# The Nexus Between Financial Development and Economic Growth in Lao PDR

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**Abstract**

The relationship between financial development and economic growth is not conclusive in existing economics literature. The aim of this paper is to test two hypotheses: 'supply-leading' hypothesis and 'demand-following' hypothesis, using Laos time series data. The ARDL bounds testing approach to cointegration is used to carry out this task. Our results confirm the presence of feedback effect between both variables. Financial development promotes economic growth and in resulting, economic growth leads financial development.

**Keywords:** Finance-growth nexus, ARDL approach, Granger causality, Laos

**JEL** Classifications: O11, O16, O53

## 1. Introduction

Financial sector development is considered a source of economic growth. Therefore the contribution of financial development to economic growth has been examined extensively in the relevant literature. Despite the significant amount of work in this area, the relationship between financial development and economic growth is not conclusive. Most of research has found a positive relationship between financial development and economic growth (Levine et al. 2000; Christopoulos and Tsionas 2004; Shahbaz, 2009), but some studies have found a negative relationship between financial development and economic growth (Friedman and Schwartz 1963; Lucas 1988). In addition, some studies have reported the bidirectional causal relationship between financial development and economic growth (Roussea and Vuthipadadorn 2005).

The direction of causality between financial development and economic growth is complex and differs between countries according to the individual characteristics of financial development and varied economic growth patterns. Laos became market-oriented in 1986 and has since undergone financial reforms. However, Lao's financial system is still weak, highly regulated, and dominated by the State-owned commercial bank (SOCB) in terms of assets, savings and loans (Kyophilavong, 2010). The financial sector in Laos faces various challenges, such as a lack of financial depth, poorly-performing loans, an undiversified financial system, and weak institutions (Kyophilavong, 2010). However, according to the ASEAN cooperation scheme, Laos plans to deregulate and liberalize her financial sector. Due to a dearth of empirical studies in Laos, the relationship between financial development and economic growth is not well understood.

Therefore, the purpose of this paper is to investigate this relationship between both variables using Laos' time series data. This paper contributes in existing literature by three ways. Firstly, this paper is pioneering efforts to investigate the relationship between financial development and economic growth in the case of Laos economy. Secondly, better understanding the relationship between financial development and economic growth is crucial to the development of policy for Lao government. Thirdly, this research can provide important information for the Lao government and the Bank of Laos in their twin tasks of formulating and implementing monetary

policy and financial reforms–both of which are vital if Laos is to maintain and increase economic growth.

This paper is organized as follows. Section 2 contains the literature review and Section 3 briefly discusses economic growth and financial development in Laos. Section 4 presents data and methodology, followed by empirical results in Section 5 and conclusions in Section 6.

## 2. Review of Literature

From a theoretical standpoint, different approaches have been applied in investigating the finance–growth nexus. For example, Schumpeter (1911) argued that a well-performing banking system can contribute to economic growth through the technological innovations that may occur as a result of the efficient allocation of funds. In contrast, Robinson (1952) exposed that financial development is a result of improvements in economic performance. Accordingly, the first perspective is called the 'demand following' hypothesis, while the second is called the 'supply leading' hypothesis (Patrick, 1966). The fundamental question in relevant empirical literature is: What role does financial development play in economic growth of a nation? To answer this, it is necessary to investigate the causal relationship between the two variables (Levine, 2005; Ang, 2008; Demirgüç-Kunt and Levine, 2008; Shahbaz et al. 2010). Although the direction of causality has received much attention from researchers, the nature of this causal relationship remains vague (Calderon and Liu, 2003). As countries' characteristics differ (such as political history, economic history, culture, institutional arrangements, level of financial development, role of financial institutions etc.), so too can be causal relationship between financial development and economic growth in these countries. Results from earlier studies of financial development and economic growth fall into four broad categories: 1) the unidirectional causality running from financial development to economic growth; 2) the unidirectional causality running from economic growth to financial development; 3) the bidirectional causality between financial development and economic growth; and 4) no causality between financial development and economic growth i.e. neutral hypothesis.

Empirical studies which support the 'supply-leading' hypothesis—that is, the unidirectional causation that runs from financial growth to economic growth—are found in, for example, McKinnon, 1973; King and Levine, 1993; Neusser and Kugler, 1998; Levine et al. 2000; Majid

and Mahrizal, 2007; Odhiambo, 2007; Quartey and Prah, 2008; Baliamoune-Lutz, 2008; Gries et al. 2009; Ang, 2009; Jalil and Feridun, 2010; Gries et al. 2011; Shahbaz, 2013, Uddin et al. 2013.

On the other hand, the 'demand-following' hypothesis—that is, the unidirectional causation running from economic growth in financial development—has been supported by Gurley and Shaw, 1967; Goldsmith, 1969; Atindehou et al. 2005; Ghirmay, 2004; Levine, 2005; Odhiambo, 2007;Majid and Mahrizal, 2007; Odhiambo, 2007; Ang, 2008; Demirgüç-Kunt and Levine, 2008 and Quartey and Prah, 2008; Odhiambo, 2008; Handa and Khan, 2008; Gries et al. 2009; Odhiambo, 2009; Odhiambo, 2010; Gries et al. 2011; Rafindadi and Yusof, 2013.

In contrast to the above, several other studies have documented the bidirectional relationship between financial development and economic growth (Greenwood and Smith, 1997; Blackburn and Hung, 1998; Blackburn et al. 2005; Majid, 2007; Majid and Mahrizal, 2007; Ang and Mckibbin, 2007; Handa and Khan, 2008; Singh, 2008; Abu-Bader and Abu-Qarn, 2008; Gries et al. 2009; Wolde-Rufael, 2009; Jenkins and Katircioglu, 2010; and Gries et al. 2011. While studies conducted in developing nations support the widespread existence of both bidirectional and unidirectional causality between the variables, others argue that there is no causality between financial development and growth (Ram 1999; De Gregorio and Guidotti, 1995; Change, 2002; Majid and Mahrizal, 2007; and Gries et al. 2009).

The nexus between economic growth and financial development exists in a number of different ways, lending to support two competing hypotheses, but a consensus regarding the direction of causality between financial development and economic growth has yet to be established (Levine, 2005; Shan and Jianhong, 2006; Shan, 2005; Ang, 2008; Apergis et al. 2007; Luintel et al. 2008; Demirgüç-Kunt and Levine, 2008).

Study on the Indian Banking sector, Sufian and Noor (2012) examine the internal and external factors that influenced the performance of banks operating in the banking sector during the period 2000–08. The empirical findings from this study suggest that credit risk, network embeddedness, operating expenses, liquidity and size have statistically significant impact on the profitability of Indian banks. However, the impact is not uniform across banks of different nations of origin. Shahbaz and Rahman (2012) investigate the impact of the financial

development, import and foreign direct investment on Economic growth in Pakistan using ARDL and VECM approach. The empirical findings of this study suggest that there is a long-run relationship between these variables. Financial development, import and FDI has positive significant impact on economic growth and the causality running from financial development and economic growth and FDI to imports during the period 1990-2008. Working on the BRIC countries, Kaur et al. (2013) analyzes the impact of financial system development on foreign direct investment during the period 1991 to 2010. The main empirical finding of this study is that the FDI inflows to BRIC countries are influenced by banking sector and stock market. However, the FDI is positively influenced by size of banking sector and stock market capitalization.

The literature survey shows that the relationship between economic growth and financial development is not conclusive. In addition, there is no empirical study in case of Laos' economy.

**3. Economic Growth and Financial Development in Laos**

Switching from a centrally-planned economy to a market-oriented economy in 1986 brought strong economic growth in Laos, along with the exchange rate and price stability. This situation changed during the Asian financial crisis of 1997/98, when the macroeconomic situation quickly deteriorated. This crisis saw the steep depreciation of the Laos currency (the kip) coupled with high inflation: the kip deprecated by more than 70% against the US dollar and inflation soared to about 150% early in 1999 (Kyophilavong, 2010). It was not only the external shock that made the Lao economy vulnerable, but also weak macroeconomic management (Okonjo-Iweala et at. 1999). The macroeconomic situation has recovered since 2000, with real GDP growth at about 6-7% from 2000 to 2010, and a stable exchange rate and the rate of inflation (IMF, 2011). However, the macroeconomic situation remains fragile due to the government's weak fiscal position and the undeveloped state of the financial system.

The Lao financial sector is still at an early stage of development. At the end of 2010 the banking sector consisted of four State-owned commercial banks (SOCBs), two private banks, two joint-venture banks and nine branches of foreign banks. The SOCB dominate more than 50% of the market in terms of assets, deposits, and loans (Table-1 and 2). The Laos stock exchange was established in 2010 but to date only two companies are listed on it. Compared to neighboring

countries, Laos' financial sector lacks financial depth. For example, credit from the banking sector and the total assets of banks were less than 10% and 30% of GDP in 2010, respectively (IMF, 2011). However, this situation may change due to the fact that recently the Bank of Laos PDR (BOL) liberalized regulation in order to encourage the private sector to establish banks, with the aim of increasing opportunities for businesses to gain access to finance. In order to achieve a stable rate of inflation, economic growth, and poverty reduction, the BOL conducts monetary policy by setting the annual growth rate of money supply as an intermediate target (Kyophilavong, 2010; Keovongvichith, 2012). However, the effectiveness of this monetary policy is questionable due to the lack of monetary tools and the capability of institutions.

**Table-1: Macroeconomic indicators**

| No. | Indicators | Unit | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|
| 1 | GDP growth rate | % | 8.2 | 8.0 | 7.8 | 7.6 | 7.9 |
| 2 | GDP per capita | US$ | 745.0 | 838.8 | 935.0 | 966.3 | 1,087.5 |
| 3 | Inflation rate (Year end) | % | 4.7 | 5.6 | 3.2 | 3.9 | 8.4 |
| 4 | M2/GDP | % | 15.2 | 15.5 | 19.8 | 22.8 | 24.9 |
| 5 | Budget deficit (excl. ODA)/GDP | % | -7.4 | -6.7 | -6.9 | -6.9 | -8.2 |
| 6 | Current Account Balance/GDP | % | -7.2 | 1.4 | 2.5 | 1.7 | -2.4 |
| 7 | Trade deficit/GDP | % | -5.0 | -3.4 | -5.9 | -7.3 | -5.2 |

Sources: Ministry of Planning and Investment, Lao PDR, 2011

**Table-2: Financial statistics for commercial banks in Laos (end of 2010)**

| Type of Bank | Total Assets (Kip billion) | Market share (%) | Total deposits (Kip billion) | Market share(%) | Total loans (kip billion) | Market share(%) |
|---|---|---|---|---|---|---|
| SOCBs(4) | 16548.56 | 59.3 | 11,654 | 67.4 | 7719.47 | 60.5 |
| Private Banks(9) | 5007.92 | 18 | 3,401 | 19.7 | 2583.62 | 20.2 |
| Joint venture banks(2) | 3362.38 | 12.1 | 1,248 | 7.2 | 946.09 | 7.4 |
| Branches of foreign banks(11) | 2976.95 | 10.7 | 985 | 5.7 | 1519.48 | 11.9 |
| Total | 27895.81 | 100.1 | 17288 | 100 | 12768.66 | 100 |

Source: Quarterly Satistics Review of Bank of Lao PDR (Various issues)

## 4. Methodology and Data

Following Rebelo (1991) and Pagano (1993), the long run relationship between economic growth and financial development, following augmented Cobb-Douglas production function as follows:

$$Y = A\ K^{\alpha 1} L^{\alpha 2} e^{\varepsilon} \quad (1)$$

Where, *Y* is real GDP, *K* is capital, and *L* is labor (population), *A* is technology and and *e* is error term assmed N(iid). Cobb-Douglas technology is restricted to ($\alpha 1 + \alpha 2 = 1$) to get a constant return to scale. We assume that technology to be endogenously determined by the level of financial development. The contribution of financial development to GDP via efficient uses of capital formation; encourages foreign direct investment and technology and managerial transfer (Shahbaz, 2012, 2013). The technology can express as follows:

$$A^{(t)} = \phi\ F(t)^{\beta} \tag{2}$$

Where $\phi$ is time-invariant constant, and F is financial development. We divided both sides by population in equation (1) in order to get each series in per capita term (Shahbaz, 2012).

$$\ln YL_t = \beta_1 + \beta_2 \ln F_t + \beta_3 \ln KL_t + \mu_t \tag{3}$$

Where $\ln YL_t$ is the real GDP per capita which proxy for economic development (King and Levine, 1993; Gries et al. 2009; and Ang, 2009) from World Development indicators (CD-ROM, 2013). $\ln F_t$ is financial development which defined as the ratio of M2 to GDP. This is the standard measurement of financial development which used by several authors (Roubini and Sala-I-Martin 1992; King and Levine, 1993; Murinder and Eng, 1994; Demetriades and Hussein, 1996; and Odhiambo, 2004). This data was taken from International Financial Statistics (CD-ROM, 2103). $\ln KL_t$ is real capital stock per capita proxy for capital stock[1]. $\mu_t$ is residual term assumed to be normally distributed. This empirical study uses annual data over the period of 1984–2012 due to data availability.

Economic growth and financial development series are more likely to have unit roots and are thereby non-stationary. Nelson and Plosser (1982) found that most macroeconomic variables are characterized by unit-root processes. The variables must be integrated of order one, i.e. I(1), before they can be tested for cointegration. Hence, checking unit roots for all three variables is required. The Augmented Dickey-Fuller (ADF) test is widely used in this regard (Dickey and

[1] Estimation of capital stock was based on the studies of Kyophilavong (2003).

Fuller, 1979; 1981). Phillips and Perron (1988) proposed a modification of the Dickey-Fuller (DF) test and have developed a comprehensive theory of unit roots[2].

We employ the autoregressive distributed lag (ARDL) bounds testing approach to cointegration developed by Pesaran et al. (2001) to explore the existence of a long run relationship between economic growth, financial development, and capital stock. This approach has a number of advantages compared to Johansen cointegration techniques (Johansen and Juselius, 1990; Johansen, 1988). Firstly, it requires a smaller sample size comparing to Johansen cointegration technique (Ghatak and Siddiki, 2001) and it can be applied whether the variables are purely I (0) or I (1), or mutually cointegrated. Secondly, it provides unbiased long-run estimates with valid t statistics if some of the model regressors are endogenous (Odhiambo, 2008). Finally, it provides a method of assessing short run and long run effects of one variable on the other simultaneously and it also separates short run and long run effects (Bentzen and Engsted, 2001). Moreover, a dynamic unrestricted error correction model (UECM) can be derived from the ARDL bounds testing through a simple linear transformation. The UECM integrates the short run dynamics with the long run equilibrium without losing any long run information. The UECM is expressed as follows:

$$\Delta \ln YL_t = \alpha_1 + \alpha_{YL} \ln YL_{t-1} + \alpha_F \ln F_{t-1} + \alpha_{KL} \ln KL_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta \ln YL_{t-i} + \sum_{j=0}^{q} \alpha_j \Delta \ln F_{t-j} + \sum_{k=0}^{r} \alpha_k \Delta \ln KL_{t-k} + \mu_t \quad (4)$$

Where $\Delta$ is the first difference operator, and $\mu_t$ is an error term assumed to be independently and identically distributed. Pesaran et al. (2001) suggests *F*-test for joint significance of the coefficients of the lagged level of variables. For example, the null hypothesis of no long run relationship between the variables is ($H_0 : \alpha_{YL} = \alpha_F = \alpha_{KL} = 0$) against the alternative hypothesis of cointegration ($H_1 : \alpha_{YL} \neq \alpha_F \neq \alpha_{KL} \neq 0$). Pesaran et al. (2001) provide lower and upper bound critical values for the *F*-test. The lower bound critical values assume all variables are I(0), while the

[2] Monte Carlo simulations show that the power of the various ADF tests can be very low (Enders, 2010, p. 234). Kim (1998, p. 107) comment that the ADF test is less powerful than the PP test.

upper bound critical values assume all of the variables are I(1)[3]. If the calculated *F*-statistics exceed the upper bound, the null hypothesis of no cointegration among the variables can be rejected. If the calculated *F*-statistics fall below the lower bound, the null hypothesis of no long-run relation cannot be rejected[4]. The next step is the estimation of the long-run coefficients that are involved in determining the ARDL model with optimal lags. The selection criteria for the optimal lags such as the Schwarz Bayesian Criterion (SBC) and the Akaike Information Criterion (AIC) are mostly used to determine the order of the ARDL model.

Once the variables are cointegrated for the long-run relation, the long-run and short-run causality can be investigated. The long-run and short-run direction of causality between financial development, economic growth and capital stock was investigated by the VECM (vector error correction method) Granger causality framework. The vector error correction method (VECM) is as follows:

$$(1-L)\begin{bmatrix}\ln YL_t\\ \ln KL_t\\ \ln F_t\end{bmatrix}=\begin{bmatrix}\phi_1\\ \phi_2\\ \phi_3\end{bmatrix}+\sum_{i=1}^{p}(1-L)\begin{bmatrix}a_{11,i} & a_{12,i} & a_{13,i}\\ b_{21,i} & b_{22,i} & b_{23,i}\\ c_{31,i} & c_{32,i} & c_{33,i}\end{bmatrix}\times\begin{bmatrix}\ln YL_{t-1}\\ \ln KL_{t-1}\\ \ln F_{t-1}\end{bmatrix}+\begin{bmatrix}\xi_1\\ \xi_2\\ \xi_3\end{bmatrix}\times\begin{bmatrix}\ln YL_{t-1}\\ \ln KL_{t-1}\\ \ln F_{t-1}\end{bmatrix}\times[ECT_{t-1}]+\begin{bmatrix}\mu_{1t}\\ \mu_{2t}\\ \mu_{3t}\end{bmatrix} \quad (5)$$

Where the difference operator is $(1-L)$ and the $ECT_{t-1}$ is generated from long-run relation. The significance of the coefficient for the $ECT_{t-1}$ refers to long-run causality. The statistical significance of the F-statistic using Wald-test means the short run causality.

**5. Estimation Results**

Table-3 presents the results of both ADF and PP tests, both of which provide us with a consistent picture. All series have unit roots regardless of whether the tests are I(1). These results confirm that we could apply the ARDL because our series are not I(2)[5].

[3]Pesana et al. (2001) caution that the critical values for the bound test are sensitive to the number of regressors (k) in the model, and Narayan (2005) argues that the critical value of the *F*-test depends on the sample size.

[4] The alternative efficient way of establishing cointegration is by testing the significant negative lagged error-correction term (Kremers et al. 1992; Bahmani-Oskooee, 2001).

[5] F-test would be spurious if variables are stationary at 2nd difference(Ouattara, 2004) because the critical bounds are based on the assumptionthat variables are I(0) or I(1) (Narayan, 2005; Pesaran et al., 2001).

**Table-3: Unit Root test results**

| Variables | ADF test | | | | PP test | | | |
|---|---|---|---|---|---|---|---|---|
| | Level | | Difference | | Level | | Difference | |
| | Intercept | With trend | Intercept | With trend | Intercept | With trend | Intercept | With trend |
| $LnYL_t$ | 2.933 [1.000] | -1.687 [0.730] | -3.778** [0.008] | -5.151** [0.001] | 6.041 [1.000] | -2.430 [0.357] | -3.717* [0.009] | -7.685* [0.000] |
| $LnF_t$ | 0.932 [0.994] | -2.192 [0.475] | -8.061* [0.000] | -7.993* [0.000] | 1.165 [0.997] | -2.368 [0.386] | -7.402* [0.000] | -7.366* [0.000] |
| $LnKL_t$ | -2.563 [0.103] | -0.711 [0.961] | -5.244* [0.000] | -6.070* [0.000] | -1.163 [0.675] | -1.439 [0.826] | -4.977* [0.000] | -6.070* [0.000] |

Note: * and ** is significance level at 1% and 5% respectively.

Before conducting the ARDL bound testing approach, we select the optimal lag length based on Schwartz Bayesian Criterion (SBC) because it performs better than others (Narayan, 2004; Pesaran et al. 2001). The result indicates that two is the optimal lag order[6]. In order to account for the fact that we have a relatively small sample size, we have produced new critical values (CVs) of the F-test, computed by stochastic simulations using 20,000 replications. The results of the ARDL bounds testing approach to cointegration are reported in Table-4. This indicates that the calculated *F*-statistic (6.192) exceeds the upper critical bound (UCB) at the 1 % significance level when real GDP per capita ($\ln YL_t$) is the predicted variable. This suggests that there is cointegration between real GDP per capita, real capital stock and financial development. The coefficients of long run and short run results are reported in Table-5. In the long run equation, our results indicate positive and significant impact of financial development on economic growth at 1 per cent level.

**Table-4: Results of ARDL Cointegration Test**

| Dependent Variable | $LnFL_t$ |
|---|---|
| *F*-statistics | 6.192** |

[6] We set the maximum lag order up to four to ensure sufficient degree of freedom for econometric analysis. In order to save spaces, the results are not presented but are available upon request.

| Critical values | 5 per cent level | 10 per cent level |
|---|---|---|
| Lower bounds | 4.389 | 3.475 |
| Upper bounds | 5.567 | 4.557 |
| $Adj-R^2$ | 0.978 | |
| *F*-statistics | 13.108* | |
| Note: * and ** show the significance at 5% and 10% level respectively. | | |

In short run, empirical evidence shows that financial development has positive and statistically significant impact on economic growth. However, one year lag of financial development has negative and statistically significant impact on economic growth in the current period. These results indicate that the estimate of the lagged error correction term ($ECM_{t-1}$) is statistically significant with negative sign at 1 % level of significance. This shows the speed of adjustment from the short-run towards the long-run. We find that the deviations in the short run towards the long run are corrected by 46% each year. This low speed of adjustment in economic growth might be due to the low competitiveness of financial sector in Laos. Diagnostic tests were also applied to test the adequacy of the model specifications. These diagnostic tests suggest that long-run and short-run estimates are free from serial correlation, misspecification of the short run model, non-normality of the error term, and heteroskedasticity (Table-6).

**Table-5: Long-run and short run results**

| Dependent Variable = $LnYL_t$ | | |
|---|---|---|
| **Long-Run Results** | | |
| Variable | Coefficient | *T*-Statistic |
| Constant | 1.584* | 57.565 |
| $LnF_t$ | 0.233* | 4.073 |
| $LnKL_t$ | 0.241* | 6.799 |
| **Short-Run Results** | | |
| Variable | Coefficient | *T*-Statistic |
| $\Delta LnF_t$ | 0.043*** | 1.989 |
| $\Delta LnF_{t-1}$ | -0.077* | -6.057 |
| $\Delta LnKL_t$ | 0.374** | 2.777 |
| $\Delta LnKL_{t-1}$ | 0.087*** | 1.766 |
| $ECM_{t-1}$ | -0.467* | -5.261 |
| Note: *, ** and *** denote the significant at 1, 5 and 10 per cent level respectively. | | |

**Table-6: Diagnostic Tests**

| | LM-version | | *F*-version | |
|---|---|---|---|---|
| | Statistics | *P*-Value | Statistics | *P*-Value |
| A: Serial Correlation | $F(4, 50)=0.130$ | 0.718 | $\chi 2\ (4)=0.087$ | 0.771 |
| B: Functional Form | $F(1, 53)= 3.379$ | 0.066 | $\chi 2\ (1)=2.575$ | 0.1.26 |
| C: Normality | $\chi 2\ (2)=0.579$ | 0.748 | | |
| D: Heteroscedasticity | 0.0412 | 0.839 | $\chi 2\ (1)=0.0382$ | 0.847 |

Hansen (1992) claimed that potential bias and misspecification of the model should be avoided when testing the stability of long run parameters. Therefore, the stability of the ARDL parameters was tested by applying the CUSUM and CUSUMsq tests developed by Brown et al. (1975). The graphs of both tests are shown in Figures-1 and 2 respectively. These results show that the ARDL parameters are stable because graphs of the CUSUM and CUSUMsq (blue lines) are within the critical bounds (red lines) at the 5 per cent level of significance (see Appendix-1).

The existence of a cointegration relationship between the variables allows us to apply the VECM Granger causality approach. The information about the direction of causality between the variables provides an important picture for policymakers to formulate policy. Therefore, the VECM Granger causality approach which provides information about the causality is crucial. The results of Granger causality test are reported in Table-7. The long run causality is indicated by the significance of the coefficient of one period lagged error-correction term $ECT_{t-1}$ in equation (3) using t-test. The short run causality can be detected by the joint significance of F-test of the lagged explanatory variables in the equation. The empirical results suggest that $ECT_{t-1}$ is having negative sign and statistically significance in all the VECM equations.

The long run causality results indicate that there is the bidirectional causality between financial development and economic growth, financial development and capital stock, and economic growth and capital stock. It supports the 'demand-following' hypothesis, and the 'supply-leading' hypothesis in Lao context. It indicates that financial sector is important to promote

economic growth. The financial reforms which part of economic reform has been implemented in 1980s (Kyophilavong, 2010). This reform promoted sound and efficient financial sector in Laos. It has facilitated the flow of funds, improving an efficient allocation of resources and quality of investment. In addition, economic growth generates more demand for financial services and resources which lead to promote financial development in Laos. This empirical result is consistent with Ang and Mckibbin (2007) for Malaysia, Majid (2007) and Majid and Mahrizal (2007) for Thailand, Gries et al. (2009) for Nigeria, and Senegal, Abu-Bader and Abu-Qarn (2008) for Egypt, Wolde-Rufael (2009) for Kenya, Jenkins and Katircioglu (2010) for Cyprus, and Gries et al. (2011) for Costa Rica, Chile, and Suriname, Shahbaz (2103) for Pakistan.

**Table-7: The VECM Granger Causality Analysis**

| Dependent Variable | Direction of Causality | | | |
|---|---|---|---|---|
| | Short Run | | | Long Run |
| | $\Delta \ln YL_{t-1}$ | $\Delta \ln KL_{t-1}$ | $\Delta \ln F_{t-1}$ | $ECT_{t-1}$ |
| $\Delta \ln YL_t$ | …. | 1.255<br>[0.306] | 0.947<br>[0.404] | -0.198**<br>[0.050] |
| $\Delta \ln KL_t$ | 2.179<br>[0.139] | …. | 5.893*<br>[0.009] | -0.120***<br>[0.071] |
| $\Delta \ln F_t$ | 0.899<br>[0.422] | 1.834<br>[0.185] | …. | -0.262***<br>[0.091] |
| Note: *, ** and *** show significance at 1, 5 and 10 per cent levels respectively. | | | | |

In order to capture the how the series responds when there is a shock in one of the variables beyond the selected time period, we employed the generalized impulse response analysis using vector autoregressive (VAR) developed by Pesaran and Shin (1998). Several scholars have argued that with the VAR framework, generalized impulse response analysis produces better results compared to other traditional approaches (Engle and Granger, 1987; Ibrahim, 2005). The main advantage of this approach compared to orthogonalized impulse response analysis is that it is not sensitive to ordering of the variables because ordering of the variables is uniquely

determined by VAR systems. Secondly generalized impulse response analysis estimates the simultaneous shock effects.

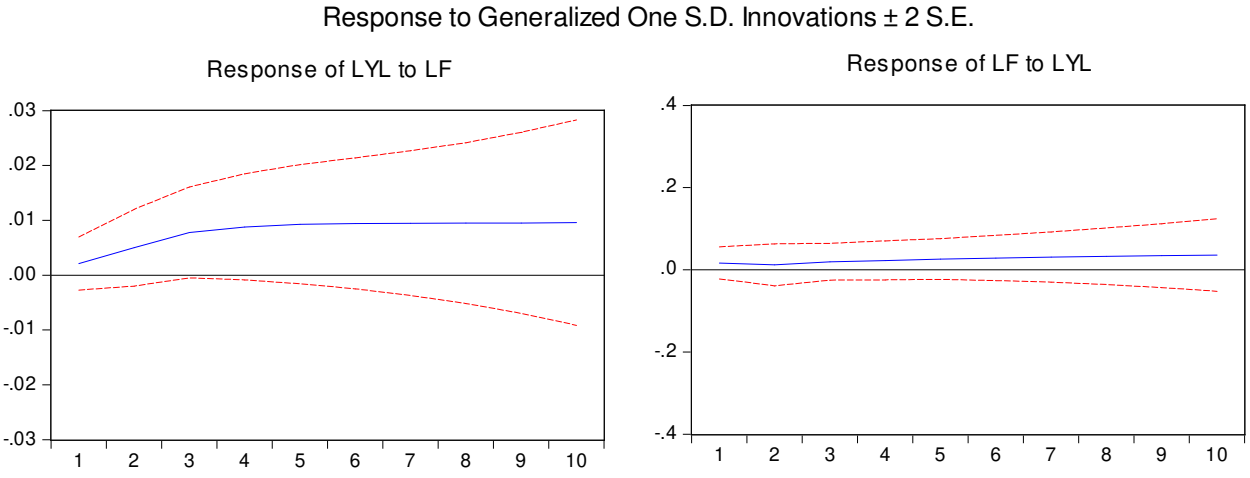
Table-8 shows the variance decomposition, which explains how much of a variable's predicted error variance is described by the innovations generated from each independent variable in a system. These results indicate that economic growth is explained by financial development of 52%, and capital stock of 19% at period-10. In addition, financial development is explained by economic growth of 7 %, and capital stock of 2% at period-10. The variance decomposition approach also confirms the feedback effect between economic growth and financial development.

Figure-1 shows the impulse response function, which indicates how long and to what extent the dependent variable reacts to shocks in the forcing variables. This shows positive response of economic growth due to one standard deviation shock in finance. In addition, there is also the positive response of financial development due to one standard deviation shock in economic growth. It confirms the positive shocks between two variables.

## Table-8: Variance decomposition approach

| Variance Decomposition of LnF: | | | | |
|---|---|---|---|---|
| Period | S.E. | LnF | LnKL | LnYL |
| 1 | 0.088 | 100.000 | 0.000 | 0.000 |
| 2 | 0.113 | 98.842 | 1.012 | 0.145 |
| 3 | 0.133 | 97.761 | 1.272 | 0.967 |
| 4 | 0.148 | 96.707 | 1.303 | 1.990 |
| 5 | 0.161 | 95.753 | 1.166 | 3.081 |
| 6 | 0.171 | 94.844 | 1.028 | 4.128 |
| 7 | 0.181 | 93.899 | 1.014 | 5.087 |
| 8 | 0.189 | 92.857 | 1.201 | 5.942 |
| 9 | 0.197 | 91.689 | 1.623 | 6.688 |
| 10 | 0.204 | 90.395 | 2.274 | 7.331 |
| Variance Decomposition of LnKL: | | | | |
| Period | S.E. | LnF | LnKL | LnYL |
| 1 | 0.074 | 7.655 | 92.345 | 0.000 |
| 2 | 0.129 | 21.162 | 78.417 | 0.421 |
| 3 | 0.173 | 24.819 | 74.528 | 0.653 |
| 4 | 0.205 | 26.664 | 72.441 | 0.895 |
| 5 | 0.228 | 27.615 | 71.270 | 1.116 |
| 6 | 0.243 | 28.176 | 70.510 | 1.313 |
| 7 | 0.253 | 28.540 | 69.977 | 1.484 |
| 8 | 0.260 | 28.798 | 69.575 | 1.627 |
| 9 | 0.263 | 28.996 | 69.261 | 1.743 |
| 10 | 0.266 | 29.154 | 69.010 | 1.836 |
| Variance Decomposition of LnYL: | | | | |
| Period | S.E. | LnF | LnKL | LnYL |
| 1 | 0.011 | 3.583 | 20.838 | 75.580 |
| 2 | 0.015 | 13.557 | 16.443 | 70.000 |
| 3 | 0.018 | 27.185 | 13.915 | 58.900 |
| 4 | 0.021 | 36.713 | 13.008 | 50.278 |
| 5 | 0.024 | 42.960 | 13.189 | 43.851 |
| 6 | 0.027 | 46.900 | 14.031 | 39.070 |
| 7 | 0.030 | 49.358 | 15.238 | 35.404 |
| 8 | 0.032 | 50.879 | 16.608 | 32.513 |
| 9 | 0.034 | 51.812 | 18.010 | 30.178 |
| 10 | 0.037 | 52.379 | 19.364 | 28.257 |

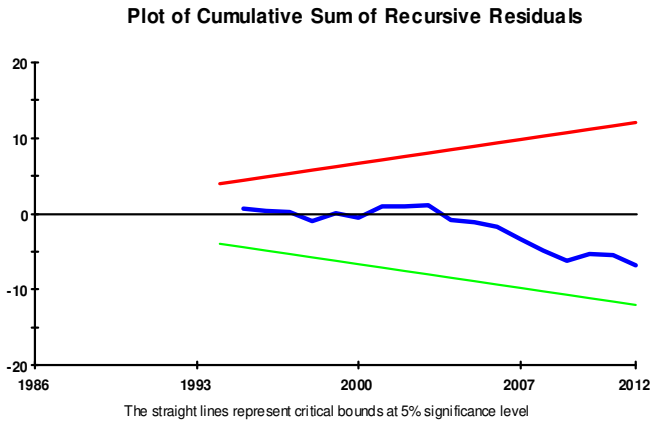
## Figure-1. Impulse response function

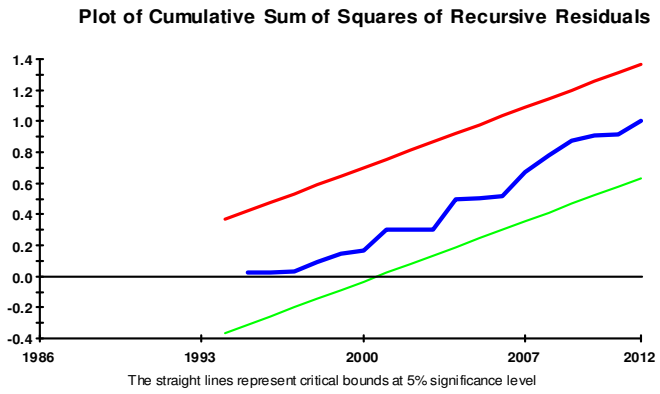


## 6. Conclusion and Policy Implications

The main objective of this paper is to investigate the relationship between financial development and economic growth in Laos by applying the ARDL bounds testing approach to cointegration. Our results confirm the existence of long run relationship between financial development and economic growth. This study found that two hypotheses- the 'supply-leading' hypothesis and the 'demand-following' hypothesis are held in case of Laos. It indicates that promotion of financial sectors could contribute to economic growth and at the same time, economic growth also stimulates financial development. During the past decade the Lao banking sector has been dominated by state-owned commercial banks (SOCB) and there has been a lack of competition among banks. In addition, SOCBs have been much more interested in providing credit to sated-owned enterprises (SOEs). Therefore, in order to promote economic growth, it is important to improve banking function and competition by liberalizing the banking sector and promotion of private banks in Laos. At the same time, it is important to maintain high economic growth to stimulate demand for financial services which also promote financial development in case of Laos.

## Appendix -1. Plot of the CUSUM and CUSUMsq



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### References

Abu-Bader, S., Abu-Qarn, A. S., 2008. Financial development and economic growth: The Egyptian experience, Journal of Policy Modelling 30, 887-898.

Ang, J . B., 2008. Survey of recent developments in the literature of finance and growth. Journal of Economic Surveys 22, 536–576.

Ang, J. B., 2009. Financial development and the FDI-growth nexus: the Malaysian experience. Applied Economics 41(13), 1595-1601.

Ang, J. B., Mckibbin, W. J., 2007. Financial liberalization, financial sector development and growth: Evidence from Malaysia. Journal of Development Economics 84, 215-233.

Apergis, N. Filippidi, I. and Economidou, C., 2007. Financial deepening and economic growth linkages: A panel data analysis. Review of World Economics 143, 179–198.

Atindehou, R.B. Guyeie, J.P., Amenounve. E.K., 2005. Financial intermediation and economic growth: Evidence from Western Africa. Applied Financial Economics 15, 777–790.

Bahmani-Oskooee, M., 2001. How stable in M2 money demand function in Japan? Japan and World Economy 13, 455–461.

Baliamoune-Lutz, M., 2008. Financial development and income in North Africa, International Advances in Economic Research 14, 422-432.

Bentzen, I., Engsted, T., 2001. A revival of the autoregressive distributed lag model in estimating energy demand relationship. Energy 26, 45–55.

Blackburn, K., Hung, V.T.Y., 1998. A theory of growth, financial development and trade. Economica 65, 107–124.

Blackburn, K. Bose, N., Capasso, S., 2005. Financial development and financial choice and growth. Review of Development Economics 9, 135–149.

Brown, R.L. Durbin, J., Evans, M., 1975. Techniques for testing the constancy of regression relations over time. Journal of the Royal Statistical Society 37, 149–163.

Calderon, C., Liu, L., 2003. The direction of causality between financial development and economic growth. Journal of Development Economics 72, 321-34.

Change, T., 2002. Financial development and economic growth in Mainland China: a note on testing demand-following or supply-leading hypothesis. Applied Economics Letters 9(13), 869-873.

Christopoulos, D. K., Tsionas, E. G., 2004. Financial development and economic growth: evidence from panel unit root and cointegration tests. Journal of Development Economics 73(1), 55-74.

De Gregorio, J., Guidotti, P., 1995. Financial development and economic growth. World Development 23, 433–448.

Demetriades, P. O., Husseina, K. A., 1996. Does financial development cause economic growth? Time-series evidence from 16 countries. Journal of Development Economics 51(2), 387–411.

Demirgüç-Kunt, A., Levine, R., 2008. Finance, financial sector policies, and long-run growth. Working Paper, 4469, The World Bank Development Research Group, development of financial markets. Journal of Economic Dynamics and Control 21, 145–182.

Dickey, D., Fuller, W. A., 1979. Distribution of the estimates for autoregressive time series with a unit root. Journal of the American Statistical Association 74, 427-431.

Dickey, D., Fuller, W. A., 1981. Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica 49(4), 1057-1072.

Engle, R.F., Granger, C. W. J., 1987. Co-integration and error correction: Representation, estimation, and testing. Econometrica 55(2), 251-276.

Friedman, M., Schwartz, A. J., 1963. Money and business cycles. Review of Economics and Statistics 45, 32-64.

Ghatak, S., Siddiki, J., 2001. The use of ARDL approach in estimating virtual exchange rate in India. Journal of Applied Statistics 28, 573–583.

Ghirmay, T., 2004. Financial development and economic growth in Sub-Saharan African countries: Evidence from time series analysis. African Development Review 16, 415–432.

Goldsmith, R.W., 1969. *Financial Structure and Development*. Yale University Press, New Haven, CT.

Gries, T., Kraft, M., Meierrieks, D., 2009. Linkages between financial deepening, trade openness, and economic development: Causality evidence from Sub-saharan Africa. World Development 37(12), 1849-1860.

Gries, T., Kraft, M., Meierrieks, D., 2011. Financial deepening, trade openness and economic growth in Latin America and the Caribbean. Applied Economics 43, 4729-4739.

Gurley, J., Shaw, E., 1967. Financial structure and economic development. *Economic* Development and Cultural Change 34, 333-46.

Handa, J., Khan, S. R., 2008. Financial development and economic growth: a symbiotic relationship. Applied Financial Economics 18(13), 1033-1049.

Hansen, B. E., 1992. Convergence to stochastic integrals for dependent heterogeneous processes. Econometric Theory 8(4), 489-500.

Ibrahim, M, H., 2005. Sectoral effects of monetary policy: Evidence from Malaysia. Asian Economic Journal 19, 83-102.

IMF (International Monetary Fund)., 2011. Lao People's Democratic Republic: Recent *Economic Developments*. IMF Country Report and Public Information, IMF, Washington, DC.

Jalil, A., Feridum, M., Ma, Y., 2010. Finance-growth nexus in China revisited: New evidence from principal components and ARDL bounds tests. International Review of Economics and Finance 19, 189-195.

Jenkins, H. P., Katircioglu, S. T., 2010. The bounds test approach for cointegration and causality between financial development, international trade and economic growth: the case of Cyprus. Applied Economics 43(13), 1699-1707.

Johansen, S., 1988. Statistical analysis of cointegration vectors. Journal of Economic Dynamics and Control 12(2-3), 231–254.

Johansen, S., Juselius, K., 1990. Maximum likelihood estimation and inference on cointegration- with applications to the demand for money. Oxford Bulletin of Economics and Statistics 52(2), 169–210.

Keovongvichith, P., 2012. An analysis of the recent financial performance of the Laotian banking sector during 2005-2010. International Journal of Economics and Finance 4(4), 148-162.

Kim, A., 1998. Unit roots, cointegration, and structure change, Cambridge: Cambridge Press.

King, R.G., Levine, R., 1993. Finance and growth: Schumpeter might be right. Quarterly Journal of Economics 108, 717-738.

Kremers, J.J. Ericson, N.R., Dolado, J.J., 1992. The power of cointegration tests. Oxford Bulletin of Economics and Statistics 54, 325–347.

Kyophilavong, P., 2003. The analysis of Lao Economy: Macroeconomic model approach. Ph.D dissertation, Kobe: Kobe University, Japan.

Kyophilavong, P., 2010. Lao People's Democratic Republic: Dealing with multi currencies. In Dealing with Multiple Currencies in Transitional Economies, (Ed.) Capannelli, G. and Menon, J. Asian Development Bank.pp. 99-130.

Lean, H. H., Smyth, R., 2010. On the dynamics of aggregate output, electricity consumption and exports in Malaysia: evidence from multivariate Granger causality tests. Applied Energy 87, 1963-1971.

Levine, R., 2005. Finance and growth: Theory, mechanism and evidence. In Aghion, P. and Durlauf, S.N. (Eds.) Handbook of Economic Growth, 1. Elsevier, North-Holland, 865–934.

Levine, R. Loayza, N., Beck, T., 2000. Financial intermediation and growth: Causality analysis and causes. Journal of Monetary Economics 46, 31-77.

Liang, Q., Teng, J-Z., 2006. Financial development and economic growth: Evidence from China, China Economic Review 17, 395-411.

Lucas, R. E. Jr., 1988. Money demand in the United States: A quantitative review. Carnegie-Rochester Conference Series on Public Policy 29, 137–167.

Luintel, K.B. Khan, M. Arestis, P., Theodoridis, K., 2008. Financial structure and economic growth. Journal of Development Economics 86, 181–200.

Majid, M. S. A., 2007. Does financial development and inflation spur economic growth in Thailand. Chulalongkorn Journal of Economics 19(2), 161-184.

Majid, M. S. A., Mahrizal., 2007. Does financial development cause economic growth in the ASEAN-4 countries?. Savings and Development 31(4), 369-398.

McKinnon, R.I., 1973. Money and Capital in Economic Development. Washington, DC: Brookings Institution.

Murinder, V., Eng, F. S. H., 1994. Financial development and economic growth in Singapore: demand-following or supply-leading?. Applied Financial Economics 4, 391-404.

Narayan, P.K., 2004. New Zealand's trade balance: evidence from the J-curve and Granger causality. Applied Economic Letter 11, 351–354.

Narayan, P.K., 2005. The saving and investment nexus for China: evidence from cointegration tests. Applied Economics 37, 1979–1990.

Nelson, C. R., Plosser, C. R., 1982. Trends and random walks in macroeconomic time series: Some evidence and implications. Journal of Monetary Economics 10(2), 139–162.

Neusser, K., Kugler, M., 1998. Manufacturing growth and financial development: Evidence from OECD countries. Review of Economics and Statistics 80, 638-46.

Odhiambo, N. M., 2004. Is financial development still a spur to economic growth? A causal evidence from South Africa. Savings and Development 28, 47-62.

Odhiambo, N. M., 2007. Supply-leading versus demand-following hypothesis: Empirical evidence from three SSA countries. African Development Review 19(2), 257-280.

Odhiambo, N. M., 2008. Financial depth, savings and economic growth in Kenya: A dynamic causality linkage. Economic Modelling 25, 704-713.

Odhiambo, N. M., 2009. Finance-growth-poverty nexus in South Africa: A dynamic causality linkage. The Journal of Socio-Economics 38, 320-325.

Odhiambo, N. M., 2010. Finance-investment-growth nexus in South Africa: an ARDL-bounds testing procedure. Economic Change and Reconstruction 43, 205-219.

Okonjo-Iweala, N. Kwakwa, V. Beckwith, A., Ahmed. Z., 1999. Impact of Asia's Financial Crisis on Cambodia and the Lao PDR. Finance & Development 36,(3 September). Washington, DC: International Monetary Fund.

Ouattara, B., 2004. Modelling the long run determinants of private investment in Senegal.The School of Economics Discussion Paper Series 0413. Economics, The University of Manchester.

Pagano, M., 1993. Financial markets and growth: An overview. European Economic Review 37, 613-622

Patrick, H.T., 1966. Financial development and economic growth in underdeveloped economies. Economic Development and Cultural Change 14, 174-89.

Pesaran, M. H., Shin, Y., 1998. Generalized impulse response analysis in linear multivariate models. Economics Letters 58, 17-29.

Pesaran, M.H., Pesaran, B., 1997. Working with Microfit 4.0: Interactive econometric analysis. Oxford: Oxford University Press.

Pesaran,M.H. Shin, Y., Smith, R.J., 2001. Bounds testing approaches to the analysis of level relationships. Journal of Applied Economics 16, 289–326.

Phillips, P. C. B., Perron, P., 1988. Testing for a unit root in time series regression Biometrika 75 (2), 335-346.

Quartey, P., Prah, F., 2008. Financial development and economic growth in Ghana: Is there a causal link. *African Finance Journal*, 10, 28–54.

Rafindadi, A. A., Yusof, Z., 2013. Is Financial Development a Factor to the Leading Growth Profile of the South African Economy? Measuring and Uncovering the Hidden Secret. International Journal of Economics and Empirical Research 1(9), 99-112.

Ram, R., 1999. Financial development and economic growth: Additional evidence. Journal of Development Studies 35, 164–174.

Rebelo. S., 1991. Long run policy analysis and long run growth. Journal of Political Economy 99, 500-521.

Robinson, J., 1952. The rate of interest and other essays. London: Macmillan

Rousseau, P. L. and Vuthipadadorn, D. (2005) Finance, investment, and growth: Time series evidence from Asian economies. *Journal of Macroeconomics* 27(1), 87–106.

Roubini, N., Sala-i-Martin, X., 1992. Financial repression and economic growth, Journal of Development Economics 39, 5-30.

Schumpeter, J.A., 1911. The theory of economic development. Cambridge: Harvard University Press.

Shahbaz, M., 2012. Does Trade Openness Affect Long Run Growth? Cointegration, Causality and Forecast Error Variance Decomposition Tests for Pakistan. Economic Modelling 29(6), 2325-2339.

Shahbaz, M., 2013. Financial Development, Economics Growth, Income Inequality Nexus: A Case Study of Pakistan. International Journal of Economics and Empirical Research 1(3), 24-47.

Shahbaz, M., Lean, H. H., 2012. Does financial development increase energy consumption? The role of industrialization and urbanization in Tunisia. Energy Policy 40, 473-479.

Shan, J., 2005. Does financial development 'lead' economic growth, a vector autoregression

appraisal. Applied Economics 37, 1353–1367.

Shan, J., Jianhong, Q., 2006. Does financial development 'lead' economic growth: The case of China. Annals of Economics and Finance 1, 231–250.

Singh, T., 2008. Financial development and economic growth nexus: a time-series evidence from India. Applied Economics 40, 1615-1627.

Sufian, F and Noor, M. A. (2012). Determinants of Bank Performance in a Developing Economy: Does Bank Origins Matters?. Global Business Review 13(1), 1-23.

Uddin, G. S., Sjo, B., Shahbaz, M., 2013. The causal nexus between financial development and economic growth in Kenya. Economic Modelling 35, 701-707.

Wolde-Rufael, Y., 2009. Re-examining the financial development and economic growth nexus in Kenya. Economic Modelling 26, 1140-1146.

Kaur, M., Yadav, S. S. and Gautam, V., 2013. Financial System Development and Foreign Direct Investment: A Panel Data Study for BRIC Countries. Global Business Review 14(4), 729-742.

Shahbaz, M. and Rahman, M. M., 2012. The dynamic of financial development, imports, foreign direct investment and economic growth: cointegration and causality analysis in Pakistan. Global Business Review 13(2), 201-219.

Shahbaz, M., Shamim, S. M. A. and Aamir, N. (2010). Macroeconomic Environment and Financial Sector's Performance: Econometric Evidence from Three Traditional Approaches. The IUP Journal of Financial Economics. (1 & 2), 103-123.

Shahbaz, M. (2009). A Reassessment of Finance-Growth Nexus for Pakistan: Under the Investigation of FMOLS and DOLS Techniques. The IUP Journal of Applied Economics, 65-80.