Financial Development, Innovation, and Economic Growth: The Case of Selected Asian Countries[8]

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Abstract

We empirically examine the effect of financial sector development on economic growth by taking into account innovations for the sample of twelve Asian countries. We estimate panel data model by applying random effects estimator. We use balance panel data over the time period of 1995 to 2016. Our study provides significant evidence that in the presence of innovation, economic growth declines with financial development. However, innovation and financial development both are positively related to economic growth. Other variables namely the rate of inflation and the domestic saving to GDP ratio also appear significant in determining economic growth in the selected countries during the examined period.

Keywords: Economic Growth, Innovation, GDP, Domestic saving, Inflation, Panel data, Random effect model

1.Introduction

The factors driving sustainable economic growth and financial development get attention from financial experts, "economists, and policymakers in current era. Economic growth of any country is contingent on sophisticated financial development while financial development is highly associated with innovation (Schumpeter (1911)). Pardhan et al. (2016) have documented that the relationship between financial depth, innovation, and economic growth is obvious. Levine (1997) reported the significant relationship between financial development and economic growth. Fuety and Marin (1996) manifested that the financial sector contributes to economic growth positively through portfolio service (innovation). Similarly, Christopoulos and Tsinas (2004) explained the obvious unidirectional relationship between financial development and economic growth. Romer (1990) also provided evidence that the innovation (the technological progress, human

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resource, and research and development) significantly causes economic growth.

Several empirical studies have examined the association between financial development and economic growth. However, the findings are inconclusive. Some studies have provided evidence of the significant relationship between financial development and economic growth (Levine (1997), Gregorio and Guidotti (1995) Christopoulos and Tsinas (2004), laeven et al. (2015)). On the other hand, some other studies have established the negative relationship between financial development and economic like, (He and Tian (2013)).

After the arrival of endogenous growth theory, several theoretical and empirical studies work on financial depth and economic growth. Examples of these studies include (Gregorio and Guidotti (1995), Khan (2001), Hermes and Linksink (2013), Madsen et al. (2016), Romer (1990), Fuente and Marín, (1996)). One of the common findings emerging from these studies is that financial depth played a significant role in determining economic growth. Innovation plays a vital role in economic growth. The innovation enhance productivity through efficient allocation of resources thus economic growth. This findings supported by different studies like, (Schumpeter (1911), Pradhan et al. (2016), Robinson (1952)).

The literature also examined the relationship between financial sector development and economic growth for several developing and emerging economies, including Asian countries and show positive relationship between financial sector development and innovation and economic growth like, (Hsu et al. (2014), Cristopouls and Tsionas (2004), Hassan et al. (2011), Ramirez et al. (2017)). The literature is also available on causal relationship between financial development and economic growth for example, (Hsueh et al. (2013)).

Theoretically, innovation has a vital role in enhancing economic growth. A common understanding is that there are two methods to increase output of the country, either by increasing factors of production or using new way of production with the same level of inputs. However, when we review empirical literature we find only hand-full papers that have examined the relationship between innovation and economic growth. For example Verspagen (2005) examined the impact of innovation on economic growth found that there is a significant relationship between innovation and

economic growth. Similarly, Pardhan et al. (2016) studied the role of innovation on economic growth for 18 Eurozone countries and documented the evidence of the positive relationship between innovation and economic growth.

The objective of this study is twofold. First it contributes to the existing literature by providing further evidence on the impact of financial development and innovation on economic growth for selected Asian countries. Second, and more importantly, it examines the role of innovation in establishing the relationship between financial sector development and economic growth. The results of the study reveal that although both financial development and innovation are positively and significantly related to economic growth, the development of financial sector affects economic growth negatively in the presence of innovation. These findings are consistent with the literature like, (Pardhan et al. (2016), Hsu et al. (2014), Hsueh et al. (2013), Schumpeter (1911), Fuente and Marín, (1996))".

The remaining part of the article structure is structured as follows. The following section presented the empirical model, data description, variable definition, and estimation methods. The next section presents and discusses the empirical results. The final section concludes the paper.

2.Empirical Model, Data, and Methodology

To bring the objectives in empirical work we follow the existing literature of, (Pardhan et al. (2016), Christopoulos and Tsinas (2004), Robinson (1952)), and we start our empirical analysis by estimating the following regression model based on Pardhan et al. (2016) model.

$$G_{i,t} = \theta_0 + \theta_1 npan_{i,t} + \theta_2 dcp_{i,t} + \delta X_{i,t} + \varepsilon_{i,t} \quad (1)$$

where G represents economic growth, $npan$ stands for innovation and is defined as of the numbers of patents by nonresidents per thousand population, dcp is financial development. X is a vector of explanatory variables that are inflation and domestic saving (% of GDP), where, δ is vector of coefficient, ε is the error term and subscript *i* represents country and *t* is time.

To check the impact of innovation on economic growth we estimate the following model.

$$G_{i,t} = \delta_0 + \delta_1 rpar_{i,t} + \delta_2 dcp_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t} \quad (2)$$

where, G represents economic growth, rpan is defined as the the numbers of patents by residents per thousand populations, $ndcp$ is financial development. X is a vector of explanatory variables that are inflation and domestic saving (% of GDP), where, γ is vector of coefficient, ε is the error term and subscript *i* represents country and *t* is time.

To explain the effect of total innovations on economic growth we estimate the following specification.

$$G_{i,t} = \vartheta_0 + \vartheta_1 tino_{i,t} + \vartheta dcp_{i,t} + \delta X_{i,t} + \varepsilon_{i,t} \quad (3)$$

At this time we consider $tino$ total number of innovations that include number of patents by resident as well as non-resident population of the countries.

To examine whether innovation has a role to play in establishing the linkages between financial development and economic growth, estimate the model where we included the variable of interaction between financial development and innovation. The estimation of this model enables us to examine the indirect or conditional impact of financial development on economic growth through the level of innovations in the economy.

$$G_{i,t} = \varphi_0 + \varphi_1 pan_{i,t} + \varphi_2 dcp_{i,t} + \varphi_3 pan_{i,t} \times dcp_{i,t} + \delta X_{i,t} + \varepsilon_{i,t} \quad (4)$$

The data of innovation are taken from World Development Indicators (WDI) database. The economic growth variable is defined as the real per capita economic growth. The empirical analysis is based on a panel dataset for 12 selected Asian countries.[11] These countries are Bangladesh, China, India, Japan, Malaysia, Pakistan, Saudi Arabia, Srilanka, Indonesia, Kazakhstan, Jordan, and Korea.

Following the existing literature we use domestic credit to private sector (DCP) as a proxy of financial development (Pradhan et al. (2016)). We use the rate of inflation and the ratio of domestic saving to GDP as the control variables in the study.

3. Empirical Results and Discussion

To "check the level of unit root, we applied panel unit root test using Levin, Lin & Chut t* criteria. Similarly, to check whether

[11] The selections of countries are on the basis of availability of data.

fixed or random effects estimator is appropriate we apply the Hausman test. The results of the Hausman test suggest the use of random effects model. Table 1 shows the summary statistic. Summary statistic gives us inside information of data set. Most importantly, summary statistics contain mean value, standard deviation, skewness and kurtosis of mentioned variables".

Table 1: Summary Statistic

Variable	Mean	SD	Skewness	Kurtosis
Gdp	3.486	0.616	0.308	1.808
Pan	3.465	0.951	0.058	1.627
Dcp	6.424	5.874	0.738	2.559
Par	3.119	1.367	0.4995	1.834
Svc	3.465	0.951	0.058	1.627
In	5.749	1.003	10.603	13.535

One can see from the table that average value of growth rate is 3.486 for the period of 1995 to 2016. The standard deviation, which shows the volatility of the data series, is 0.616. In addition to these, we also look to two other features of data set (skewness and Kurtosis), the calculation of skewness is important because the values in frequency distribution are concentrated at either at a small or large value of quantifying scale of the horizontal axis. Surprisingly, our all variables are showing positive skewness. Finally, the kurtosis shows the Preakness of data set.

The result of equation (1) is presented in Table 2. "It indicates that there is positive and statistically significant relationship between innovation and economic growth for Asian countries. This means innovation enhance economic growth which is supported by literature Hsu et al. (2014). The result also postulates that there is positive and significant relationship between financial development and economic growth Mihaylova (2015). The positive coefficient of inflation implies that high inflation results in higher economic growth. However, the only variable saving to GDP appears as an insignificant variable.

To compare these results we estimate another model, which is presented in Table 3. Here we use another proxy of innovation that is number of patent by resident of a country but the results do not change. Which conjure the relationship between innovation and growth is obvious. Interestingly, here the variable saving to GDP also appear statistically

significant, that is high saving enhance high economic growth. Like the first model inflation is positively and significantly related to GDP growth.

We estimate four different models for this analysis. The first three models explain the partial effect of macroeconomic indicators on economic growth. Table 3 shows the positive and significant relationship between innovation and economic growth. Similarly, financial development and saving rate are also positively related to economic growth. Finally, there is insignificant relationship between inflation and economic growth. Table 4 also follows the literature where innovation, financial development and saving rate have positive and significant effect on economic growth. Table 5 is showing the total innovation effect on economic growth beside the effect of other variables like, financial development, saving rate and inflation. We estimate equation (3), which contains total effect of innovation on economic growth. The estimated result shows that innovation has positive and significant impact on economic growth, which is proven from the literature like, Hsu et al. (2014). All the other variables are according to theory.

Finally, we introduce interaction term between innovation and financial development and we find the negative relationship between financial development and economic growth in the presence of innovation. So there is trade of between financial development and innovation. Innovation has positive impact on economic growth however, the negative sign of interaction term shows that this effect diminishes when the spread of financial development improves". The other variables like, innovation, financial development, and saving rate are significantly related to economic growth and their signs also follow the literature.

Table 3: Estimation results from the random effect regression models of Model 1.

Variable	Co-efficient	T-Statistic
C	1.660***	-2.434
Pan	0.379***	-5.449
Dcp	0.002***	-4.535
Svc	0.127***	-3.259
Ln	0.002	-1.308
Observations	242	
F-Statistic	32.39***	
R-Sqr	0.51	

Table 4: Estimation results from the random effect regression models of Model 2.

Variable	Coefficient	T-Statistics
C	1.972***	-5.57
Par	0.410***	-12.074
Dcp	0.002***	-11.76
Svr	0.120***	-3.259
Ln	0.004	-1.308
Observation	242	
F-Statistics	51.93***	
R-Sqr	0.47	

Table 5: Estimation results from the random effect regression models of Model 3.

Variable	Coefficient	T-statistic
C	1.167**	-2.434
Tino	0.511***	-8.6
Dcp	0.001***	-3.633
Svc	0.106**	-3.259
Ln	0.002**	-4.308
Observtions	242	
F-Statistics	38.429***	
R-Sqr	0.537	

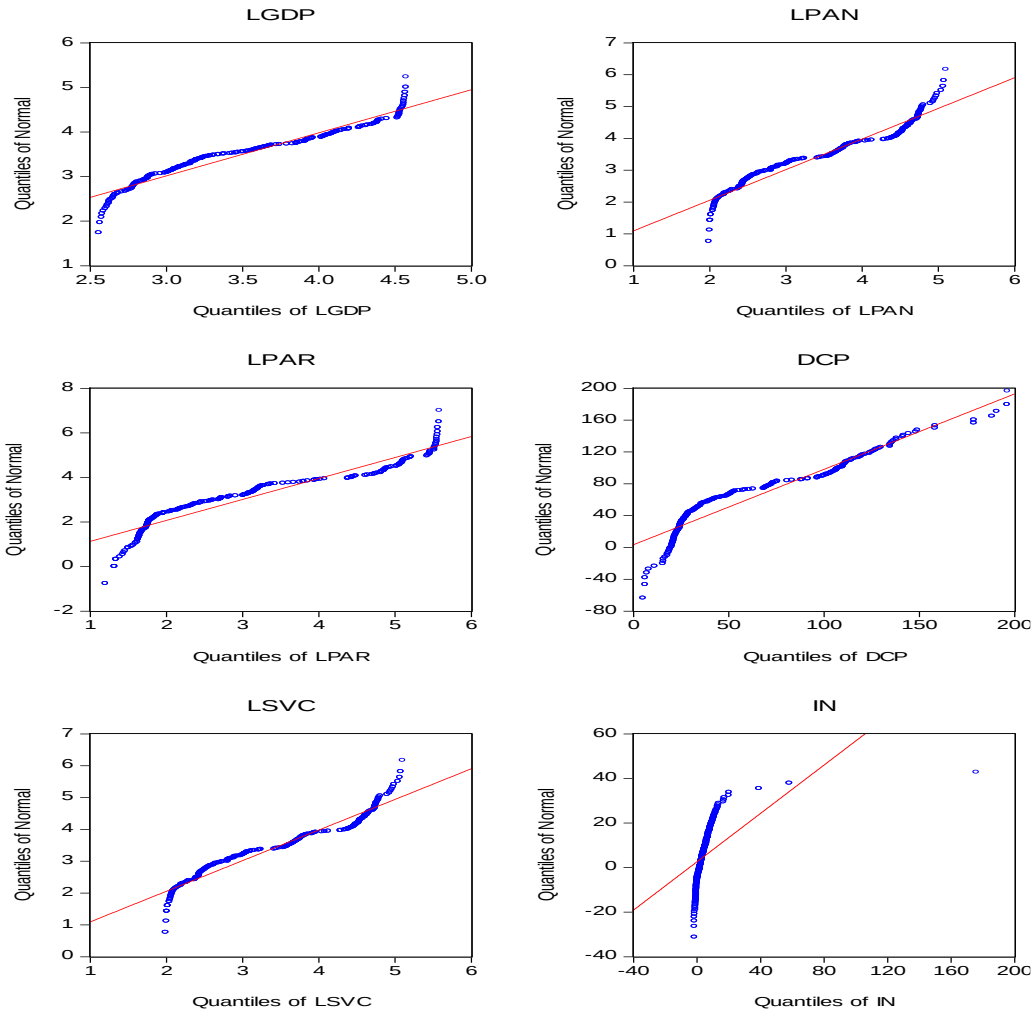
Table 6: Estimation results from the random effect regression models of Model 4.

Variable	Coefficient	T-Statistic
C	1.154*	-1.872
Pan	0.506***	-5.432
Dcp	0.011***	-6.842
Pan*Dcp	-0.002***	(-4.916)
Svc	0.132***	-11.76
Ln	0.002**	-4.308
Observation	242	

F-Statistic	51.953***
R-Sqr	0.396

Note: Dependent variable is growth rate. * shows p<0.1, ** p<0.05, *** and p<.01

Form all the above tables the relationship between innovation and economic growth is positive and statistically significant which is also proven from the literature like, Verspagen (2005), Pradhan et al. (2016). "Similarly, the relationship between economic growth and financial development is also positive and significant. This finding overlap with the literature for example, Schumpeter (1911), Hsu et al. (2014), Fuente and Marín, (1996). Our study also captured the relationship between saving rate and inflation rate which are also statistically significant and their signs are also proven from the literature like, Schumpeter (1911), Hsu et al. (2014), Pardhan et al. (2016), Hsueh et al. (2013), Fuente and Marín, (1996)). Most importantly, the relationship between financial development and economic growth in the presence of innovation reveals negative relationship for the mentioned economies shown in Table 1.3. These finding match with the literature of Hsu et al. (2014). In addition to these estimate we also use quartile diagram. The purpose of using quartile diagrams are to show how many of the elements are belong to set". Figure 1 shows the quartile diagrams of data set.



4. Conclusion

The purpose of the study is to examine the relationship financial development and economic growth in the presence of innovation. We find that the financial development has significant rule to define economic growth in the presence of innovation. Moreover, innovation and financial development matter in determination of economic growth for the above countries. The other variables, savings and the inflation have significant impact on economic growth.

Our estimated results suggest that to enhance economic growth in Asian countries, policy makers should give primary importance to financial sector and also focus patent sector and

allocate adequate resources for patent to stipulate key economic sector in these mentioned countries. Financial sector reforms are needed to insure efficient allocation of financial resources accelerate productivity. Similarly, innovation and saving can also use to propel economic growth in the region. Moreover, the central bank should maintained inflation at reasonable level to sustain economic growth.

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Appendix:

Panel Unit Root for Macroeconomic variables

Table 2: Result of Unit Root Tests

Variables	**Levin, Lin & Chut t***	
	With trend	**Without trend**
	Panel A: Result of Levels	
Gdp	-27.850***	1.064
Pan	-2.405*	-1.721**
Par	-2.615**	-2.942***
Dcp	1.696	-2.094*
Svc	-2.401***	-1.721**
In	-36.067***	44.871***
Panel B: Result of 1st difference		
ΔGdp	-16.751***	
ΔDcp	-3.304***	

Note: one * is for those variables which are stationary at less than 10%. ** is for those variables which are stationary at less than 5%. *** shows the stationary of those variables which are at less than 1%.