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Finance-Growth Nexus: Evidence based on New Measures of Finance

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ABSTRACT

This study examines the impact of financial development on economic growth using both the development of banking sector and the development of stock market as indicators of financial development. In order to reduce information loss, new measures of the banking sector and the stock market development are derived from various available measures via principal component analysis. Using the generalized method of moments (GMM) estimation technique on a 1988-2012 sample of 53 countries, the study reveals that the development in the banking sector and the stock market are both important to promote economic growth

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INTRODUCTION

The importance of financial market on economic growth has been recognized since the original work of Schumpeter (1911). The study mentions that the services provided by the financial intermediaries are significant to stimulate technological innovation and economic development, and also vital in financing entrepreneurs to actualize their invention into tangible or intangible final consumer goods. Well-developed financial systems are crucial to channel financial resources to their most productive use, which in turn may lead to economic growth and expansion.

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Subsequently, many studies have been carried out to investigate the financial-growth nexus. Pagano (1993), King and Levine (1993b) and Greenwood and Jovanovic (1990) construct theoretical models to explain the relation between these two economic variables. The models postulate that well-developed financial intermediaries promote efficient allocation of resources that lead to economic expansion.

Theoretically, the positive impact of financial intermediaries on economic growth can be via two channels: the capital accumulation channel and the productivity channel. In the first channel, the financial sector acts as agents to mobilize saving to the productive sector, which will boost capital accumulation and output growth. In the second channel, the financial sector plays an important role in financing innovative activities, which are vital to enhance economic activities. Empirical studies by Ang (2008) and Levine (2005) show that financial markets have significant and positive impact on economic output and growth. Financial innovations created by the financial intermediaries reduce transaction and information costs while hedging tools facilitate investment and spur economic growth. Although the importance of the financial sector on growth is highly upheld, findings are mixed and a general consensus has not been achieved. While some studies argue that financial development significantly contributes to economic growth (Bloch and Tang, 2003; Minier, 2009), others are of the view that financial development does not enhance economic activities (Aziakpono, 2005; Naceur and Ghazouani, 2007).

Authors of existing studies on finance-growth nexus have used only one of two important indicators of financial development: the development of the banking sector or the development of the stock market. For instance, King and Levine (1993) and Iyare and Moore (2011) use the banking sector development to estimate the relationship, while N'Zue (2006) and Naceur and Gazhouni (2007) use the stock market development in their analysis. In theory, both the banking sector and the stock market are essential in promoting economic activities. Stock market is vital in mobilizing resources and investment while the banking sector is a major source of finance especially to small and medium scale firms that do not have access to the stock market. Furthermore, Van Nieuwerburgh *et al*. (2006) claims that the existence of these two sectors may create a complementary relationship that may lead to significant and positive economic impact. Thus, the absence of one of these indicators in an estimation model or analysis can lead to the loss of some vital information to accurately understand the relationship between financial sector development and economic growth.

Existing and previous studies on the finance-growth nexus also find it challenging to select the best measure of financial development. They have used several measures to represent the development of the banking sector or the stock market, all of which have their own merits and shortcomings. Using only one indicator to measure the development in a particular sector may cause some loss of vital information that is carried by other measures (Wu et. al., 2009). Furthermore, with a single measure of financial development, the selected measure may not be the optimum representative of financial development (Levine, 2005; Rioja and Valev, 2000). On the other hand, using more than one measure in a single regression model may raise the issue of multicollinearity as most measures of banking sector and/ or stock market development tend to be highly correlated and can lead to misleading findings.

The purpose of our study is to examine the impact of financial development on economic growth by using new approach to measuring financial development. The study is carried out using a sample of 53 countries during the period of 1988 to 2012. To avoid losing vital information due to inappropriate selection of financial development indicators, we undertake two actions. First, we include the measures of the banking sector development and stock market development in a single estimation model. Second, we derive a new measure of financial development using several common measures used in related studies using principal component analysis technique. Our study included only one measure for each particular sector, and this eliminates the possibility of multicollinearity, which may distort the results. The findings of our study show that both development in the banking sector and the stock market play a significant and positive role in economic growth.

This paper is organized as follows. Section 2 discusses the methodology, theoretical and empirical models. Section 3 presents the empirical findings and discussion of the analysis. Section 4 concludes.

METHODOLOGY AND DATA

Theoretical Model

Pagano (1993) proves that financial development, both equity and credit market development, has a significant positive effect on economic growth. Based on the assumption of constant return to scale, a simple production function is as follows:

$$Y_t = AK_t \qquad (1)$$

where A denotes marginal efficiency of capital, and K represents capital stock (both labour and non labour factor inputs). Gross investment is defined as:

$$I_{t+1} = K_{t+1} - (1 - \delta) K_t \qquad (2)$$

where δ denotes capital consumption, K is the stock of capital as defined above, and t is time factor. Static tradeoff theory of corporate finance states that financial intermediations and stock market are two alternative external sources of financing available to firms. Thus, working under the assumptions that investment spending is financed via debt (issues of equity) and credit (financial intermediation), and that these two sources interact with each other and on the constant elasticity of substitution (CES) theory, the investment function can be written as follows:

$$I_t = f\,(CD_t, SMt) \qquad (3)$$

This is similar to

$$It = (\alpha CD^{p}{}_{t}, SM^{p}{}_{t})^{1/P} \qquad (4)$$

where CD and SM are credit market financing and debt financing, respectively, α and β are coefficients of credit and equity financing, respectively, t is time factor and P is the ratio of financing.

Pagano further assumes that funds obtained from credit financing is a given proportion of saving (S_t). That is,

$$CD_t = \theta S_t \tag{5}$$

Therefore,

$$I_t = [(\alpha S_t)^P + \beta (SM_t)^P]^{1/P} \tag{6}$$

A simple manipulation of the equations (5) and (6) will give growth rate of output equation as

$$G_{t+1} = AI_t/Y_t - \delta \tag{7}$$

$$= A \{[\alpha (\theta S_t)^p + \beta (SM_t)^P]^{1/P}\} Y_t - \delta \tag{8}$$

$$= A [\alpha (\theta S_t)^p / Y_t + \beta (SM_t)^P / Y_t]^{1/P} - \delta \tag{9}$$

Hence, steady state growth rate of output is given as

$$A [\alpha (\theta S_1)^p + \beta (S_2)^P]^{1/P} - \delta \tag{10}$$

where S_1 and S_2 denotes steady state saving and equity to output ratios, respectively. It shows the importance of both financial intermediation and equity financing to financial development and hence economic growth.

Model Specification

The specification model of this study as follows:

$$T_{it} = \beta_{0i} FD_{it} + \beta_{2i} X_{it} + \varepsilon_{it} \tag{11}$$

where Y_{it} is real per capita income, *FD* is the indicators of financial development (both banking and stock market development), *X* are the vector of other economic growth determinants, and ε is the error term. In this case, *FD* denotes financial development, which is represented by the banking sector and the stock market development, while *X* is a vector of control variables that consist of trade openness, investment, inflation, and government expenditures. The specification model is

$$Y_t = \beta_{0i} + \beta_{1i} Y_{t-1} + \beta_{2i} BANK_t + \beta_{2i} STOCK_t + \beta_{2i} tradeopen_t + \beta_{2i} INV_t + \beta_{2i} gov_t + \beta_{2i} inf_t + \mathcal{E}_t \tag{12}$$

where BANK is the banking index produced by the principal component of banking sector development, and STOCK is stock market index produced by the principal component of stock market development. The variables are expressed in log form, so the specification model is as follows:

$$1n\ Y_{it} = \beta_{1i}\ 1h\ Y_{t-1} + \beta_{2i} BANK_{it} + \beta_{2i} STOCK_{it} + \beta_{2i}\ 1h\ tradeopen_{it} + \beta_{2i}\ 1h\ INV_{it} + \beta_{2i}\ 1h\ gov_{it} + \beta_{2i}\ inf_{it} + \mathcal{E}_{it} \tag{13}$$

Generalized Method of Moments

This study uses dynamic panel Generalized Method of Moment estimator (henceforth referred to as GMM) as proposed by Holtz-Eakin *et al*. (1989), and later extended by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). The selection of this method of estimation is because of its superiority relative to other dynamic panel estimators in addressing the problems of simultaneity, individual specific effect, and dynamic panel bias (Nickell, 1981), and the likelihood of obtaining consistent parameter estimates even in the presence of measurement errors and endogeneity of regressors (Bond, Hoeffler, and Temple, 2001).

Arellano and Bond (1991) introduces GMM difference estimator for dynamic panel data that estimate the model in first differences and use lagged level of the variables as instruments. The GMM difference estimator uses the lagged levels of the explanatory variables as instruments under the conditions that the error term is not serially correlated and that the lagged levels of explanatory variables are weakly exogenous (i.e., they are uncorrelated with future error terms).

$$E\,[Y_{i,t-s}\,(\mathcal{E}_{i,t} - \mathcal{E}_{i,t-1})] \quad for\ s \geq 2,\ t = 3,\ldots,T, \qquad (14)$$

$$E\,[X_{i,t-s}\,(\mathcal{E}_{i,t} - \mathcal{E}_{i,t-1})] \quad for\ s \geq 2,\ t = 3,\ldots,T. \qquad (15)$$

The difference GMM estimator does, however, has its shortcomings. This estimator is inappropriate in cases where the series are persistent. Any estimator that relies on differencing to remove individual specific effect and has lagged levels of regressors as instruments for the difference equations is expected to perform poorly in a situation where the series is persistent or the parameter estimates being near unit root, which is highly likely in growth rate of time series data (Bond, 2002). Arellano and Bover (1995) propose an alternative and more efficient GMM estimator that put together both the difference and level equations, known as the system GMM. This estimator combines the moment conditions for the difference equations with that of the level equations (Blundell and Bond, 1998) and utilizes the assumptions about the initial conditions to generate a moment condition that is still informative even in the presence of persistent series. This yields the following stationary properties:

$$E[y_{i,t+p}.\eta_i] = E[y_{i,t+q}.\eta_i] \ and\ E[X_{i,t+p}.\eta_i] = E[X_{i,t+q}.\eta_i] \ for\ all\ p\ and\ q \qquad (16)$$

The additional moment conditions for the regression in level are:

$$E\,[(y_{i,t-s} - y_{i,t-s-1})\,(\eta_i + \mathcal{E}_{i,t})] = 0 \qquad for\ s = 1 \qquad (17)$$

$$E\,[(X_{i,t-s} - X_{i,t-s-1})\,(\eta_i + \mathcal{E}_{i,t})] = 0 \qquad for\ s = 1 \qquad (18)$$

The moment conditions in equation (15), (16), (17) and (18) are used in generating consistent and efficient GMM system estimator. The consistency of the GMM estimator depends on the validity of the instruments, which is tested by the Sargan test of over identifying restrictions suggested by Blundell and Bond (1998).

Principal Component Analysis

Principal Component Analysis (PCA) is a mathematical method which recognizes pattern in datasets in a way that highlights the similarities and differences, while at the same time, retaining most of the information inherent in the original datasets in the principal components (Smith, 2002). PCA employs orthogonal transformation to convert a set of large number of correlated variables into a fewer set of uncorrelated variables called the principal components. This is achieved by reducing the dimension of the original data matrix into smaller number of unrelated variables, which explains significant changes in the original datasets without significant loss of information contained in the original datasets. This approach is appropriate if we wish to develop a smaller number of artificial measures from a large number of observed measures that will account for most of the variance in the original observed variables.

Based on the assumption of zero empirical mean (that is; the empirical mean of the distribution has been subtracted from the data set), the principal component w1 of a data set X can be defined as:

$$W_1 = \underset{\|w\|=1}{\arg\max}\ Var\ \{w^T X\} = \underset{\|w\|=1}{\arg\max}\ E\ \{(w^T X)^2\} \tag{19}$$

With the first $k-1$ components, the kth component can be found by subtracting the first $k-1$ principal components from X:

$$\hat{X}_{k-1} = X - \sum_{i=1}^{k-1} w_i w_i^{\mathrm{T}} X \tag{20}$$

and by substituting this as the new data set to find a principal component in

$$w_k = \underset{\|w\|=1}{\arg\max}\ E\ \{[w^T X_{k-1}]^2\} \tag{21}$$

where, $X = \{X[m,n]\}$ data matrix of M*N dimension, consisting of the set of all data vectors, one vector per column,$w = \{w[p,q]\}$ matrix of basis vectors of M*L dimension, one vector per column, where each basis vector is one of the eigenvectors of C, and where the vectors in W are a sub-set of those in V, C = covariance matrix of M*M dimension, $V = \{v[p,q]\}$ is the eigenvector of C of M*M dimension one eigenvector per column.

Principal Component analysis has two important features; firstly, the first extracted component records the highest amount of changes in the original observed variables, which would be correlated with at least one or more of the observed variables and it measures communalities among the sets of observed datasets. Secondly, the second component extracted records the highest amount of variance in the datasets that is not accounted by the first principal component, and it is uncorrelated with the first principal component.

Data

Our study utilizes annual data of 53 countries from 1988-2012 averaged over five-year period. The selection of the sample countries, which are a mix of developed and developing countries, is mainly based on data availability. Data for the measures of financial development are obtained from *Financial Structure Database.* For economic growth, gross fixed capital formation, inflation, and government expenditures, the data are obtained from *World Development Indicator. Trade Openness* is constructed from the ratio of export and import to GDP (obtained from *World Development Indicators*). While *banking sector* and *stock market* developments are represented by the principal components of each of them respectively.

For banking sector development, its principal component is derived from three measures: *the ratio of liquid financial liability to GDP, the ratio of private sector credit by the deposit money bank to GDP*, and *the ratio of deposit money bank assets to the sum of deposit and central banks assets.* These three measures are chosen due to their merits. For instance, *the ratio of liquid financial liability to GDP* measures the overall size of the financial intermediation in the country, t*he ratio of private sector credit by the deposit money bank to GDP* captures the size of credit to the private sector by the banking sector in relation to overall domestic credit issued, *the ratio of deposit money bank assets to the deposit plus commercial banks assets* measures the degree and capacity to which commercial banks can allocate saving in relation to the central bank (Saci *et al*., 2009).

For stock market development, its principal component is derived from another three measures: *the ratio of market value of listed shares on the domestic exchange/GDP, the ratio of total value traded to GDP*, and *turnover ratio*. Likewise, the choice of these factors is because of their functions in stock market development. For example, *the ratio of market value of listed shares on the domestic exchange/GDP* denotes the efficiency of the stock market (Wu *et al*., 2009), *the ratio of value traded to GDP* measures market activity (Saci *et al*., 2009), while *turnover ratio* complements both capitalization and value traded ratios.

Economic growth is measured by *real per capita income* as used by Saci *et al*. (2009). *Investment* is measured by *gross fixed capital formation* as used by Liang and Teng (2006). Trade openness is measured by the *ratio of the sum of exports and imports of goods and services measured to the share of gross domestic* product as used in Law and Shah Habibullah (2009). *Government expenditures* and *inflation* are control variables used in this study.

RESULTS AND DISCUSSION

This study adopts two types of *Generalized Method of Moments (GMM)* estimators - *two step difference GMM* and *System GMM* estimators - to analyze the economic growth impact of financial development. Since all the regressors are likely to be endogenous, they are included in the instrument set with two lags of themselves. The results of the estimation is shown in Table 1 explain that both *stock market development* and *banking sector developmen*t have positive and significant effect on *economic growth. Trade openness*, surprisingly, has a negative relationship to *economic growth,* while inflation and *government expenditures* are found to be non-significant. The insignificant result of the autocorrelation text AR(2) for both GMM estimators shows there is no second order serial correlation.

Table 1 Result of Two Step Dynamic Panel GMM

	Two Step Difference GMM	Two Step System GMM
LGDPC	0.5494**	0.8687**
	[0.000]	[0.000]
PCBANK	0.0230**	0.0097*
	[0.000]	[0.037]
PCSTOCK	0.0273**	0.0339**
	[0.000]	[0.000]
LTRADEOP	-0.1364**	-0.0419**
	[0.000]	[0.000]
LINV	0.1622**	0.0588**
	(0.01587)	(0.0076)
	[0.000]	[0.000]
INF	-0.0066	-0.0002
	[0.163]	[0.745]
LGOV	-0.0044	-0.0006
	[0.222]	[0.921]
AR(2)	-0.6329	-0.7939
	[0.5268]	[0.4272]
SARGAN TEST	30.7124**	36.5069
	[0.0061]	[0.192]

NOTE: LGDPC = log of real GDP per capita, PCBANK = principal component of banking sector development, PCSTOCK = principal component of stock market development, LTRADEOP = log of trade openness, LINV = log of investment, INF = inflation, LGOV = log of government expenditure. n= 53. Values in [ ] denote p-values. ** and * denote significance at 1% and 5%, respectively.

We also run the estimation of two step difference GMM and two step system GMM using annual data of 26 years observation (1988 – 2012). The results are consistent with the estimation using average data of 5-year intervals. The results are not reported and will be given upon request. We run two tests to check for robustness of our results. In the first test, we discarded stock market development from the model, leaving only banking sector development to measure financial development. In the second test, we discarded banking sector development and maintained stock market development in the model. The results of the two robustness tests, shown in Tables 2 and 3 respectively, are similar to the results of the main model. These two estimations also shows insignificant of AR(2) test which suggest the non-existence of second order serial correlation among residuals of the differenced equations.

Table 2. Result of Two Step Dynamic Panel GMM
(Banking Sector Development and Economic Growth)

	Two Step Difference GMM	Two Step System GMM
$LGDPC_{i,t-1}$	0.5747**	0.8579**
	[0.000]	[0.000]
PCBANK	0.028**	0.0281**
	[0.000]	[0.000]
LINV	0.2078**	0.0684**
	[0.000]	[0.000]
LTRADEOP	-0.1662**	-0.055**
	[0.000]	[0.000]
LGOV	-0.0092	-0.0041
	[0.082]	[0.544]
INF	-0.0001	-0.00004
	[0.103]	[0.604]
AR(2)	-0.6769	-1.4606
	[0.4985]	[0.1441]
SARGAN TEST	26.4688**	32.4448
	[0.0226]	[0.527]

NOTE: LGDPC = log of real GDP per capita, PCBANK = principal component of banking sector development, LTRADEOP = log of trade openness, LINV = log of investment, INF = inflation, LGOV = log of government expenditure. n= 53. Values in [ ] denote p-values. ** and * denote significance at 1% and 5%, respectively.

TABLE 3 Result of Two Step Dynamic Panel GMM
(Stock Market Development and Economic Growth)

	Two Step Difference GMM	Two Step System GMM
$LGDPC_{i,t-1}$	0.6976**	0.8792**
	[0.000]	[0.000]
PCSTOCK	0.0313**	0.0399**
	[0.000]	[0.000]
LINV	0.1687**	0.054**
	[0.000]	[0.000]
LTRADEOP	-0.1114**	-0.0405**
	[0.000]	[0.000]
LGOV	-0.0063	0.0008
	[0.312]	[0.914]
INF	-0.0008	-0.0001
	[0.274]	[0.909]
AR(2)	-0.8011	-0.7579
	[0.4228]	[0.4485]
SARGAN TEST	30.8128**	36.4408
	[0.0059]	[0.1957]

NOTE: LGDPC = log of real GDP per capita, PCSTOCK = principal component of stock market development, LTRADEOP = log of trade openness, LINV = log of investment, INF = inflation, LGOV = log of government expenditure. N= 53. Values in [ ] denote p-values. ** and * denote significance at 1% and 5%, respectively.

The of positive relationship between banking sector development and stock market development with economic growth are similar to the results of Christopoulos and Tsionas (2004), Akinlo and Olufisayo (2009), Rousseau and Wachtel (2000), Iyare and Moore (2011) and, Yang and Yi (2008). The positive relationship indicates that the functions of financial sectors such as mobilizing and distributing financial resources, diversifying savings, sources of investments and many others, play an important role in promoting economic growth. For example, stock market provides firms with long-term capital, which is essential for growth (Van Nieuwerburgh *et al*., 2006). The banking sector, on the other hand, provides short-term loans, which are usually sought after for viable and productive investment (Ang, 2008). Banks also serve as the only avenue and means through which small businesses can raise fund for business purposes (Laeven, 2000). Small and medium scale industry has been pivotal to economic growth even in industrialized economies.

The positive and significant relationship between investment and economic growth is in line with theoretical expectations (the Solow growth model). Investment is argued to be the most volatile component of economic growth. It affects growth through multiplier effect. As investment increases, employment of factor inputs may increase also. This may lead to increase in output and consequently economic growth. From the angle of income effect, a rise in investment may increase employment of factor of production. This may result in an increase in household income and eventually to increased output as production increases to meet rising aggregate demand. Even if investment takes the form of human capital development or research and development, these are argued to be very important for economic growth (simple production function). In fact, the human capital development affects growth via efficiency parameter in growth model. The result is consistent with those by Christopoulos and Tsionas (2004).

The negative relationship between trade openness and growth may be due to the sample of the study which contained mainly developing countries. According to Bahmani-Oskooee and Shabsigh (1992), the effect of trade openness is country specific. Trade openness may be beneficial to countries that have trade partners that are of the same competitive edge, export finished product while importing primary product, or export products they have competitive advantage over trading partners while importing goods they have comparative disadvantage (refer to the theory of comparative cost). Therefore, trade liberalization is more likely to be beneficial to developed countries. This conclusion however, may not hold true in the sample of developing countries as most developing countries are at comparative disadvantage, export primary products and import finished goods. Liberalizing trade will retard the growth of local firms in developing countries, and therefore negatively affects their economic growth. Our result is in line with those by Ji and Long (2010), and Bahmani-Oskooee and Shabsigh (1992).

The non-significant relationship between inflation and growth and between government expenditure and growth may be due to the fact that inflation has been stable among most countries in our sample and is no longer an economic threat, consistent to findings by Christopoulos and Tsionas (2004). We find inflation to not affect growth as it remains relatively stable across time and countries. There is a shift from state-control economies to market base economies, which has reduced the size of and limit the governments' supervisory role. Therefore, the government was not viewed as an engine of growth in the market system, which led to the reduction in government spending. The results are consistent with those by Tsai and Huang (2007).

CONCLUSION

Existing studies of finance-growth nexus have mainly used one indicator, which is either the development of banking sector or the development of stock market, to represent financial development. Each of these indicators is proxied by one measure although there are several measures available. Theoretically, the developments of banking sector and stock market are vital to economic growth and each measure carries important distinct information. Thus, the absence of one indicator and its measures may lead to the loss of vital information in the analysis. To overcome this issue, our study uses both indicators in estimating the relationship and produces a new measure of each indicators which is derived from several available measures. The estimation results suggest that development in the banking sector and the stock market are crucial in promoting economic growth. Results of this study suggest that it is essential for banking sectors and stock markets in a country to develop well in order for their economies to grow significantly.

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