent level. However, for K_AVGHR, DEP_TOT displays uni-directional causality at the 1-percent level. Interestingly, inspection of the panel-regression shows support for the Granger-test for DEP_TOT on capital accumulation in returning significant results at the 5-percent level for both lags. Turning to the coefficients, note that they partially depart from theory as the first lag shows a negative impact of 0.192 while the second is consistent with theory with a positive impact of 0.151. Indeed, Levine & King, employing only contemporary variables, record a significantly lower value for their regression of the growth of capital per capita on deposit money bank assets (0.022). The size of the coefficients, coupled with significance at the 5-percent level indicate that the predominant effect of the growth in deposit money bank assets is on the rate of capital accumulation. Similarly, DEP_GDP is only significant for K_AVGHR and is negative and positive for the first and second lag respectively. Conclusions about the impact of the growth of private domestic credit on the growth of the capital stock/hours per worker should only be drawn with caution, however, given the modest coefficients and the bi-directional Granger results.

Interestingly, despite the fact that both credit variables were incorporated in this study on the suggestion of Levine & King among others, our results are far more ambiguous than theirs. In fact, similar to the comparisons with Levine & Zervos for the stock-market variables, Levine & King obtain highly robust results for the growth rates of both deposit money bank assets and private domestic credit to GDP on the growth rates of RGDP per capita, capital stock per capita and the residual (see theoretical model section 3.2), while we produce similar results only for K_AVGHR for the developed segment, and TFPG for the emerging segment (only DEP_TOT). In contrast with earlier results our estimates for DEP_TOT for the developed segment actually far exceed those of Levine & King in absolute value for both lags (0.192>0.022 for the first and

0.152>0.022 for the second). The same is not true for the effect of DEP_GDP on capital accumulation where the coefficient for the same variable on the growth of the capital stock per capita is slightly larger.

Our results suggest that, in some fashion, there exists an income-based response of both deposit money bank assets and private credit, however, not only in the form expected initially. Upon inspection of the emerging segment, the only significant results for DEP_TOT are found for TFPG, where the first lag is significant at the 5-percent level and the second at the 10-percent level. Although the signs are reversed from the regression of K_AVGHR on DEP_TOT, the relative magnitudes are greater for the emerging segment. For DEP_GDP, the effect appears slightly weaker for the emerging segment than for the developed since significance is attained only at the first lags for K_AVGHR and TFPG and then merely at the 5-percent level for TFPG and the 10-percent level for K_AVGHR. The sign on the coefficients both defy theory in indicating negative effects on both TFPG and K_AVGHR, but DEP_GDP has a more pronounced negative effect than for the developed segment on the first lag, while the reverse is true for the effect on K_AVGHR. It would appear that at least for the credit variables (in particular for DEP_TOT) the choice to fracture the sample in two segments was appropriate. While the dynamic effects are roughly equal for both segments, the effects are greater (both negative and positive) for the emerging segment. The implications for the theory of an income-based response of financial on economic development cannot be discerned without the results from the long-run model since the contradictory results suggest a time-varying effect, but the short-run results do suggest a more vehement effect with lower income. Furthermore, the absence of fracturing would also have failed to pick up on how the growth of credit has varying degrees of importance for different aspects of economic development. Surprisingly, even though both variables clearly have some effect on the mechanisms of GDP-growth posited by Levine & King and Levine (1997), none of the segments return significant results for GDP_AVGHR. It is unlikely that this discrepancy with Levine & King would be explained solely by the use of hours instead of capita to deflate GDP-growth, thus this could hint at a breakdown of the causal links between capital accumulation and total factor productivity growth.

Levine & King are not alone in relating distinct measures of credit to GDP-growth. As mentioned in the literature review, Cecchetti & Kharroubi, De Gregorio & Guidotti and Ahmed et al use private credit to GDP, Demetriades & Hussein, Mirdala and Ghildiyal et al use

measures comparable with DEP_TOT. The results of Demetriades & Hussein, Mirdala and Ghildiyal et al will be discussed in relation to the long-run results. A common detraction from these studies is that they make no attempts to identify causal mechanisms and opt instead for only studying the effects on different definitions of GDP-growth. Starting with Cecchetti & Kharroubi, it is important to note that since they do not difference their credit-variable and use five-year averages, a complete comparison is difficult. Their results are divided into separate presentations for each of the six five-year periods in their sample but the coefficients do not vary significantly and range between 0.035-0.038 for the first five periods and 0.048 for the final period (Cecchetti & Kharroubi, 2012, p. 5). As was the case for the comparison with Levine & King, Cecchetti & Kharroubi find a robust relationship between private credit and GDP-growth, while we are unable to find any such relationship, and even if we could, their estimates of the effects are greater than ours. Indeed, the relevance of their results are somewhat magnified since Cecchetti & Kharroubi use the same definition of GDP-growth.

Although they find significant results for private credit to GDP and measure it in levels, De Gregorio & Guidotti's results for high-income countries align more with our results. Since their observations are made up of five-year averages they organize their results like Cecchetti & Kharroubi and thus report results for each period. Their estimates range from -0.005 to 0.024 (De Gregorio & Guidotti, 1995, p. 439) which is closer to our results than any reported above. The similarities are not projected onto the results for their low and middle-income segment, however, where their significant estimates range from 0.044 to 0.135. Note that this comparison abides by the same caveat as for Cecchetti & Kharroubi since they use levels of private credit to GDP averaged over five years. This caveat makes tracing the origins of the diverging results difficult, but one explanation relates to the prospect of non-stationarity. Our IPS-results indicated the existence of a unit root in the coefficient for the level variable of DEP_GDP but neither De Gregorio & Guidotti nor Cecchetti & Kharroubi report making any adjustments to accommodate this possibility. While their R-squared values do not indicate spurious regressions, this is indeed worth mentioning.

If the absence of differenced variables and use of five-year averages made the above comparison difficult, comparison with Ahmed et al should be made all the easier. While, as mentioned they only run regressions with GDP-measures as independent variables, they do include the growth of the per capita capital stock as an independent variable. For the regression of the growth of RGPD per capita, their estimate of -0.0004 is much lower than our results for

both segments and similarity is compounded by their inability to achieve significant results for any level but at the 10-percent level. Another interesting result emerges if the comparison is made between the results of the regression of K_AVGHR onto DEP_GDP and the estimate of Ahmed et al for the effect of growth of the per capita capital stock on the growth of RGDP per capita. Their estimate is a meager 0.005 obtained on the 10-percent significance level. Since their study is case-oriented, the generalizability of their results may be questionable, nonetheless, they may be used together with other results in questioning the mechanisms posited by Levine, at least in the short run.

Another interesting result is the effect of the net interest margin. While the Granger-tests categorically fail to confirm causality running in either direction for any of the variables, the panel regression obtains slightly different, albeit weak, results. Only at the first lag is significance obtained and then merely at the 10-percent level. The signs on the coefficients for the first lag conform to theory and the effects are indeed non-negligible for all three equations. Nonetheless, the net interest margin does not seem to wield noteworthy effect on economic development for the developed segment. However, the NIM does seem to exert influence on economic development for the emerging segment. For the first lag, the NIM is significant at the 5-percent level for both TPFG and GDP_AVGHR and at the 10-percent level for K_AVGHR. The effect seems to subside after two periods since none of the second lags are significant for either segment. The coefficients display the expected negativity as well as fulfilling the expectation that the effect is larger for the emerging than for the developed segment.

Our choice of control-variables appears slightly misguided, at least for the developed segment. While the first lag of average inflation is highly robust, the results for both trade and schooling are unconvincing. Schooling is significant at the ten-percent level only on the first lag for all equations while it achieves the same result for TPFG but for both lags. For the emerging segment inflation at both lags appears appropriate but the expectation of negative effects is only validated for the first lags of all dependents, while reversing for second lags.

The interpretation of the results for the developed segment is concluded by observing the adjusted R-squared-values. Table 7 reveals that TFPG is explained to the greatest extent explained by the measures of financial development and control variables at 53.1% with GDP_AVGHR at 43.5% and K_AVGHR at 38.5%.

5.4.1 Summary

With some exceptions, a clearly discernible pattern is that of the relative under-estimation of the relationships between several of the independent and dependent variables. Particularly for the stock-market measures but at a lesser extent also for the credit measures does this pattern ring true. Surprisingly, given the findings of Levine & Zervos, the short-run effect of the stock-market variables can with some confidence be entirely written off for both segments. In terms of the credit variables, a notable result is that for neither segment is any of the variables significantly related to the growth in RGDP/hour. The effect of the credit variables appears instead to be linked to the growth of total factor productivity for the emerging segment and the growth of the capital stock for the developed segment but with different signs on the coefficients across periods.

The most robust results are found for the measures of bank efficiency but with a decided contrast between the developed and emerging segments. While the return on assets appears inconsequential for the developed segment, it is highly relevant for the emerging segment, even more so in fact, than for Ferreira's sample. The effects of the return on equity are more evenly balanced across the segments but the negative effect for the emerging segment defies the predictions of theory. In contrast with Ferreira's results, we do not find much support for the effect of the ROE on the growth of the capital stock.
The importance of income is extended to the final measure of financial system efficiency, the net interest margin. While the developed segment records an effect for the first lag of TFPG, the emerging segments show effects for the first lags of NIM in all three equations. Finally, the coefficients indicate a larger impact for the emerging segment.

5.5 Long-run effects

The long-run effects of the independent variables onto the dependent ones, estimated as described in section 5.1, are presented in table 6. The long-run impact is measured separately for each variable. The test reveals several interesting results, notably there appears to be more variables that have a significant impact for the group of emerging countries than for the developed one. Of interest is also that the sign of several variables in many cases is negative

which often contradicts what would be expected. This is shared amongst both groups, suggesting that some aspects of financial development have a negative impact on economic growth in the long run.

Table 6 – Long-run effects

	Developed			Emerging		
	GDP	K	TFPG	GDP	K	TFPG
ROA	-0.060	0.020	-0.073	0.489***	0.144*	1.805***
ROE	0.021*	0.009	0.006	-0.042***	-0.017**	-0.193***
NIM	-0.140	0.058	-0.119	-0.305***	-0.104**	-0.767**
DEP_TOT	-0.022	-0.043**	-0.087	0.035***	0.017**	0.115***
DEP_GDP	-0.003	-0.006**	-0.011*	-0.017***	-0.011***	-0.066***
STOCK_TOT	-0.003	-0.004*	-0.014	0.010	0.009	0.011
TURNOVER_RATIO	0.001	0.002	0.011*	-0.001	-0.001	0.001

*Note: asterisks reflect the level of significance. ***, **, * is equivalent to significant results at the 10 %, 5 % and 1 % level.*

5.5.1 Developed countries

The long run effects of all variables on GDP per hours worked is negative except for two, return on equity and turnover ratio. Return on equity is also the only variables that have a significant impact. While return on equity is significant also in the short run there seems to be no long-run effects carried over from NIM and STOCK_TOT. Only the variables DEP_TOT and DEP_GDP, that both have negative signs, have any significant impacts on capital formation per hours worked. The difference from the short-run results is that NIM and STOCK_TOT have no long-run impact and that the long run effects from the credit variables are negative. DEP_GDP and TURNOVER_RATIO are the variables that have significant impacts on total factor productivity growth in the long run. For the stock-market variables, the transition from short to long run produce no notable changes, although the weak significance for GDP_AVGHR on the first lag of STOCK_TOT disappears to be replaced by the same effect for K_AVGHR. The marginally significant second lag for TFPG on the TURNOVER_RATIO seem valid even in the long run but with the similarly meager effect. This result stands out as the only stock-market variable that aligns with the positive effect foretold by theory. More engaging is the long-run results of the credit measures. The ambiguous dynamic effects of both DEP_TOT and DEP_GDP encountered in the short-run are substituted for unanimously negative results with DEP_TOT maintaining its dominance of DEP_GDP.

These results for the bank variables are, as mentioned, remarkably different from that of previous research. Ferreira finds significant and strictly positive effects for ROA and ROE on both the growth of GDP per capita and capital formation per capita. Remarkable is also how the effect of the ROE seems to abate over time since the coefficients for all three equations shrink in the transition from short to long run and only for GDP_AVGHR is it significant (and marginally at that). The irrelevance of the ROA for the developed segment translates almost seamlessly from the short to the long-run and is, in fact, reinforced in the long run by the failure of the second lag to have any lasting impact. For the NIM, the short-run effects are reflected largely in their long-run counterparts except for the fact that the already tenuous effect on TFPG breaks down in the long run.

5.5.2 Emerging countries

For the group of emerging countries all variables but the ones related to stock market activity have significant long-run effects on GDP per hours worked. This differs from the results in short run where some of the credit-variables are insignificant. As is the case in the short-run several of the variables, ROE and DEP_GDP, somewhat surprisingly have negative impacts on economic development. The results are similar when measuring the long run effects on the growth of capital accumulation and total factor productivity. Overall, the coefficients mostly share the same sign as in the short run.

The results for the long-run effect of the stock market variables are interesting as they have no significant impact whatsoever. As in the case of the developed countries this result goes against the findings by Levine & Zervos and is perhaps more intriguing as one might expect financial development to have a more pronounced impact on less developed countries. The results are also starkly different from those obtained by Ghildiyal et al for India, where they find a highly significant and positive relationship between market capitalization and GDP growth per capita. As is the case in the paper by Ferreira both ROA and ROE have significant impacts on all the dependent variables. For both variables, the short-run effects are upheld even in the long run where, for the ROA, some of the coefficients even improve on their short-run performance.

The long-run effect of the NIM is even stronger than those for the first lag which is surprising since the lack of significant results on the second lag may be taken as a sign of a diminishing effect over time.

The coefficient for DEP_GDP is negative and highly significant, improving on its short-run performance but maintaining the negativity. These results are contrary to those of De Gregorio & Guidotti and Cecchetti & Kharroubi who in different panel data studies finds that credit as a share of GDP has a positive effect on GDP growth per capita. The contrasting results are even more apparent as De Gregorio and Guidotti show the effect to be highest in countries with low- or mid-level income, which should correspond to our group of emerging countries. The results also differ from those of Ghildiyal et al who find positive but insignificant effects from credit as a share of GDP onto GDP per capita. Our results are surprising and hard to explain but the sample used in the other studies includes countries with lower income levels than those of the emerging countries in Europe which makes it possible that the effects are diluted in comparison to ours. The other credit variable on the other hand, DEP_TOT, gives results that are consistent with those obtained in earlier research. Coefficients for the long-run effect on all dependent variables are both positive and highly significant, as also obtained by Levine & King.

The credit measures in the emerging segment delivers even starker contrasts between long and short run than for the developed segment. While the short-run regressions are unable to confirm robust relationships between any of the credit variables and any of the dependent variables other than TFPG, the long-run estimates are robust for both variables on all three dependents. As for the developed segment, the time-variant effects are erased in the long run but in contrast with the short run, they turn out positive instead of negative. Compared to the first lags of DEP_TOT, the long-run effects are smaller than the non-significant results on K_AVGHR and GDP_AVGHR and the significant TPFG which would indicate an abating effect over time. The effect of DEP_GDP is still negative in the long run but with slightly diminished effects.

5.5.2 Summary

The major takeaway from the long-run equations is the tendency of significant relationships, principally for the emerging segment, to be achieved where none were found in the short run. Where the short-run relationship between both credit measures only showed signs of significant impact for TFPG, the long-run multiplier offered significant results for K_AVGHR and GDP_AVGHR. The same pattern recurs, albeit with lesser heft, for the ROE where all three dependents are significantly affected. The stock-market variables are roughly as inconsequential to any measures of economic development as was found the short-run. The analysis of the emerging segment also helps to throw into contention the idea of a breakdown

in how the rate of capital accumulation and total factor productivity growth feed into GDP-growth. It would appear that, at least, for the emerging segment, the mechanisms feed into GDP-growth cumulatively over time. That this effect is not found for the developed segment may indicate that the posited collapse of the positive impact of financial development on economic development, indeed, has something going for it.

5.6 Testing for Granger causality

Given the contradictory results of empirical studies of whether financial development causes economic growth, as theory suggests, we are interested in finding out the causal relationship between our dependent and independent variables. In order to examine this, we conduct Granger causality tests. The test determines if the past observations of one variable help to explain, or improves the explanation, of another variable's future performance and vice versa (Enders, 2015, p 305-306). To conduct these tests, we convert our panel-data model to a Panel-VAR specification. The nature of VAR-model necessitates that the set of explanatory variables contain no contemporary values. The test is run for each of the dependent variables against the complete set of independent ones, where all variables are corrected for non-stationarity when necessary. Stationarity is a crucial property as the test is nonstandard and unusable otherwise (Enders, 2015, p 309). With the null hypothesis being that the variable in question does not Granger-cause the corresponding variable a significant result is taken as an indication that there is a Granger-causal relationship.

Granger causality tests are conducted for the different lag lengths of all dependent variables showing the Granger-causal relationship to the independent ones, and vice versa. The results in terms of level of significance for GDP_AVGHR as dependent variable are presented in table 5 and 6. Results of testing the other dependent variables are merely discussed.

The results of our estimations, at least in part, differ from those of previous research. Ferreira finds strong evidence for bidirectional Granger causality when examining the link between GDP growth, capital formation and bank efficiency in Europe for the period 1996-2008 which our results, at least in part, contradict. King and Levine (1993) on the other hand, albeit not by computing Granger-causality tests, find that credit variables similar to ours helps explaining the

growth of GDP per capita, capital per capita and total factor productivity growth for the earlier period 1960-1989. Our results again show less synonymous results.

5.6.1 High Income-group

The results of the Granger test for the high-income group reveals that few combinations display the behavior that would suggest a Granger causal relationship between financial development and economic growth. As is shown in table 5 only ROE can be said to Granger-cause GDP_AVGHR for both lags while no link is apparent for ROA. However, for capital formation the bidirectional relationship between the two lags of both bank efficiency variables. As for TFPG there is a unidirectional link with lag one of ROA and a bidirectional link for lag 2. There is a unidirectional link between TFPG and ROE for both lags. Lastly, net interest margin is a curious case amongst the efficiency variables as it has no apparent Granger causal link with any of the dependent variables. The results for ROA and ROE are very different from those reported by Ferreira. A plausible reason is the difference in the samples that are tested. While that study as well as this one uses panel data and regards Europe over the past couple of decades there is one potentially important distinction. While Ferreira considers the EU as a whole we have, as described, divided the sample into two groups of emerging and developed countries which could skew the results.

As for the variables that reflect the credit market there is a weak reverse relationship between GDP_AVGHR and DEP_TOT for lag 1. There is a unidirectional link with capital growth per capita and DEP_TOT for lag 2 and bidirectional one with DEP_GDP for both lags. Between TFPG and the credit variables there is solely a reverse relationship with DEP_GDP for lag 2. The results are, as mentioned, much less convincing than those presented by King and Levine who find strong relationships between measures for credit and the various variables for economic growth. Our estimations instead lean towards the results by Cecchetti & Kharroubi who find that financial development has a diminishing effect on economic growth, which could explain the relative lack of significant causal relationships.
STOCK_TOT has a bidirectional link with all three dependent variables for both lags. The last dependent variable, TURNOVER_RATIO, has a unidirectional link with GDP_AVGHR for both lags, a unidirectional one with K_AVGHR for lag one and a bidirectional link with TFPG for lag 2. The results somewhat support those of Levine who find strong evidence that similar stock market measures contribute to the growth of all three dependent variables whereas we

find more sprawling results. The possible explanation that once again comes to mind is the diminishing benefit of financial development, which could result in more uncertain results.

Table 7 – Granger causality tests for developed countries

Dependent variable	Causality	Explanatory variable	1 lag	2 lags
GDP_AVGHR	←	ROA	0.2941	0.1941
	→		0.6434	0.2881
	←	ROE	0.0057***	0.0023***
	→		0.8126	0.7208
	←	NIM	0.1380	0.2342
	→		0.9767	0.6082
	←	DEP_TOT	0.4596	0.7408
	→		0.0532*	0.4772
	←	DEP_GDP	0.3877	0.7092
	→		0.4387	0.0144**
	←	STOCK_TOT	0.0193**	0.0451**
	→		0.0009***	0.0106**
	←	TURNOVER_RATIO	0.0041***	0.0312**
	→		0.5057	0.2783

*Note: asterisks reflect the level of significance. ***, **, * is equivalent to significant results at the 10 %, 5 % and 1 % level. The arrows denote in which direction the causality is running.*

5.6.2 Emerging

Testing for granger-causality in the group of emerging countries reveal the same, relative, lack of causal relationships between the dependent and independent variables. Neither ROA or ROE Granger causes GDP_AVGHR. Instead they are both part of reverse relationships for both lags. For capital accumulation ROA and ROE are part of reverse relationships for both lags. TFPG has a bidirectional link with ROE for lag 2 but none whatsoever with ROA. NIM is again a difficult one as it only has a reverse granger causal link with GDP_AVGHR. DEP_TOT has a reverse relationship with GDP per worker for lag one while DEP_GDP is part of a bidirectional one for both lags. The same link between DEP_GDP and K_AVGHR is true for both lags while there is none with DEP_TOT. TFPG only has a bidirectional link with DEP_GDP for lag 2. Curiously none of the stock market variables has any Granger causal link whatsoever with any of the dependent variables for the group of emerging countries, clearly contradicting the results by Levine (1997).

The results from the group of emerging countries puts the possible explanation for the lack of solid evidence of Granger-causality for the previous group of countries somewhat to shame, as

its only at a stretch that the link between financial development and economic growth can be said to be stronger. However, as presented by Ahmed et al (2008) this is not the first time that the granger causal relationship between financial development and growth is unclear also for countries with less developed financial markets. They offer the possible explanation that the expansion of financial markets benefits less efficient investment and speculation rather than promotes economic growth. The bidirectional results for the variable DEP_GDP, which stand out amongst the other variables, are somewhat supported by the results found by Mirdala. When studying emerging countries in Europe individually they find Granger causal relationship between credit as a share of GDP and GDP growth for some of the countries examined. A possible explanation as to the unsatisfying results could be that while the emerging economies have less developed financial markets in comparison to their European neighbors it is also a possibility that they still are refined enough to the point that they miss out of the benefits of an improved financial sector, as described in the previous section.

Table 8 – Granger causality tests for emerging countries

Dependent variable	Causality	Explanatory variable	1 lag	2 lags
GDP_AVGHR	←	ROA	0.7238	0.7882
	→		0.0154**	0.0152**
	←	ROE	0.7049	0.7782
	→		0.0285**	0.0375**
	←	NIM	0.7838	0.1116
	→		0.9143	0.0312**
	←	DEP_TOT	0.6935	0.2952
	→		0.0034***	0.1237
	←	DEP_GDP	0.0153**	0.0207**
	→		0.0010***	2.E-05***
	←	STOCK_TOT	0.1802	0.2549
	→		0.3517	0.8220
	←	TURNOVER_RATIO	0.3698	0.4201
	→		0.9581	0.3543

*Note: asterisks reflect the level of significance. ***, **, * is equivalent to significant results at the 10 %, 5 % and 1 % level. The arrows denote in which direction the causality is running*

6 Conclusion

In concluding our study, a fruitful start is to reconsider the questions posed at the outset. The first question was formulated as: *Does financial development cause economic development?* This question is answered by noting how causality is mediated by income. As hinted at by several researchers, income does exert impact on causal relationships. Both long and short-run estimations indicate that both the growth of credit allocation and measures of the quality (or efficiency) of the financial system have effects that are larger for the emerging segment. In contrast to findings that indicate that stock-market measures have an effect on economic development, we are not able to verify this claim for any of the segments. The Granger causality-tests indicate that those studies that deny the long-run causality between financial development (Hansson & Jonung and Demetriades & Hussein) may draw their conclusions somewhat prematurely even for the developed segment. Uni-directional causality is confirmed for the effect of the return on asset on the growth of RGDP per hours worked and TFPG while other variables have, at least, bi-directional causality. Interestingly, in light of theory and our panel-results, the picture is more muddled for the emerging segment but once again causality is not completely denied for financial development on economic development, which agrees with the results of Mirdala. It appears that we are served particularly well by fracturing the financial development into several measures, since otherwise chance might have lead us to concur with the skeptics. Nonetheless, our findings allow us to answer yes to the question if financial development causes economic development but, as always, with some qualifications.

We are now in a position to answer our second question, which reads as follows: *How does financial development cause economic development?* Again, this answer is contingent on income but also on the distinction between long and short run. The developed segment shows lesser signs of a dichotomy between long and short run, however, and for this segment appears the puzzling result that for variables whose effects on the growth of capital accumulation and TFP, are not significant for the growth of RGDP per hour. That this result would indicate that capital accumulation and TFG are inconsequential to the growth of RGDP per hour and GDP in general is far from obvious, however. It is more likely that the failure to obtain robust results for GDP owes to flaws in our study.

The conclusion is more interesting for the emerging segment. As we have seen there is a notable difference between the short and long run that did not emerge for the developing segment. Where the link between technological innovation and capital accumulation with RGDP/hours appeared severed in the short-run, it was re-established in the long run. Furthermore, in the short run financial development appears only to feed into the growth of total factor productivity, while its effect on capital accumulation was found only in the long run. Those financial measures that were found weakly significant in the short run improved on their performance when in the long run (credit measures and efficiency measures), albeit with diminished coefficient values. Thus, while we find support for the mechanisms proposed by Levine & King , Levine and Levine & Zervos, our findings also indicate that they were remiss in specifying under which circumstances they are expected to be valid. Without fracturing the sample into income-based segment or computing both short and long-run estimates, these results would remain obscured, suggesting a need for further refinement in further research.

The findings of an income-based response to financial development raises interesting questions on the nature of this response. While De Gregorio & Guidotti and Jonung & Hansson suggest only a diminishing effect, Cecchetti & Kharroubi's theory instead emphasize a negative relationship. Since, with some exceptions, we find that the effects of financial development are larger for the emerging segment the diminishing effect is supported. However, Cecchetti & Kharroubi's U-turned relationship between economic and financial development is also discernible, particularly, for the growth of the credit-variables. While our study is not fully equipped to evaluate their theory, these findings hint at the need for wider application.

Finally, as always, the appraisal of any study should take into account its limitations. While the study benefits from the ability to compare a wide range of variables through the use of a single sample, limited data availability for some variables forces us to limit the time-span considered. This pragmatism compromises slightly the comparison with those studies that engage with a dataset that ranges over longer time-periods. This problem is a lesser concern for the comparison with the panel-studies since they employ samples closer to ours, but more so for the VEC-studies. Comparison with the VEC-models also involve juxtaposing levels with growth-rates which may serve as a further cause of reservation. Another caveat concerns the potential inadequacies of fracturing the EU based on income treated in section 3.2.1. While the study appeared to vindicate the ETE as a proxy for low-income countries, it is not beyond doubt that the effects for the emerging segment are due to other aspects than income. As noted earlier,

the transition from centrally planned to market economy implies that, initially, these countries would have a relatively underdeveloped financial system which may have an impact independent of income. This possibility cannot be resolved by our study but does beckon further research.

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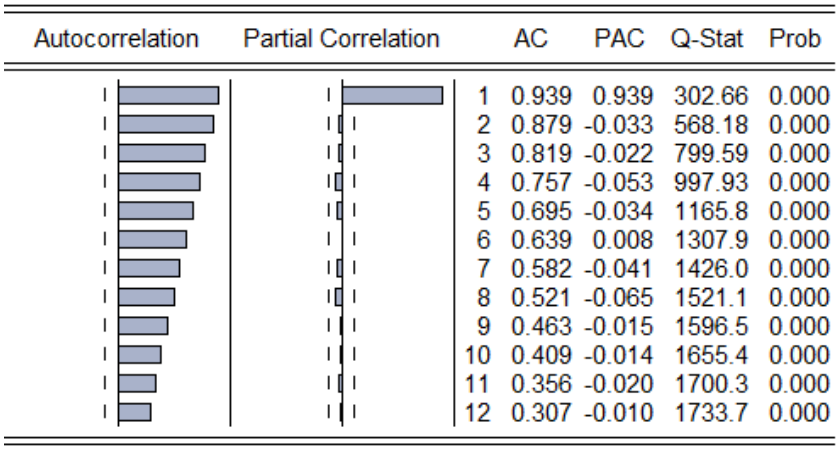
Appendix

ACF and PACF diagrams

The ACF and PACF for all dependent variables, GDP_AVGHR, K_AVGHR and TFPG, are presented for both groups of countries. As is shown they all support using an AR(1) model.

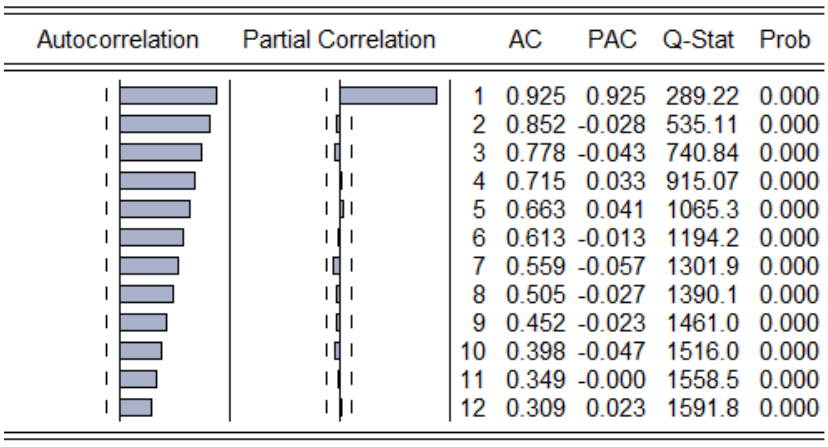
Developed

Figure 3 - GDP_AVGHR



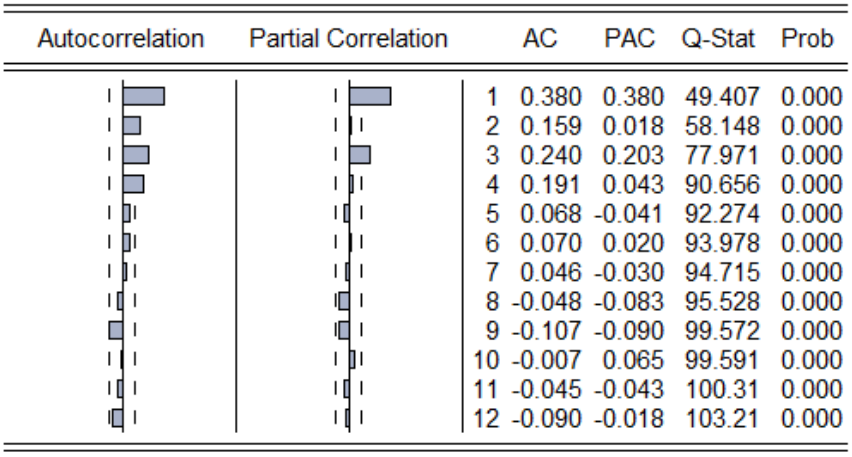
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.939	0.939	302.66	0.000
		2	0.879	-0.033	568.18	0.000
		3	0.819	-0.022	799.59	0.000
		4	0.757	-0.053	997.93	0.000
		5	0.695	-0.034	1165.8	0.000
		6	0.639	0.008	1307.9	0.000
		7	0.582	-0.041	1426.0	0.000
		8	0.521	-0.065	1521.1	0.000
		9	0.463	-0.015	1596.5	0.000
		10	0.409	-0.014	1655.4	0.000
		11	0.356	-0.020	1700.3	0.000
		12	0.307	-0.010	1733.7	0.000

Figure 4 - K_AVGHR



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.925	0.925	289.22	0.000
		2	0.852	-0.028	535.11	0.000
		3	0.778	-0.043	740.84	0.000
		4	0.715	0.033	915.07	0.000
		5	0.663	0.041	1065.3	0.000
		6	0.613	-0.013	1194.2	0.000
		7	0.559	-0.057	1301.9	0.000
		8	0.505	-0.027	1390.1	0.000
		9	0.452	-0.023	1461.0	0.000
		10	0.398	-0.047	1516.0	0.000
		11	0.349	-0.000	1558.5	0.000
		12	0.309	0.023	1591.8	0.000

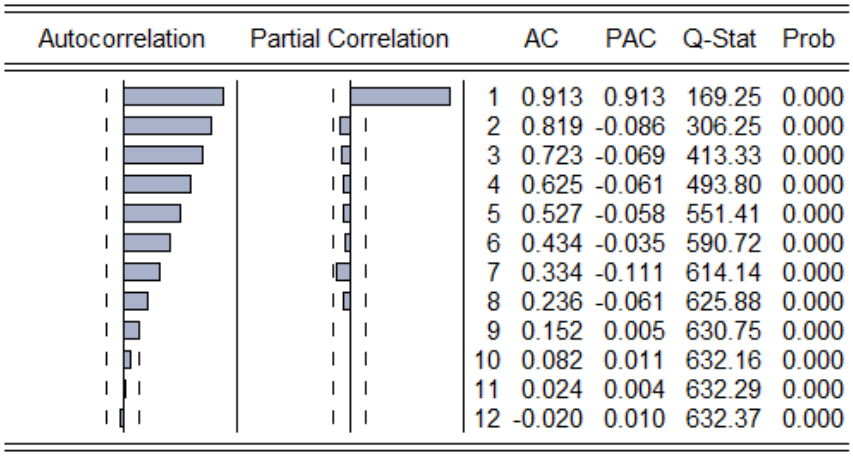
Figure 5 - TFPG



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.380	0.380	49.407	0.000
		2	0.159	0.018	58.148	0.000
		3	0.240	0.203	77.971	0.000
		4	0.191	0.043	90.656	0.000
		5	0.068	-0.041	92.274	0.000
		6	0.070	0.020	93.978	0.000
		7	0.046	-0.030	94.715	0.000
		8	-0.048	-0.083	95.528	0.000
		9	-0.107	-0.090	99.572	0.000
		10	-0.007	0.065	99.591	0.000
		11	-0.045	-0.043	100.31	0.000
		12	-0.090	-0.018	103.21	0.000

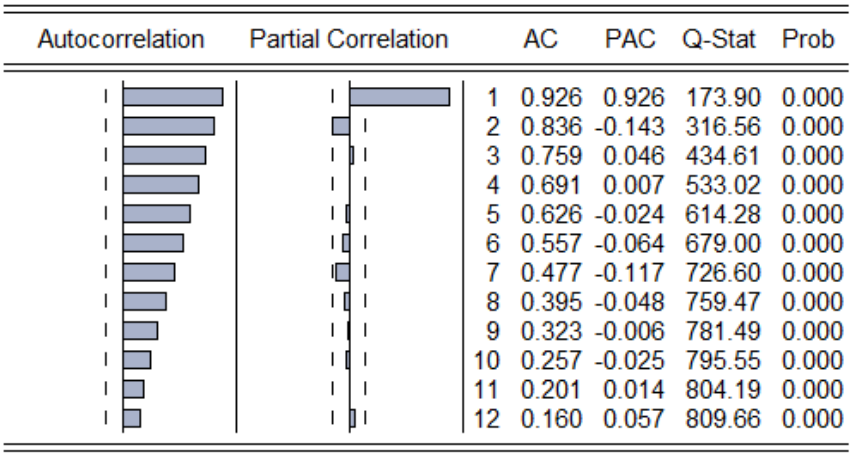
Emerging

Figure 6 - GDP_AVGHR



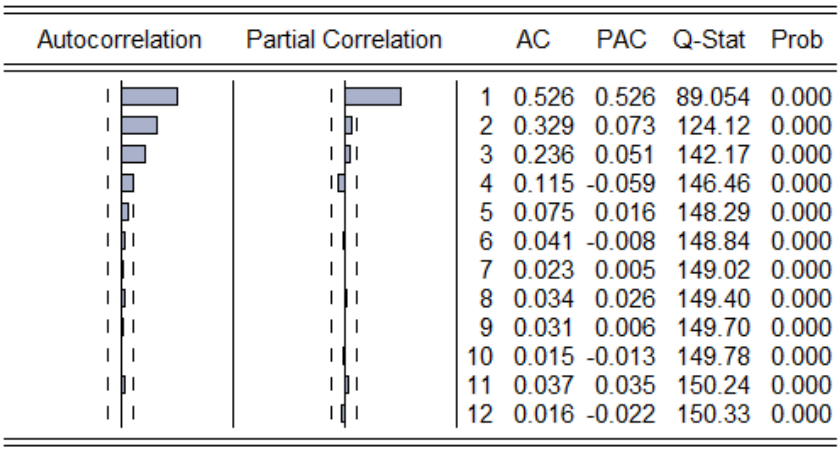
Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.913	0.913	169.25	0.000
		2	0.819	-0.086	306.25	0.000
		3	0.723	-0.069	413.33	0.000
		4	0.625	-0.061	493.80	0.000
		5	0.527	-0.058	551.41	0.000
		6	0.434	-0.035	590.72	0.000
		7	0.334	-0.111	614.14	0.000
		8	0.236	-0.061	625.88	0.000
		9	0.152	0.005	630.75	0.000
		10	0.082	0.011	632.16	0.000
		11	0.024	0.004	632.29	0.000
		12	-0.020	0.010	632.37	0.000

Figure 7 - K_AVGHR



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.926	0.926	173.90	0.000
		2	0.836	-0.143	316.56	0.000
		3	0.759	0.046	434.61	0.000
		4	0.691	0.007	533.02	0.000
		5	0.626	-0.024	614.28	0.000
		6	0.557	-0.064	679.00	0.000
		7	0.477	-0.117	726.60	0.000
		8	0.395	-0.048	759.47	0.000
		9	0.323	-0.006	781.49	0.000
		10	0.257	-0.025	795.55	0.000
		11	0.201	0.014	804.19	0.000
		12	0.160	0.057	809.66	0.000

Figure 8 - TFPG



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	0.526	0.526	89.054	0.000
		2	0.329	0.073	124.12	0.000
		3	0.236	0.051	142.17	0.000
		4	0.115	-0.059	146.46	0.000
		5	0.075	0.016	148.29	0.000
		6	0.041	-0.008	148.84	0.000
		7	0.023	0.005	149.02	0.000
		8	0.034	0.026	149.40	0.000
		9	0.031	0.006	149.70	0.000
		10	0.015	-0.013	149.78	0.000
		11	0.037	0.035	150.24	0.000
		12	0.016	-0.022	150.33	0.000

Sample

Developed countries: Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, Netherlands, Portugal, Spain, Sweden, UK

Emerging countries: Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Slovak Republic, Slovenia