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Author: Dilek Durusu-Ciftci M. Serdar Ispir Hakan Yetkiner

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Financial Development and Economic Growth: Some Theory and More Evidence

Dilek Durusu-Ciftci*
* Department of International Trade and Finance, Pamukkale University, 20070, Denizli, Turkey

M. Serdar Ispir**
** Department of Economics, Pamukkale University, 20070, Denizli, Turkey

Hakan Yetkiner***
*** Department of Economics, Izmir University of Economics, 35330, Izmir, Turkey

* Corresponding author. Email: This paper is derived from a dissertation by Dilek Durusu-Ciftci to Pamukkale University in partial fulfillment of the requirements for the Ph.D. degree. We are grateful to the Editor of JPM, referees, and Unal Seven for their helpful comments on this version. All errors remain ours.
** Email: sispir@pau.edu.tr.
*** Email: Hakan.Yetkiner@ieu.edu.tr

Abstract: This study contributes to understanding the role of financial development on economic growth theoretically and empirically. In the theoretical part of the paper, by developing a Solow-Swan growth model augmented with financial markets in the tradition of Wu et al. (2010), we show that debt from credit markets and equity from stock markets are two long run determinants of GDP per capita. In the empirical part, the long-run relationship is estimated for a panel of 40 countries over the period 1989-2011 by means of Augmented Mean Group (AMG) and Common-Correlated Effects (CCE), both of which allow cross-sectional dependencies. While the cross-sectional findings vary across countries, the panel data analyses reveal that both channels have positive long-run effects on steady-state level of GDP per capita, and the contribution of the credit markets is substantially greater. As a policy implication, we recommend that policy makers place special emphasis on implementing policies that result in the deepening of financial markets, including institutional and legal measures to strengthen creditor and investor rights and contract enforcement. Thus, by fostering the development of a country's financial sector, economic growth will be accelerated.

Keywords: Economic Growth, Financial Development, Cross-section Dependency, Common Correlated Effects, Augmented Mean Group, Panel Data Models
JEL classification: C33, G10, O47

1 Introduction

Financial markets are a key factor in producing strong economic growth because they contribute to economic efficiency by diverting financial funds from unproductive to productive uses. The origins of this role of financial markets may be traced back to the seminal work of Schumpeter (1911). In his study, Schumpeter points out that the banking system is the crucial factor for economic growth due to its role in the allocation of savings, the encouragement of innovation, and the funding of productive investments. Early works, such as Goldsmith (1969), McKinnon (1973), and Shaw (1973) put forward considerable evidence that financial development has a positive effect on economic growth.

The role of financial development on economic growth has received considerable attention since the emergence of the endogenous growth theory.

Theoretical contributions can be divided into five main strands: Firstly, most models have focused on the allocative role of the financial systems, e.g., Greenwood and Jovanovic (1990), Bencivenga and Smith (1991), Pagano (1993), and Wu et al. (2010).[1] Secondly, financial markets allow firms to diversify portfolios, to increase liquidity, and hence reduce risks, and thus stimulate growth (Levine, 1991 and Saint-Paul, 1992). Thirdly, financial development provides an exit mechanism for agents and improves the efficiency of financial intermediation (Rousseau and Wachtel, 2000; Arestis et al., 2001). Fourthly, these markets also foster specialization in entrepreneurship and the adoption of new technologies (Greenwood et al. 1997). A final theoretical consideration is financial markets' ability to impact economic growth through changes in incentives for corporate control (Demirguc-Kunt and Levine, 1996; Jensen and Murphy, 1990).

Another group of theoretical studies examine the role of financial development on economic growth by utilizing Neo-Classical growth theory. For instance, Atje and Jovanovic (1993) augment the Mankiw-Romer-Weil (MRW) growth model with stock market, and their cross-country evidence shows that stock market development may be a leading indicator of economic growth. In line with Atje and Jovanovic (1993), Cooray (2010) extends the MRW growth model by decomposing capital into two components, stock market and non-stock market capital. Both models assume that the stock market is one of the

[1] A comprehensive survey of the endogenous theoretical and empirical literature on the relationship between finance and growth is available in Levine (1997).

determinants of the steady-state level of per capita growth, which also accords with our theoretical and empirical model. This study can also be considered in the same tradition.

The role of financial development on economic growth has also received considerable attention at empirical level. Most empirical models generally indicate that well-developed financial markets enhance the efficiency of resource allocation and faster long-run growth via several channels. Goldsmith (1969) was the first to document a positive correlation between financial development and growth in his 35-country sample. The majority of subsequent studies used essentially one of two separate measures to measure financial development and its role on economic growth: either credit markets or stock markets. In regard to the former measure, King and Levine (1993b), and Berthelemy and Varoudakis (1996), show that bank development may well be an important determinant of economic growth. For the latter measure, using large country samples and cross-sectional and panel methodologies, a number of studies conclude that stock market development is positively associated with economic growth. These studies include Atje and Jovanovic (1993), Levine and Zervos (1996), Bencivenga et al. (1996), Andersen and Trap (2003), and Cooray (2010).[2] There are also a number of studies which examine the simultaneous impact of both markets on growth. Levine and Zervos (1998), and Beck and

[2] Some other studies of the positive relationship between credit markets development and economic growth are King and Levine (1993a), Beck, Levine and Loayza (2000), Abu-Bader and Abu-Qarn (2008), and between stock markets development and economic growth are Levine and Zervos (1996) and Yang and Yi (2008).

Levine (2004), show that both stock markets and banks positively influence economic growth. In another study, Arestis et al. (2001) conclude that both credit and stock markets promote economic growth, but the positive effect of the banking system is even more powerful.[3] More recent studies, such as Wu et al. (2010) and Cheng (2012), also preferred to include both channels.

There are other studies underlining the negative or insignificant impact of financial markets on economic growth, mainly in developing countries. e.g., Snigh (1997), Nili and Rastad (2007), Naceur and Ghazouani (2007), Kar et al. (2011), and Narayan and Narayan (2013). For example, Nili and Rastad (2007) indicate that the higher level of investment of the oil exporting countries can be explained rather by oil revenues, and that financial development in fact has a dampening effect on investment. Similarly, Narayan and Narayan (2013) find no evidence that neither the financial sector nor the banking sector contributes to growth for the Middle Eastern countries. The evidence on heterogeneity in the finance-growth nexus led to the grouping of countries by income level in the analysis of some researchers e.g. Odedokun (1996), Henderson et al. (2013), Andini and Andini (2014), and Rioja and Valev (2014). In this respect, for example, Rioja and Valev (2014) find that stock markets have not contributed to growth in low income countries, while banks have a sizable positive effect on capital accumulation. Several authors also emphasize that this relationship may vary according to the level of financial development, e.g. Rioja and Valev

[3] See also Benhabib and Spiegel (2000), Khan and Senhadji (2003), Beck and Levine (2004), Deidda and Fattouh (2008) and Bittencourt (2012).

(2004) and Federici and Caprioli (2009). For example, Rioja and Valev (2004) show that in the countries with intermediate and very high financial development, the effect is positive but in the intermediate region the effect is the highest. Moreover, the evidence on the non-linearity between finance and growth has been analyzed in some recent works e.g. Shen and Lee (2006), Chen et al. (2013) Beck et al. (2014), Samargandi et al. (2015). For example, Beck et al. (2014) finds that finance continues to display a positive effect on growth only up a critical threshold, beyond which the positive effect of finance on growth vanishes.

Our review underlines several weaknesses of the current literature and hence the contributions of the current study. First, in most of these studies, either the theoretical foundations are insufficient or the connection between theory and empirical application are inadequately defined. In this paper, we first develop a Solow-Swan growth model augmented with financial markets in the tradition of Wu et al. (2010).[4] In particular, we assume a saving function in which debt from credit markets and equity from stock markets have a unitary elasticity of substitution between them. These two inputs are used by the representative firm to fund its investment activities. Hence, the first contribution of this paper is its depth of focus on the theoretical backgrounds of the interaction between the financial sector and economic growth by utilizing the Trade-off Theory in order

[4] There is a particular reason why we have chosen this approach. We argue that studies such as Cooray (2010), that treat financial capital as a factor of production, do not represent the true input-output relationship, unless financial capital is transformed into labor and capital in the production function. Our theoretical model also deviates from Wu et al. (2010), as the latter relies on endogenous growth rate derived from an AK-framework in the theoretical part.

to examine the simultaneous impact on economic growth of the two main channels of financial sector. Next, we present empirical evidence for the 40 selected countries at aggregate and at individual levels. In particular, Augmented Mean Group (AMG) and Common Correlated Effects (CCE) estimation methods are employed to estimate the theoretically derived equation, using a panel of yearly data across the period 1989-2011. The second contribution of this work is the study of a group of economies as a panel, and simultaneously, at individual country level. The use of recently developed second generation panel cointegration analysis, which takes into account cross sectional dependency, is the first in the field. We show that both estimation procedures indicate a positive long-run impact of credit and stock market development on steady-state level of GDP per capita. However, country-level estimations yield some unexpected results, e.g., the similarities between the Chinese and UK coefficient of stock market development. In order to explain the nature of differences in results at country level, we use the financial structure index of Demirguc-Kunt and Levine (2001), and show that financial development has a positive or insignificant effect on growth in all the financially developed bank-based and stock market-based economies.

The organization of the paper is as follows: Section 2 develops a financial sector-augmented growth equation by using a Solovian growth framework. Section 3 is reserved for the empirical methodology and findings. Section 4 concludes the paper.

2 The Model

We provide an augmented Solow-Swan growth model to determine the contribution of stock market and credit market developments to long-run economic growth. In addition to Solow-Swan growth model assumptions, we make an assumption on the form of saving function. With regard to the related theory of capital structure, i.e., Trade-off theory, investment is financed externally with debt from credit markets and equity from stock markets. Accordingly, we assume that aggregate saving is formed by the credit and stock markets in a closed economy Solow model. Following the Trade-off Theory, we assume that investment is financed by the following Cobb-Douglas type saving function, a combination of debt and equity:[5]

$$S_t = CM_t^{\theta} \cdot SM_t^{1-\theta} \qquad 0 < \theta < 1 \qquad (1)$$

where CM_t and SM_t represent the sources of funds obtained from credit markets (financial intermediations) and stock markets, respectively. Suppose that production function at time *t* is defined as:

$$Y_t = K_t^{\alpha} \cdot (A_t \cdot L_t)^{1-\alpha} \qquad 0 < \alpha < 1 \qquad (2)$$

[5] In the literature, many studies advocate that credit markets and stock markets are substitutes. See, for example, Levine (1997), Boyd and Smith (1998), Demirguc-Kunt and Levine (2001), Arestis et al. (2001).

where Y_t is output, K_t is physical capital, L_t is labor force, and A_t is the overall technological progress, and parameter α represents production elasticity of capital. We assume that $\frac{A_{t+1}}{A_t} = 1 + x$ and $\frac{L_{t+1}}{L_t} = 1 + n$, where x is the exogenous rate of technological progress and n is the population growth rate. In a Solow framework, the fundamental equation of growth is defined as:

$$K_{t+1} - K_t = S_t - \delta \cdot K_t \tag{3}$$

where $K_{t+1} - K_t$ is net investment between $t + 1$ and t, S_t is gross saving, and δ is depreciation rate, which is assumed to be constant. Hence, fundamental equation of growth becomes

$$K_{t+1} - K_t = CM_t^{\theta} \cdot SM_t^{1-\theta} - \delta \cdot K_t \tag{4}$$

If we multiply and divide the first term on the right hand side by Y_t:

$$K_{t+1} - K_t = \left(\frac{CM_t}{Y_t}\right)^{\theta} \left(\frac{SM_t}{Y_t}\right)^{1-\theta} \cdot Y_t - \delta \cdot K_t$$

We will presume that $\frac{CM_t}{Y_t} = scm$ and $\frac{SM_t}{Y_t} = ssm$, are constant. Hence,

$$K_{t+1} - K_t = (scm)^{\theta}(ssm)^{1-\theta} \cdot K_t^{\alpha} \cdot (A_t \cdot L_t)^{1-\alpha} - \delta \cdot K_t \tag{5}$$

Let us define capital per efficient capita as $\tilde{k}_t \equiv \frac{K_t}{A_t \cdot L_t}$ and output per efficient capita $\tilde{y}_t = \frac{Y_t}{A_t \cdot L_t}$. In that case, fundamental equation of growth in effective per worker would then be

$$(1+n)(1+x)\tilde{k}_{t+1} - \tilde{k}_t = (scm)^{\theta}(ssm)^{1-\theta} \cdot \tilde{k}_t^{\alpha} - \delta \cdot \tilde{k}_t$$

Therefore, $\tilde{k}_{ss} = \left(\frac{scm^{\theta} \cdot ssm^{1-\theta}}{n+\delta+(1+n)x}\right)^{\frac{1}{1-\alpha}}$ and $\tilde{y}_{ss} = \left(\frac{scm^{\theta} \cdot ssm^{1-\theta}}{n+\delta+(1+n)x}\right)^{\frac{\alpha}{1-\alpha}}$ at steady state. Transforming the steady state of output per effective into output per capita and taking natural log of both sides yields:

$$Ln[y_{ss}] = Ln[A_0] + (1+x)t + \left(\frac{\theta\alpha}{1-\alpha}\right) Ln[scm] + \left(\frac{(1-\theta)\alpha}{1-\alpha}\right) Ln[ssm]$$
$$- \left(\frac{\alpha}{1-\alpha}\right) Ln[n+\delta+(1+n)x] \tag{6}$$

where y_{ss} is the steady-state level of output per capita. Empirically, equation (6) can be tested in order to determine the contribution of stock market and credit market to long run economic growth. In particular, we will run the following equation for measuring the contribution of stock market and credit market to long run GDP per capita.

$$Ln[y_{i,t}] = \beta_0 + \beta_1 Ln[scm_{i,t}] + \beta_2 Ln[ssm_{it}] + \ \beta_3\, Ln[n_{i,t}(1+x) + \delta + x)] + \epsilon_{i,t} \qquad (7)$$

where $\beta_0 = Ln[A_0] + (1+x)t$, $\beta_1 = \frac{\theta\alpha}{1-\alpha}$, $\beta_2 = \frac{(1-\theta)\alpha}{1-\alpha}$ and $\beta_3 = -\frac{\alpha}{1-\alpha}$. In (7), coefficients β_1 , β_2 , and β_3 measures the contribution of credit market development, stock market development, and the growth rate of employed population, augmented by technology and depreciation on the natural log of income per capita, $Ln[y_{i,t}]$, respectively. β_1 and β_2 are expected to be positive and β_3 is expected to be negative. Finally, $\epsilon_{\mathrm{i,t}}$ is the error term and the subscripts $t = 1, \dots, T$ and $i = 1, \dots, N$ denote the time period and the country indices, respectively.

3 Data, Methodology and Findings

In this section, we investigate the impact of financial development on economic growth using a panel of yearly data covering the period 1989-2011 on 40 selected countries with both credit and stock markets. Data is compiled from World Development Indicators (WDI), Global Stock Markets Factbook, and Supplemental Standard & Poor's database indicators.[6] We used Bank

[6] These 40 countries consist of Austria, Australia, Belgium, Brazil, Botswana, Canada, China, Colombia, Cote d'lovire, Denmark, Egypt, Finland, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Israel, Italy, Jordan, Japan, Malaysia, Mauritius, Mexico,

Credit[7] (scm) to control for credit market development, computed as the ratio of domestic credit to private sector to gross domestic product (GDP), which takes into account credit issued to the private sector, but not to governments. Our measure of stock market development is Value Traded[8] (ssm), which is computed as the ratio of the total value of all traded domestic shares in a stock market exchange to GDP.[9] Data for real GDP per capita and population growth rate are obtained from OECD National Accounts database.

The growth rate of technology, x, and the rate of depreciation, δ, each are assumed to be 0.025; hence their sum is 5%, á la Mankiw-Romer-Weil (1992). All variables in estimations are used in natural logarithms. Table 1 provides the descriptive statistics for all the variables.

As traditional estimations become inefficient and invalid in the presence of cross-sectional dependency, new techniques that take into account this problem have been developed for stability and cointegration tests, and for also estimation methods, in recent years. Since testing for cross-sectional dependence in a panel study is a crucial factor for selecting the appropriate estimator, the empirical work starts with cross-sectional dependency (CD) tests of Pesaran (2004) and

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Netherlands, Norway, Poland, Portugal, Saudi Arabia, Singapore, Sri Lanka, Sweden, Switzerland, Thailand, Tunisia, Turkey, United Kingdom, and United States.

[7] See for example Levine and Zervos (1998), Levine (1998), and Beck et al. (2000).

[8] See for example Levine and Zervos (1998), Cooray (2010), and Wu (2010).

[9] Value traded (ssm) is one of the two commonly used measures of stock market liquidity. The second measure of stock market liquidity is Turnover ratio. While Value traded captures trading relative to the size of the economy, Turnover captures trading relative to the size of the stock market. The first indicator is used for its appropriateness to our empirical model.

Pesaran et al. (2008), to investigate the contemporaneous correlation across countries in the panel. We take into account the Bias-adjusted CD test for the interpretation of the results, which is consistent even when the CD test is inconsistent, since the finite sample behavior of the tests successfully control the size according to Pesaran et al. (2008). As can be seen from Table 2, for the models with intercept and trend, Bias-adjusted CD test statistics reject the null hypothesis for all variables and models but Ln[n(1+x)+δ+x].[10]

Given the rejection of the null hypothesis of no cross-sectional dependence, the "first generation" panel unit root tests become invalid. Thus, we carried out two panel unit root tests, proposed by Pesaran (2006) and Hadri and Kurozumi (2008) in the presence of cross-sectional dependence to determine whether or not the series are stationary. Table 3 shows that the results of the CIPS[11] and Hadri-Kurozumi panel unit root tests indicate unit roots for Ln[y], Ln[scm], Ln[ssm] and Ln[n(1+x)+δ+x].

Since the variables are integrated of order one, we now proceed with the following steps. First, we perform two second-generation panel data cointegration tests that allow for dependence of cross sectional units, proposed by Westerlund and Edgerton (2007) and Westerlund (2008) to test for the

[10] Since GDP per capita involves trend components, we take into account "with intercept and trend models" to interpret the results.
[11] Cross-sectionally augmented Im-Pesaran-Shin Tests (CIPS) is the sample averages of individual Cross-sectionally augmented ADF (CADF) statistics. Individual CADF unit root statistics are available from authors upon request.

presence of cointegration between $Ln[y]$ and its potential determinants $Ln[scm]$, $Ln[ssm]$ and $Ln[n(1+x)+\delta+x]$.[12] As can be seen from Panel A of Table 4, the asymptotic test results of LM test indicate the absence of cointegration. However, this is computed on the assumption of cross-sectional independence. As this is not the case in our panel, we used bootstrap critical values, as also proposed by Westerlund and Edgerton (2007). In this case, the bootstrap test results provide strong evidence for the failure to reject the null of cointegration. In addition, Durbin-Hausman test of Westerlund (2008) also rejects the null hypothesis of no cointegration in the panel.

Given the evidence of panel cointegration, the long-run relations of the model can be further estimated by two methods for panel cointegration estimation. We now estimate for each country the cross-section augmented cointegration regression by the Common Correlated Effects (CCE) estimation procedure proposed by Pesaran (2006), and Augmented Mean Group (AMG) estimation procedure proposed by Eberhardt and Bond (2009), which allows cross-section dependencies that potentially arise from multiple unobserved common factors. The CCE estimation procedure has the advantage that it can be computed by least squares applied auxiliary regressions, where the observed regressors are augmented with the cross-section averages of the dependent variable and the observed regressors as proxies for the unobserved factors.

[12] Given the rejection of the null hypothesis of no cross-sectional dependence, the "first generation" panel cointegration tests also become invalid.

$$\mathrm{Ln}[y_{i,t}] = \alpha_i + \gamma_i X_{i,t} + \mu_1 \overline{\ln[y_{i,t}]} + \mu_2 \bar{X}_t + \varepsilon_{i,t}, \quad i = 1, \dots N; \quad t = 1, \dots T$$

where the coefficients μ_1 and μ_2 represent the elasticity estimates of $\mathrm{Ln}[y_{i,t}]$ with respect to the cross-section averages of the dependent variable and the observed regressors, respectively. Accordingly, $\mathrm{Ln}[scm]$, $\mathrm{Ln}[ssm]$ and $\mathrm{Ln}[\mathrm{n}(1+\mathrm{x})+\delta+\mathrm{x}]$ are contained in X and finally, $\varepsilon_{i,t}$ is the error term. Through this procedure, the individual coefficients γ_i in a panel framework were estimated, and the Common Correlated Effects Mean Group (CCEMG) estimator, a simple average of the individual CCE estimators, were computed.

$$\hat{\gamma}_{CCEMG} = \sum_{i=1}^{N} CCE_i / N \quad \text{and} \quad SE(\hat{\gamma}_{CCEMG}) = \left[\sum_{i=1}^{N} \sigma\left(\hat{\gamma}_{CCE_i}\right)\right] / \sqrt{N}$$

where $\hat{\gamma}_{CCEMG}$ and $SE(\hat{\gamma}_{CCEMG})$ denote respectively the estimated CCE Mean Group coefficients and their standard deviations. On the other hand, the AMG estimator, which is similar to the Pesaran's (2006) CCE approach, can account for time-series data properties as well as for differences in the impact of observables and unobservables across panel groups. This estimation technique works through the D_t year dummy coefficients of the pooled regression in first difference (FD-OLS), from which the year dummy coefficients are collected, which are relabeled as $\hat{\mu}_t^{\circ}$. In the second stage, this variable was included in each of the N standard country regression. Consequently, the AMG estimates were derived as averages of the individual country estimates.

AMG – Stage (i) $\Delta\ln\left[y_{i,t}\right] = \beta'\Delta X_{i,t} + \sum_{t=2}^{T} c_t \Delta D_t + e_{i,t}$

$$\Rightarrow \hat{c}_t = \hat{\mu}_t^{\circ}$$

AMG – Stage (ii) $\mathrm{Ln}\left[y_{i,t}\right] = \theta_i + \beta_i' X_{i,t} + c_i t + d_i \hat{\mu}_t^{\circ} + \vartheta_{i,t}$

where θ_i is constant and $e_{i,t}$ and $\vartheta_{i,t}$ are error terms of stage (i) and stage (ii), respectively. The cross-sectional group-specific AMG estimated, which are averaged across the panel, can be expressed as: $\hat{\beta}_{AMG} = N^{-1}\sum_i \hat{\beta}_i$. Note that Eberhardt and Bond (2009) compare the performance of AMG and CCEMG estimation techniques through Monte Carlo simulations and find robust results for both approaches. Therefore, we report the combined results of these estimation techniques for credit market development, stock market development, and the growth rate of population augmented by technology and depreciation in Table 5.

Table 5 reports panel results for the model given by Eq. (7). Panel A of Table 5 presents results for the CCE estimation method and Panel B for the AMG estimation method. Results from both estimation procedures indicate a positive long-run impact of credit market development on steady-state level of GDP per capita. Based on CCE estimation, a 1% increase in credit market development of the selected countries will impede their average GDP per capita growth by 0.065%. Our results highlight the importance of credit markets in the process of the finance-growth nexus, also consistent with previous findings, e.g., Levine and Zervos (1998), Beck, Levine and Loayza (2000), Wu (2010). Similarly, on average, over the studied countries, there is a positive and significant relationship between stock market development and the steady-state level of GDP per capita: a 1% increase in stock market development increases growth by 0.013%. Our empirical findings support our theoretical expectation that stock market development has a positive impact on economic development, and is consistent with the literature, e.g., Levine and Zervos (1998) and Cooray (2010). Moreover, the coefficient on $Ln[n(1+x)+\delta+x]$ is negative and statistically significant for both estimation procedures. AMG results for all variables in the model are mostly consistent with CCE results.

Considering the financial structure of individual countries can improve the accuracy of assessments of the effect of financial development on economic growth at country level. Therefore, we first present the Financial Structure Index (FSI) results of the 40 countries in our data set for the period 1989-2011.[13] Financial structure can be determined by calculating bank-based and stock market-based indices defined by Demirguc-Kunt and Levine (2001: 112-118), who proposed a four-category classification of countries based on the structure and level of development of their financial systems; (1) financially

[13] See Durusu-Ciftci (2015) for a more detailed analysis on the financial structure of these countries.

underdeveloped and bank-based, (2) financially underdeveloped and market-based, (3) financially developed and bank-based, (4) financially developed and market-based. Higher values of this index indicate higher levels of development on stock market relative to banking. Countries that have above the mean values of structure are classified as market-based, and the others are classified as bank-based. On the other hand, countries are defined as having an underdeveloped financial system if both of the following hold: (1) Private credits to deposit money banks/GDP is less than the sample mean and (2) Total value traded/GDP is less than the sample mean. We calculated the FSI as follows:

$$\left\{\left[\left(\frac{MC}{AS}\right)_i - \frac{\Sigma\frac{MC}{AS}}{n}\right] + \left[\left(\frac{TVT}{CR}\right)_i - \frac{\Sigma\frac{TVT}{CR}}{n}\right] + \left[\left(\frac{TVT}{OVC}\right)_i - \frac{\Sigma\frac{TVT}{OVC}}{n}\right]\right\}/3$$

where MC/AS is Market Capitalization/Domestic assets of deposit money banks, TVT/CR is Total value traded/ Private credits of deposit money banks, and TVT/OVC is Total Value Traded to GDP/ Overhead costs to the total assets of the banks. Table 6 lists the four categories of countries.

After identifying countries with respect to financial structure, country-level estimations of coefficients, as presented in Table 7, can be interpreted as follows. For the banking sector development, the sign of the significant coefficients at the country level show that, based on CCE estimation, there is a positive relationship for all except for Israel, and based on AMG, all except for

Jordan, Norway and United Kingdom. According to FSI, Israel, Jordan and Norway are financially underdeveloped bank-based economies, while United Kingdom is a financially developed market-based economy. The banking sector coefficient of financially developed bank-based economies of Australia, Canada, Denmark, Germany, Malaysia, Portugal and Thailand are all positive and significant, but insignificant for Austria, Belgium and Saudi Arabia. In this group, Denmark, Portugal and Canada have the most developed banking sector, and Belgium and Saudi Arabia, the least developed. Consequently, for the banking sector development, none of the countries that are classified as financially developed bank-based economies have negative effect on economic growth.

For the stock market development in most cases, the parameters are significant at least at the 10% level. The significant coefficients are positive for all countries except for Botswana, based on AMG estimation; and all positive except for Hungary and Tunisia based on CCE estimation. According to FSI, Botswana, Hungary and Tunisia are financially underdeveloped bank-based economies. A positive and significant coefficient stock market is found for the financially developed stock market-based economies of China, France, Finland, the Netherlands and UK, but is found insignificant for Hong-Kong, Japan, Singapore, Sweden, Switzerland and the USA. In this group, in parallel to their GDP growth, Finland, China, France and the UK showed the greatest improvement in the stock market between 1989-2011, so these findings are not surprising, while the results for the USA, Hong Kong and Switzerland may have been caused by high stock market volatility in these countries. After all, for the stock market development, none of the countries that are classified as financially developed market-based economies have negative effect on economic growth. There are still some results left that FSI does not help us to explain, but it can be conjectured that these anomalies may arise from the specific characteristics of these financial markets.

4 Concluding Remarks and Policy Implications

This study examines the role of financial development on economic growth. We first develop a Solow-Swan growth model augmented with financial markets in the tradition of Wu et al. (2010). The theoretical part of the study develops a model convenient for empirical applications utilizing the Trade-off Theory. In the second stage, the empirical model is estimated for a panel of 40 countries over the period 1989-2011 by means of AMG and CCE estimation methods, which allows cross-sectional dependencies. Our empirical analysis to determine the contribution of credit market and stock market development on economic growth provide the following findings and policy implications:

- Both credit market development and stock market development have positive long-run effects on steady-state level of GDP per capita. Our findings imply that financial development plays a role in economic growth for the majority of sample countries studied, in line with Levine and Zervos (1998), Beck, Levine and Loayza (2000), Wu (2010) and Cooray (2010).

- Although our results vary across countries, panel findings indicate that the contribution of credit market development is substantially greater. Thus, our findings support the view that credit market-based financial systems are more likely to promote long-term economic growth than stock market-based ones (e.g. Arestis et al. (2001). In this respect, emphasis should be on implementing government policies which lead to the deepening of the credit market.
- However, for a minority of countries (e.g., China and UK), the positive influence of stock market development is more powerful. One explanation can be as follows. According to Table 6, China and United Kingdom are classified as financially developed stock-market based economies. When the stock market development data of countries in this group are compared, China has shown the second fastest level of development (after Finland) since the 2000s. Thus, policymakers should take measures to encourage stock market liquidity.
- With respect to FSI, financial development has a positive or insignificant effect on growth in all the financially developed bank-based and stock market-based economies. Hence, it can be stated that, for economic growth, it is essential to implement specific policies in their financial structure, although other sectors should not be neglected in this process.

- On the whole, increasing the openness, competitiveness and security of markets is likely to create more active and dynamic financial intermediaries. Therefore, governments should take some essential measures to foster the development of a country's financial sector and accelerate economic growth. Firstly, policymakers, especially in financially developed bank-based economies, should enhance macroeconomic stability to increase investor confidence. Measures for the probability of full and timely repayment of domestic and foreign debt should be taken. In the banking sector, while ensuring full access to credit, steps should be taken to reduce the risk of payment crisis and default originating from the presence of a large amount of dollarization. Moreover, there is need for institutional and legal improvements that strengthen creditor and investor rights and contract enforcement. In this context, for instance, anti-competitive effects of subsidies and tax reductions implemented by governments should be reduced. The second key measure, especially in financially developed stock market-based economies, is the strengthening of auditing and reporting standards regarding company financial performance. The legal interests of minority shareholders and their property rights should be given greater protection. Lastly, policymakers should focus on increasing financial access, for example, the complexity of the financial markets should be reduced.

Further research in these directions would be significant contributions.

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Table 1: Descriptive Statistics

Statistics/Variables	Ln[y]	Ln[scm]	Ln[ssm]	Ln[n(1+x)+δ+x]
Mean	4.001	1.808	1.172	0.782
Std. Dev.	4.210	1.877	1.327	0.776
Minimum	2.590	0.845	-1.353	0.526
Maximum	4.831	2.357	2.861	1.233
# of Countries	40	40	40	40
# of Observations	920	920	920	920

Table 2: Results of Cross-sectional Dependency Tests

Series	Model	With intercept		With intercept and trend	
		test st.	p. value	test st.	p. value
Panel A:					
Ln[y]	CD_{LM1}[1]	1760.162	0.000	1730.082	0.000
	CD_{LM2}[2]	24.816	0.000	24.055	0.000
	CD[3]	0.612	0.270	-0.700	0.242
	Bias-adjusted CD[4]	2.143	0.016	2.790	0.003
Ln[scm]	CD_{LM1}	1194.724	0.000	1149.686	0.000
	CD_{LM2}	10.500	0.000	9.360	0.000
	CD	-0.768	0.221	-0.314	0.060
	Bias-adjusted CD	92.710	0.000	8.928	0.000
Ln[ssm]	CD_{LM1}	1023.750	0.000	1084.055	0.000
	CD_{LM2}	6.171	0.000	7.698	0.000
	CD	-1.894	0.029	-1.557	0.060
	Bias-adjusted CD	3.826	0.000	3.896	0.000
Ln[n(1+x)+δ+x]	CD_{LM1}	1135.241	0.000	1269.967	0.000
	CD_{LM2}	8.994	0.000	12.405	0.000
	CD	-0.772	0.220	0.603	0.073
	Bias-adjusted CD	-0.730	0.767	-1.102	0.865
Panel B:					
Model	CD_{LM1}	1696.568	0.000	1814.633	0.000
	CD_{LM2}	23.206	0.000	26.195	0.000
	CD	18.517	0.000	11.518	0.000
	Bias-adjusted CD	37.302	0.000	20.533	0.000

Notes: Panel A reports the CD_{LM1} test developed by Breusch and Pagan (1980), CD_{LM2} and CD tests developed by Pesaran (2004) and Bias-adjusted CD test developed by Pesaran et al (2008) for individual variables and Panel B reports these tests for the model. [1]CD_{LM1} tests the null of zero correlations in the context with N fixed and $T\rightarrow\infty$. [2]CD_{LM2} tests the null of zero correlations in the context with N and T large. [3]CD tests the null of zero correlations in the context with N large and T small. [4]Bias-adjusted CD tests the null of zero correlations in the case of panel models with strictly exogenous regressors and normal errors.

Table 3: Panel Unit Root Tests

Panel A:		CIPS (With Intercept)		CIPS (With Intercept & Trend)	
Ln[y]		-1.960		-1.940	
Ln[scm]		-1.758		-2.006	
Ln[ssm]		-2.070		-2.566	
Ln[n(1+x)+δ+x]		-1.643		-2.667	
Panel B:	Model	With	p.value	With Intercept & Trend	p.value
Ln[y]	Za_spac	-1.384	0.916	69.661	0.000
	Za_la	-3.325	0.999	67.768	0.000
Ln[scm]	Za_spac	-0.724	0.765	0.414	0.339
	Za_la	-1.014	0.844	4.740	0.000
Ln[ssm]	Za_spac	5.297	0.000	28.574	0.000
	Za_la	18.832	0.000	54.056	0.000
Ln[n(1+x)+δ+x]	Za_spac	0.241	0.407	13.546	0.000
	Za_la	1.416	0.078	28.611	0.000

Notes: Panel A reports the results of unit root tests of Pesaran (2006). The null hypothesis of the test is unit root in panel data with cross-sectional dependence in the form of a common factor dependence. The critical values for the CIPS tests were obtained from Pesaran 2006, Table 1.b, 1.c, 2.b, and 2.c.

Panel B reports the results of the panel stationarity tests with cross-sectional dependence proposed by Hadri and Kurozumi (2008). The null hypothesis of the test is stationary in heterogeneous panel data with cross-sectional dependence in the form of common factor dependence. ZA_spac: the augmented panel KPSS test statistic with long-run variance corrected by the SPC method and ZA_la: the augmented panel KPSS test statistic with long-run variance corrected by the lag augmented method. The augmented KPSS test corrected by the LA method has a similar property to that of ZA_spac for the strong cross-correlation case, while the size of the test is relatively well controlled for the weak cross-correlation. For this reason, we use “ZA_la models” when interpreting the results.

Table 4: Panel Bootstrap Cointegration Tests:

	Test st.	Asymptotic p-value	Bootstrap p-value[+]
Panel A:			
Model with intercept	8.396	0.000	0.928
Model with intercept and trend	9.392	0.000	0.999
Panel B:			
dh_group	2.414	0.012	0.008
dh_panel	4.792	0.017	0.010

Note: Panel A: LM bootstrap panel cointegration test is developed by Westerlund and Edgerton (2007). [+]The critical value (% 95) based on the bootstrapped distribution with 5000 bootstrap replications. The null hypothesis of the test is cointegration of ln(y) and its potential determinant series.

Panel B: Durbin-Hausman panel cointegration test is developed by Westerlund (2008). The null hypothesis of the test is no cointegration of ln(y) and its potential determinant series. Note that while panel statistic, denoted DH_p, is constructed by summing n individual terms before multiplying them together, the group mean statistic, denoted DH_g, is constructed first multiplying the various terms and then summing.

Table 5: Panel Estimation Results

Panel A	**Panel B**

CCE Estimators			**AMG Estimators**		
Ln[scm]	Ln[ssm]	Ln[n(1+x)+δ+x]	Ln[scm]	Ln[ssm]	Ln[n(1+x)+δ+x]
0.065**	0.013**	-0.289*	0.056**	0.025**	-0.289**
(0.023)	(0.005)	(0.174)	(0.025)	(0.005)	(0.146)

Notes: Figures in parenthesis are asymptotic standard errors. ** and * stand for significance at 5 and 10% levels, respectively.

Table 6: Country Classification of Financial Structure (1989-2011 Averages)

Financially Underdeveloped Economies		**Financially Developed Economies**	
Bank-based economies	**Structure Index**	**Bank-based economies**	**Structure Index**
Cote d'lvoire	-10.46	Australia	3.09
Botswana	-10.18	Austria	-8.42
Brazil	-9.25	Belgium	-4.46
Colombia	-10.32	Canada	-2.99
Hungary	-5.86	Denmark	-0.55
Egypt	-8.01	Germany	1.40
Greece	-3.91	Malaysia	3.94
India	-7.47	Portugal	-5.86
Indonesia	-9.39	Saudi Arabia	4.08
Israel	-5.89	Thailand	-3.68
Italy	-5.22	Group-mean	-1.34
Jordan	-3.39		
Mauritius	-10.32	**Market-based Economies**	
Mexico	-9.57	China	4.94
Norway	-1.78	France	6.26
Poland	-9.88	Hong Kong	26.01
Sri Lanka	-10.26	Japan	12.49
Tunisia	-10.39	Finland	20.89
Turkey	-7.87	Netherlands	23.20
Group-mean	-7.86	Singapore	23.94
Market-based Economies		Sweden	10.47
-	-	Switzerland	18.19
-	-	UK	11.23
-	-	USA	8.75
-	-	Group-mean	15.13

Table 7: Individual Country Results

Country	CCE Estimators			AMG Estimators		
	Ln[scm]	Ln[ssm]	Ln[n(1+x)+δ+x]	Ln[scm]	Ln[ssm]	Ln[n(1+x)+δ+x]
Australia	0.341**	-0.005	0.091	0.433**	0.040**	-0.050
	(0.121)	(0.025)	(0.056)	(0.114)	(0.020)	(0.089)
Austria	0.011	-0.003	0.235**	-0.063	-0.012	-0.045
	(0.135)	(0.006)	(0.092)	(0.129)	(0.010)	(0.085)
Belgium	0.010	0.025**	-0.149	-0.018	0.009	-0.481**
	(0.031)	(0.012)	(0.170)	(0.013)	(0.011)	(0.140)
Brazil	0.013	0.064**	1.475	0.060*	0.011	-0.124
	(0.016)	(0.011)	(1.127)	(0.032)	(0.012)	(0.711)
Botswana	0.034	-0.015	-1.070**	0.024	-0.021*	-1.213**
	(0.043)	(0.018)	(0.328)	(0.033)	(0.012)	(0.318)
Canada	0.071**	-0.018	0.629**	0.102**	0.063**	0.259
	(0.027)	(0.066)	(0.240)	(0.035)	(0.025)	(0.264)
China	0.017	0.089**	-1.912**	0.147	0.053**	0.335
	(0.224)	(0.027)	(0.920)	(0.278)	(0.016)	(1.506)
Colombia	0.118**	0.018	-0.117	0.165**	0.012*	0.107
	(0.057)	(0.011)	(0.836)	(0.041)	(0.007)	(0.991)
Cote d'lvoire	0.029	0.060**	0.064	0.004	0.056**	-0.083
	(0.077)	(0.013)	(0.203)	(0.061)	(0.015)	(0.224)
Denmark	0.013*	0.019	-0.161	-0.004	0.099**	-0.134
	(0.007)	(0.025)	(0.229)	(0.010)	(0.015)	(0.376)
Egypt	-0.074	0.008	0.140	-0.041	0.006	0.110
	(0.052)	(0.012)	(0.243)	(0.029)	(0.008)	(0.189)
Finland	0.286**	0.060**	-2.578	0.385**	0.050**	-2.888**
	(0.144)	(0.025)	(2.146)	(0.090)	(0.017)	(1.245)
France	-0.004	0.034**	0.357**	-0.021	0.032**	0.390**
	(0.042)	(0.007)	(0.121)	(0.038)	(0.006)	(0.129)
Germany	0.152*	-0.004	0.651**	0.109	0.012	0.302*
	(0.066)	(0.012)	(0.190)	(0.079)	(0.012)	(0.151)
Greece	0.592**	-0.020	1.646**	0.335**	0.033**	1.161**
	(0.095)	(0.016)	(0.220)	(0.070)	(0.016)	(0.542)
Hong Kong	-0.001	0.001	0.127	-0.115	0.046*	0.154**
	(0.111)	(0.036)	(0.075)	(0.134)	(0.027)	(0.064)
Hungary	0.256**	-0.012*	-0.384**	0.169**	0.016	-0.474**
	(0.042)	(0.006)	(0.096)	(0.016)	(0.011)	(0.126)
India	-0.097	-0.010	-1.692	0.136**	-0.028	-4.258*
	(0.105)	(0.013)	(3.272)	(0.062)	(0.021)	(2.337)
Indonesia	0.145**	-0.012	-5.145**	0.183**	0.004	-2.361
	(0.057)	(0.028)	(1.298)	(0.036)	(0.008)	(1.459)
Israel	-0.241*	-0.001	0.059	0.092	-0.024	0.057
	(0.129)	(0.011)	(0.062)	(0.098)	(0.018)	(0.095)
Italy	0.015	0.030*	0.138	-0.047	0.046**	0.150**
	(0.053)	(0.015)	(0.090)	(0.041)	(0.008)	(0.061)
Jordan	0.046	0.004	-0.228**	-0.369**	0.054**	-0.093**
	(0.056)	(0.005)	(0.026)	(0.138)	(0.012)	(0.049)
Japan	-0.062	-0.017	-0.180	0.012	-0.018	-0.304
	(0.064)	(0.070)	(0.128)	(0.059)	(0.012)	(0.231)
Malaysia	0.156**	0.060**	-0.770**	0.100**	0.060**	-0.706*
	(0.029)	(0.011)	(0.347)	(0.029)	(0.011)	(0.415)
Mauritius	0.076	0.042**	0.317	0.159	0.017**	0.047
	(0.125)	(0.020)	(0.221)	(0.105)	(0.008)	(0.254)
Mexico	0.114	-0.067	-0.703	0.046	-0.011	-0.624
	(0.077)	(0.052)	(0.637)	(0.078)	(0.037)	(0.441)
Netherland	0.108**	0.019**	0.330**	0.032	0.041**	0.331**
	(0.052)	(0.007)	(0.096)	(0.075)	(0.007)	(0.162)
Norway	-0.097	0.016	-0.692**	-0.361**	0.057**	-0.988**
	(0.140)	(0.020)	(0.172)	(0.087)	(0.024)	(0.162)
Poland	0.127**	-0.009	0.174	0.130**	0.011	-0.127
	(0.047)	(0.013)	(0.102)	(0.025)	(0.009)	(0.065)
Portugal	0.192**	0.027**	0.125*	0.180**	0.022**	0.193**
	(0.045)	(0.010)	(0.061)	(0.035)	(0.005)	(0.072)
Saudi Arabia	-0.112	-0.010	-0.188**	-0.137	-0.022	-0.208
	(0.081)	(0.010)	(0.075)	(0.099)	(0.017)	(0.123)
Singapore	-0.129	0.008	-0.045	0.012	0.057	-0.027
	(0.110)	(0.042)	(0.050)	(0.111)	(0.037)	(0.048)
Sri Lanka	-0.001	0.023*	-0.011	-0.021	0.016**	0.002
	(0.023)	(0.011)	(0.034)	(0.018)	(0.005)	(0.021)
Sweden	0.009	0.058	0.438*	-0.046	-0.009	0.073
	(0.019)	(0.039)	(0.256)	(0.033)	(0.026)	(0.279)
Switzerland	0.027	-0.036	0.258**	-0.013	-0.008	0.198**
	(0.111)	(0.040)	(0.090)	(0.117)	(0.014)	(0.085)
Thailand	0.189**	0.030	-1.414*	0.258**	0.078**	-0.147
	(0.057)	(0.034)	(0.716)	(0.066)	(0.014)	(0.114)
Tunisia	-0.032	-0.017*	0.051	-0.017	-0.009	0.039
	(0.105)	(0.010)	(0.097)	(0.099)	(0.008)	(0.071)
Turkey	0.142**	-0.012	-1.318	0.108**	0.008	-0.037
	(0.071)	(0.025)	(4.221)	(0.030)	(0.010)	(1.599)
United Kingdom	-0.077	0.100**	0.039	-0.244**	0.120**	-0.061
	(0.069)	(0.010)	(0.591)	(0.089)	(0.011)	(0.499)
United States	0.236**	0.005	-0.319	0.368**	0.018	-0.211
	(0.075)	(0.014)	(0.293)	(0.095)	(0.015)	(0.076)

Notes: Figures in parenthesis are Newey-West standard errors.
** and * stand for significance at 5 and 10% levels, respectively.