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The Impact of Foreign Direct Investment and Trade Openness on Economic Development in Lao PDR.

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Abstract
The main purpose of this paper is to measure the impact of foreign direct investment and trade openness on economic development in Lao PDR based on the bounds testing approach of Autoregressive Distributive Lag (ARDL). The results reveal that there is the association relationship between a dependent and explanatory variables. Among these, Foreign Direct Investment, Trade Openness and Capital Formation play a crucial role in promoting Laos' economic development in the long run. However, the evidence of the short run found only in trade openness and capital formation as positive effect on economic development in Lao PDR.
Keywords: FDI, trade openness, development, ARDL, Lao PDR

1. Introduction

Foreign Direct Investment (FDI) and trade openness are considered as a crucial element of economic development in the developing and least developed countries (LCDs) (Alfaro & Chanda, 2006), (Pegkas, 2015) and (Hussain & Haque, 2016). Accessing to the market of developed countries provides the better opportunity of idle human and capital recourses to improve the productivity and increase foreign exchange earnings through the export performances. As suggest by Constant and Yaoxing (Constant & Yaoxing, 2010), Hussain (Hussain & Haque, 2016) and Suvannaphakdy (Suvannaphakdy, 2013) The greater performs on the nation's export can also finance the scare physical and financial recourses. Numerous of previous studies in various countries has supported that FDI inflow to the host country have more positive contribute to the economic performance than negative effects including Darrat and Sarkar (Darrat & Sarkar, 2009), Mah (Mah, 2010), Saibu (Saibu & T., 2014) and Louzi and Abadi (Louzi & Abadi, 2011). Moreover, Borenszteina et al. (Borenszteina, Gregoriob, & Leec, 1998) have pointed out that inward FDI also helps to improve the economic productivity and economic growth of recipient country through to technology spillover and skill up gradation. Inflows of FDI not only transfer in the form of financial resource but also transfer the new modern technology to domestic firms of the host countries, which in turn, plays a key role in supporting the national export performance as it increases the export capacity which causes the developing or least developed country increase foreign exchange earnings (Iamsiraroj, 2016).

Furthermore, trade openness as FDI has emerged as one of the key element in boosting economic development in developing and least developed countries as the major source of international earning. There are the positive notions toward contribution of trade openness on economic development. Notably, Oluwasey (Oluwaseyi, 2013) added the more open on international trade, not only increase the channels of financial resource but also increase the stock of capital formation, and opportunity to access a variety of goods and advanced technologies. This views consistent with studies by Matadeen et al. (Matadeen, Matadeen, & Seetanah, 2011), Freund and Bolky (Freund & Bolaky, 2008) Estrada and Yap (Estrada & Yap, 2006) and Dawson (Dawson, 2006) Liberalization increase specialization and division of labors, which stimulates the local entrepreneurs to be more actively and productivity, thus positively contributed to export capacity as well as economic performance.

More specifically, both together the role FDI and trade openness has been widely recognized as the considerable components of an economic growth process. Many previous empirical studies both in cross-countries and country-specific. In particular, Makki & Somwaru (Makki & Somwaru, 2004), Farshid et al. (Farshid, Ali, & Gholamhosein, 2009), Constant & Yaoxing (Constant & Yaoxing, 2010), Bhattacharya (Bhattacharya, 2010), Adhikary (Adhikary, 2012) and Belloumi (Belloumi, 2014) concluded that inflow foreign direct investment and trade openness promote economic development of the host countries.

However, even though, numerous of the previous studies have been well-documented in the economic literature, the empirical evidence on the measurement of the impact of FDI and trade openness on economic development has not paid much attention for the case of the least developed economy like the Lao PDR. The existence of few works of literature related to the role of FDI and trade openness is still a controversy and questionable in fostering economic development in case of the Lao PDR. The previous empirical studies by

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Chansomphou & Ichihashi (Chansomphou & Ichihashi, 2011) based on the vector error correction model (VECM) suggests that Both of FDI and trade openness is negatively significant effect on Laos' economic development, which consistent with the later investigation by Srithilat (Srithilat, 2013) confirms that trade openness also found to be negatively effected on economic development. In contrast, the empirical evidence base on Ordinary Least Square (OLS) by Anitta (Anitta, 2013) and Suvannaphakdy (Suvannaphakdy, 2013) found that both FDI and trade openness positively effects on economic development in Lao PDR.

To full fill the gap, this study attempts to address the more precise evidence on the impact of foreign direct investment and trade openness on economic development in Lao PDR, by employing the most advanced technique of autoregressive distributed lag (ARDL) developed by Pesaran et la. (Pesaran, Shin, & Smith, 2001).

2 Literature Reviewed Related to the Foreign Direct Investment, Trade Openness and Economic Growth in developing countries

Adhikary (Adhikary, 2012) had studied on the impact of foreign direct investment, trade openness, domestic demand and foreign exchange rate on the export performance of Bangladesh by employing the vector error correction model (VECM) and time series from the period 1980-2009. The stationary checking in both of intercept and intercept plus trend of ADF and PP approaches were utilized to investigate for stationarity of variables. The authors employed Vector Error Correction Model (VECM). The empirical study indicates that FDI is positively related to the export performance in long-run and short-run, but not for the other variables. The recent empirical study by (Hussain & Haque, 2016) using the time series data from 1973-2014, the empirical result also supports the previous literature and shows a positive effect of foreign direct investment, trade openness and economic growth in Bangladesh.

Belloumi (Belloumi, 2014) Analysis on the relationship between foreign direct investment, trade openness and economic growth in Tunisia by applying the bounds testing approach (ARDL) to cointegration for the time series data from 1970-2008. The independent variable used in this study, the author utilised the Cob-Douglass: Total Productive Function (TPF). The result of bounds testing suggests that all variables are associated when FDI is the dependent variable, and there exists the long-run relationship between foreign direct investment, trade openness and economic growth. Nevertheless, The Granger causality indicates no significant causal relationship was running from FDI to economic growth and economic growth to FDI or event from trade openness to economic growth and vice versa.

Constant and Yaoxing (Constant & Yaoxing, 2010) Examines the long-run and short-run relationship between foreign direct investment, trade openness and economic growth in the case of Cote d'Ivoire, for the time series data from 1980-2007. The author employs the bounds testing technique (ARDL) and VAR Granger causality/ Block Exogeneity Wald tests for the short-run analysis. The empirical result shows the long-run relationship between foreign direct investment, trade openness and economic growth. The result of the Granger causality running from foreign direct investment, trade openness to economic growth and from economic growth and foreign direct investment to trade openness. That means both foreign direct investment and trade openness are the significant factors influences economic development in Cote d'Ivoire.

Farshid (Farshid et al., 2009) Utilizing on the Augmented Production Function (APF) growth model to analyze the impact of FDI and trade openness on economic growth in selected countries such as China, Korea, Malaysia, Philippine, and Thailand. The panel data from 1980-2006 for each country were pick up to apply on the panel data analysis approach. The result of this study demonstrates that there exists the cointegration relationship between and its determinant in APF model. However, the positive impact of inflow foreign direct investment and trade openness on economic growth found only in case of Thailand, Korea, and China. In contrast, foreign direct investment and trade openness have a negative relationship on economic growth in case of Philippine and Malaysia.

The empirical conducted by Bhattacharya (Bhattacharya, 2010) to investigate the causal linkage between trade and inflow foreign direct investment on economic growth in the case of India by using quarterly time series data from the period of 1996 Q1-2007 Q4. The author had employed the Johansen cointegration and multivariate Granger causality test based on the Error Correction Model (VECM) to examine the causality between all variables. The Granger causality testing also indicates the bidirectional causality between foreign direct investment, the volume of trade and economic growth in Indian economy. And (Shaheen, Ali, & Kauser, 2013) also conducted the empirical in India, the author has used the time series data from 1990-2010. The empirical result indicates that trade openness and foreign direct investment have a different direction on economic development. The positive sign is found for trade openness, but be negative for foreign direct investment.

The case study of Nigeria by Oluwaseyi (Oluwaseyi, 2013) on trade openness, foreign direct investment and economic growth in Nigeria: a long-run analysis. The time series data span of the period from 1960-2011 and the Johansen cointegration technique had been used to investigate the association between variable. The findings explain that trade openness has a positive impact on economic growth in Nigeria. Meanwhile, the

foreign direct investment shows a negative direction on economic growth. Djeri (Djeri, 2009) Explored the impact of Chinese investment and bilateral trade with Nigeria economic growth. This study uses the augment aggregate production function (APF) model covering the time series and panel data from the period of 1990-2007. The author employed the Ordinary Least Square (OLS) method and Granger causality testing. The result of this study suggests that Chinese investment and bilateral trade are positive relationships with economic growth in Nigeria in the long-run. And the Granger causality testing also explains the positive sign between those variables.

Makki and Somwaru (Makki & Somwaru, 2004) was applied the panel data of 66 developing countries over three decades on the impact of foreign direct investment and trade openness on economic growth. The author estimates a system of three equation, where dependent variables are the growth rate of GDP per capita and domestic investment. Meanwhile, the independent variables are FDI, trade openness, human capital, and inflation rate and government consumption. The result also confirms that foreign direct investment interacts positively with the trade to stimulate domestic investment and economic growth in developing countries.

The empirical study in Lao PDR by Anitta and Suvannaphakdy (Anitta, 2013) and (Suvannaphakdy, 2013) investigated the impact of foreign direct investment on economic growth in Lao PDR. The author utilized the multiple regression in the form of Ordinary Least Square (OLS). The independent variables and other control variable included FDI, FDI in hydropower, Trade openness, real exchange rate, export, interest rate labour and two dummy variables of the financial crisis. The findings reveal that the FDI inflows in the manufacturing sector and FDI inflows in hydropower played an essential role in promoting the economic growth in Lao PDR. (Suvannaphakdy, 2013) Analyzed the link between foreign direct investment and trade in Lao economy. The author had developed two empirical model to capture the relationship between variables. The first model using a panel data to analyze the causality whether trade and inward FDI are complement or substitutes. The second model is used to investigate the determinant of FDI-trade linkage in Laos. The author utilizes the balanced panel data of 72 countries of trade and FDI partners over the period 1989-2009. The finding suggests that the contribution of FDI and trade to economic development is very small between 0.01%-0.3percent annually.

By way of contrast, Chansomphou (Chansomphou & Ichihashi, 2011) Explored the long-run and short-run impact of foreign aid and foreign direct investment on income per capita growth in Lao PDR. The author had followed the Solo growth model and replace by FDI and foreign aid variable. And applied to the Johansen cointegration and Vector Error Correction Model to capture the long-run and short-run association among variables. The empirical result exists the long-run association between foreign aid, foreign direct investment economic growth. However, both the long-run and short-run relationship between foreign direct investments is found to be a negative effect on economic growth.

3. Research Methodology

To accomplish the measurement of the impact of foreign direct investment and trade openness on economic development in Lao PDR, The qualitative and an econometrics model is necessary needs to be utilized to capture the association among variables. This study has used the time series data from 1990-2015, therefore, it is necessary to check for stationarity of data to avoid spurious regression problem (Engle & Granger, 1987) and (Phillips & Perron, 1988). Since the time series data have been used for econometrics analysis, it is found that most of the time series data are not stationary in same integrated order. According to Engle and Granger (Engle & Granger, 1987), suggested that the non-stationary data would make bias result for the estimation.

In light of this, all series need to be applied for unit root testing, to check the stationarity, by employing the most popular unit root tests technique of Augment Dicky-Fuller (ADF) (Dickey & Fuller, 1979). Secondly, formulate the association relationship model between a dependence and independence variables to capture a short-run and long-run relationship. The long run and short-run model based on Auto Regressive Distributed Lag (ARDL) and Vector Error Correction Model (VECM). Thirdly, investigates the causality relationship among those variables to check whether the variable is interconnected each other.

3.1 Data Collection

In this study has used various sources of data, to make the empirical result more accurate and can be implemented in the real economic situation of Laos. The data uses in this study is covered or the period 1990-2015. The variables use to analyze on this study are based on the previous empirical studies included (Adhikary, 2012), (Constant & Yaoxing, 2010), (Zaheer, Khan Kakar, and Bashir, 2011) and (Suvannaphakdy, 2013):

The real annual gross domestic product per capital is used as the proxy of economic development, was collected from the World Development Indicator (WDI 2017). The annual inflow of foreign direct investment in to Lao PDR obtained from Department of foreign direct investment promotion, Ministry of Planning and Investment of Lao PDR and the degree of trade openness measured by the sum of total export and import to GDP for each year or (EX+IM)/GDP, was also obtained from the IMF and World Development Indicator (WDI 2017) data bases. The data on capital accumulation in the economy including investment in fix assets, change in

inventories, saving etc.. was compiled by the IMF and World Development Indicator (WDI 2017).

3.2 Methodology and Specific Model.

3.2.1 Unit root test

This study employs the Augment Dickey-Fuller (ADF) test as a unit root testing (using program E-views 9 for the Windows operating system) to make sure that none of series fall in to the second difference I(2). The ADF test proposed by Dickey and Fuller (Dickey & Fuller, 1979), The ADF unit root testing procedure has begun by considering both order integration in the level I(0) and first difference I(1) combines with intercept and trend respectively. To get conclude that those variables are stationary at the level, the calculated ADF statistic must be bigger than the critical value with the significant level of no less than 90% or reject the null hypothesis of non-stationaryH_0, otherwise, the data are non-stationary at the level. In case, time series data are non-stationary at the level, the same process of unit root testing needs to be applied once again with the difference of order at first difference I(1). The unit root testing equation can be written as below:

$\Delta x_t = \alpha + \gamma x_{t-1} + \sum_{t=i}^{p} \theta_i \Delta x_{t-1} + e_t$ (3) Intercept

$\Delta x_t = \alpha + \beta_t + \gamma x_{t-1} + \sum_{t=i}^{p} \theta_i \Delta x_{t-1} + e_t$ (4) Intercept and trend

Where x_t and x_{t-1} time variable of period t and $t-1$.
$\alpha, \gamma \; and \; \theta$: Coefficient.
β_t: Time trend.
e_t: Error term.

3.2.2 Model Specification

The specific model adopted in this study based on the previous empirical literatures which has specific completed mostly in developing countries include: (Adhikary, 2012), (Hussain & Haque, 2016), (Constant & Yaoxing, 2010), (Oluwaseyi, 2013) and (Zaheer, Khan Kakar and Bashir, 2011). This study extended the previous literature by regarding the Asian financial crisis which occurred in 1997 as the dummy variable of the model. The specific model can be formulated as bellows:.

$GDP = f(FDI, TRD, CP, Dummy)$ (1)

$lnGDP_t = \beta_0 + \beta_1 lnFDI_t + \beta_2 TRD_t + \beta_3 CP_t + \beta_4 Dummy_t + \varepsilon_t$ (2)

Where: GDP: gross domestic product per capital.
FDI: Foreign direct investment inflow.
TRD: Trade openness.
CP: Capital formation or accumulation of total investment.
$Dummy$: Asian financial crisis, 1= year 1997-1999, 0= others.
t: Time period and
ε: Error term.

In this study has used Auto Regressive Distributed Lag (ARDL) model that introduced by Pesaran (Pesaran et al., 2001) to cointegrate the association relationship among variables, regarding variety of its comparative advantage included: Firstly, ARDL model can be applied when all variables are purely integrated at the level I(0), or purely integrated at first difference I(1) , and/or all variables are integrated mixture both I(0) and I(1). Secondly, ARDL is appropriated to apply even for small sample size, and fourth, the error correction model (ECM) can be obtained from approach through the simple Ordinary Least Square (OLS) transformation and finally, the ARDL technique provides unbiased estimates of a long-run model. Thus, equation (2) can be transformed in to ARDL model as follows:

$$\Delta lnGDP_t = \alpha_0 + \sum_{i=1}^{p} a_i \Delta lnGDP_{t-i} + \sum_{i=1}^{p} b_i lnFDI_{t-i} + \sum_{i=1}^{p} c_i TRD + \lambda_1 lnGDP_{t-i} + \lambda_2 lnFDI_{t-i} + \lambda_3 TRD_{t-i} + \lambda_4 CP_{t-i} + DUMMY_t + e_t \quad (3)$$

Where: α_0 : Intercept.
$a_i, b_i, \; and \; c$: Short-run coefficients.
λ_1, λ_2 and λ_3: Long-run coefficients.
e : Error term.
p: lag order.
t: Time period.
Δ : First difference.

The procedure of ARDL approach has divided into three steps. The first step is to estimate the joint F-statistic and bounds critical statistic and the second step is to estimate the long-run and short-run coefficients and the last step is model diagnostic. The joint F-statistic can be estimated by using the Ordinary Least Square (OLS)

for equation (3). According to Pesaran et al. (Pesaran et al., 2001), the bull hypothesis of no cointegration between a dependent and independent variables are considered through the joined F-statistic compare with the bound critical value given in the table. The null hypothesis and alternative hypothesis can be written as bellows:

$H_0: = \lambda_1 = \lambda_2 = \lambda_3 = 0$ No long-run relationship or no cointegration

Versus alternative hypothesis

$H_1: \lambda_1 \neq \lambda_2 \neq \lambda_3 \neq 0$ Long-run relationship or cointegration

The null hypothesis of no cointegration H_0 will be rejected, if the estimated joined F-statistic from equation (3) is greater than the upper critical bounds or I(1), on the contrary, the null hypothesis will be accepted, if the estimated joined F-statistic is smaller than lower critical bounds or accept alternative hypothesis H_1. Otherwise, the cointegration is inconclusive.

- Long-run and Short-run model

The next step is the estimation of the long-run and short-run models to examine the long-run and short-run relationship between variables. The long-run model is normally based on Ordinary Least Square equation (OLS), regardless the lag length criterion as be shown in equation (4). Lag length order is the necessary element to make estimation accuracy to capture the relationship between variables in the short-run in equation (5). The lag section based on Akaike information criteria (AIC) and Schwartz Information Criterion (SIC). To capture the short-run relationship of the impact of foreign direct investment and trade openness on economic development, the Error Correction Model (ECM) based on Bounds testing approach has been developed by considering with appropriate lag order and time trend t for each variable in this form $ARDL(M, N_1, N_2, N_3)$.

Long-run model:

$$lnGDP_t = \alpha_0 + \sum_{i=1}^{p} a_i \Delta lnGDP_{t-i} + \sum_{i=1}^{p} b_i lnFDI_{t-i} + \sum_{i=1}^{p} c_i TRD + \varepsilon_t \quad (4)$$

Where α_0: intercept and

$a_i, b_i \; and \; c_i$ Coefficients

ε: Error term.

Short-run model:

$$\Delta lnGDP_t = \alpha_0 + \sum_{i=1}^{M} \delta_1 \Delta lnGDP_{t-i} + \sum_{i=1}^{N_1} \delta_2 lnFDI_{t-i} + \sum_{i=1}^{N_2} \delta_3 TRD + \sum_{i=1}^{N_3} \delta_4 CP + \omega_1 \Delta lnGDP_{t-i} + \omega_2 \Delta lnFDI_{t-i} + \omega_3 \Delta TRD_{t-i} + \omega_4 DUMMY_t - \omega_0 ECT_{t-1} + \mu_t \quad (7)$$

Whereas:

$$ECT_{t-1} = e_t = lnGDP_t - (\alpha_0 + \omega_2 \Delta lnFDI_{t-i} + \omega_3 \Delta TRD_{t-i} + \omega_4 DUMMY_t) \quad (8)$$

ECT_{t-1} is error correction term or speed adjustment from short-run to long-run equilibrium. Normally, ECT_{t-1} value is between 0.5 indicates the medium speed of adjustment, in case the ECT_{t-1} value is least than 0.5 indicates high speed adjustment and finally, the ECT_{t-1} is bigger than 0.5 indicates slow speed of adjustment to a long-run equilibrium. The significant indicator of speed adjustment term by considering the T-statistic at 99%, 95% and 90% level of significant and expected to be negative.

- Model Diagnostic.

Despite, ARDL model has numerous advantages compared with other econometric methodologies, but it is necessary to be diagnosed before doing the estimation. To ensure that there is no serious problem for the estimated model. Most of the diagnostic procedures are involved Auto-correlation, Normality, and Heteroscedasticity by considered p-value regarding $ARDL(M, N_1, N_2, N_3)$, where, M is the appropriate lag of independent variables, N_i is the most appropriate lag for dependent variables. This kind of model diagnostic can even deal with Heteroscedasticity and Auto-Correlation them self. Moreover, to make the estimated model more robustness and fit very well for implementation, it needs to be checked the stability of coefficients by applying on Cumulative Sum (CUSUM) and Cumulative Sum of Square (CUSUMSQ) with more than 90% level of significant (Lutkepohl, 2007).

4. Result and Discussion

4.1 Unit root testing.

The result of unit root test for all variables is presented in Table 4.1. The test has utilized the maximum of the lag order of 5 which is a maximum standard lag length on software E-views9. And then, the appropriate lag for each variable will be selected automatically according to the lag selection criterions Akaike information criteria (AIC) and Schwartz Information Criterion (SIC). The critical value with asterisks indicates the rejection of the null hypothesis, namely, one asterisk for 1% significant level and two asterisks for the 5% significant level. The unit

root test suggested that none of the variables are I(2). More precisely, Both FDI and TRD are found to be stationary in level I(0) in terms of intercept and trend with the calculated T-statistic value of -4.08742 and -3.633091 and significance level at 1% and 5% respectively, whereas GDP is found to be integrated in first difference I(1) both in intercept and intercept and trend with the T-statistic -4.61581 and -4.4414 respectively of 5% significance level.

The mixture order of unit root test also justifies the use of Autoregressive distributed lag ARDL model instead of the maximum likelihood approach of cointegration proposed by (Johansen & Juselius, 1990) which require all variables to be integrated into first difference I(1).

Table 4.1 Unit root testing results by Dickey-Fuller approach.

Variables	Level		First difference	
	Intercept	Intercept & Trend	Intercept	Intercept & Trend
GDP	5.011882 [0]	-2.187064 [0]	-4.6158148* [0]	-4.441462* [1]
FDI	-1.896976 [1]	-4.08742** [0]	-9.813651** [0]	-9.641812** [0]
TR	-2.752087 [3]	-3.633091* [2]	-4.364602* [2]	-4.72411** [2]
CP	4.736164 [2]	2.471234 [2]	-4.098765* [3]	-5.085209** [1]

*Note: ** and * is statistically significant level at 1% and 5% respectively. The value in [] is an optimum lag order for each variable, here used maximum five lag.*
Source: Author's caculation

4.2 Cointegration , long-run and short-run relationships.

Regarding the given bounds testing is to estimate the joined F-statistic whether the null hypothesis of no-cointegration will be rejected or not. Bounds testing procedure starting with an appropriate lag set equal 2. Table 4.2 reports the calculated joined F-statistic with given lag order which indicates that the joined F-statistic 11.59595 is higher than the upper bound critical value of 3.29 and 4.37 at 1%level of significant. Therefore, the null hypothesis of no-cointegration is rejected, implying that there exists the long-run cointegration relationship among the variables in the model.

Table 4.2 Cointegration testing result.

Independent variable: log(GDP)

Critical Value	At 1%	At 5%	At 10%
Lower bounds I(0)	3.29	2.56	3.09
Upper bounds I(1)	4.37	3.49	3.09
F-statistic:		11.59595***	

*Note: *** is significance level at 1%*
Source: Author's caculation

4.2.1 Long-run relationship.

The long-run relationship between foreign direct investment (FDI) and economic development (GDP) are found to be positive in the long run. Implying that an increase of 1% in foreign direct investment (FDI) cause the economic growth to increase by 0.0039%, with the T-statistic 2.842996 and the level of significance at 5%. This empirical results consistent with previous literatures includes (Suvannaphakdy, 2013), (Anitta & Mekong Institute, n.d.) in Lao PDR (Saibu & T., 2014) in Sub-Sahara/ Africa, (Darrat & Sarkar, 2009) in Turkey, (Adhikary, 2012) in Bangladesh, (Belloumi, 2014) in Tunisia, (Constant & Yaoxing, 2010) in Cote'Ivoire, (Bhattacharya, 2010) in India, (Oluwaseyi, 2013) studied of more than 60 countries and (Makki & Somwaru, 2004) in Nigeria.

The impact of trade openness (TOP) is also positively effects on economic development (GDP) in the long-run. An increase by 1% in the degree of trade openness leads to increase in economic growth by 0.0063%, with the T-statistic of 2.033432 and the level of significance at 5%. This result support the previous works by (Suvannaphakdy, 2013) (Anitta & Mekong Institute, n.d.) in Lao PDR (Saibu & T., 2014) in Sub-Sahara/ Africa, (Belloumi, 2014) in Tunisia, (Constant & Yaoxing, 2010) Cote'Ivoire, (Zaheer, Khan Kakar and Bashir, 2011) and (Makki & Somwaru, 2004) in Nigeria.

Another dependent variable, specifically, capital formation (CP) also exhibits the positive relationship to economic development in the long-run. Moreover, the CP coefficient which indicates the contribution of capital formation on economic growth is found to be greater than other independent variables. An increase 1% in capital formation cause economic growth to increase by 0.377992% with the T-statistic of 11.297643 and 1% level of significance.

However, the dummy variable of Asian financial crisis is not found a significant effects in explain economic development. It denotes that the Asian financial crisis happened and has a significant effect on the economy only in short-run during 1997-1999. Hence, there is no evidence for the existence of long-run impact on economic development in Lao PDR. The T-Statistic of the dummy variable represents 2.033432 and P-value equals 0.0589.

Table 4.3 Long-run relationships.

ARDL(1,0,0,0,1)				
Variable	**Coefficient**	***Std. Error***	**t-Statistic**	**Prob.**
FDI	0.00397*	0.016337	2.842996	0.0154
CP	0.377992**	0.033458	11.297643	0
TRD	0.006301*	0.002722	2.31464	0.0342
DUMMY	0.172754	0.084957	1.933432	0.0589
C	4.24584**	0.116294	36.509514	0

*Note: ** and * is statistically significant level at 1% and 5% respectively.*
Source: Author's caculation

4.2.2 Short-run relationship.

The short-run impact of foreign direct investment and trade openness on economic development based on error correction model (ECM) in the form ARDL(1,0,0,0,1) is reported in Table 4.4. The error correction term (ECT) is found to be significantly and shown negative sign as expectation, which is strongly confirmed the existence of long-run association between dependent and independent variables in the long-run model. However, foreign direct investment (FDI) is not found to be significant in the short run model. Although the sign of its coefficient shown positively direction, but other significan statistic value is not confirmed the existence of short-run relationship with T-statistic of 0.391741 and the probability value 0.7004, which is bigger than significance level of 5%.

The estimated statistic of trade openness is positively and statically significant. When giving other factors constant, an increase 1% in trade openness leads to increased roughly by 0.0005% of economic growth in Lao PDR. This significant contribution is confirmed by T-statistic of 2.529538 and 1% level of significance. This results contrasting the previous studies by (Chansomphou & Ichihashi, 2011) (Srithilat, 2013).

Another dependent variable of capital formation also found to be positively contributed to economic development in the short-run. When giving other factors constant, the capital formation increase by 1% cause economic growth to increase by 0.030%. This positive effect is strongly confirmed by the T-statistic of 5.673141 and 1% level of significance.

The dummy variable, represents the Asian financial crisis is also found to be negatively significantce on economic development in the short-run in Laos. This results consistent with the fact that Lao has suffered economic instability, economic uncertainty during the Asian financial crisis 1997-1999. In the end of 1999, inflation rate has reached the peak at 128% and domestic currency was sharply decreased almost 500% in only two years from 2007-2009 (Srithilat & Sun, 2017).

Table 4.4 Short-run relationship

ARDL(1,0,0,0,1)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(FDI)	0.000609	0.001555	0.391741	0.7004
D(CP)	0.030894**	0.005446	5.673155	0
D(TR)	0.000465*	0.000184	2.529538	0.0223
DUMY	-0.02333*	0.004806	-4.854575	0.0002
ECT(-1)	-0.084311**	0.00251	-33.596305	0

*Note: ** and * is statistically significant level at 1% and 5% respectively.*
Source: Author's caculation

4.4 Diagnostic

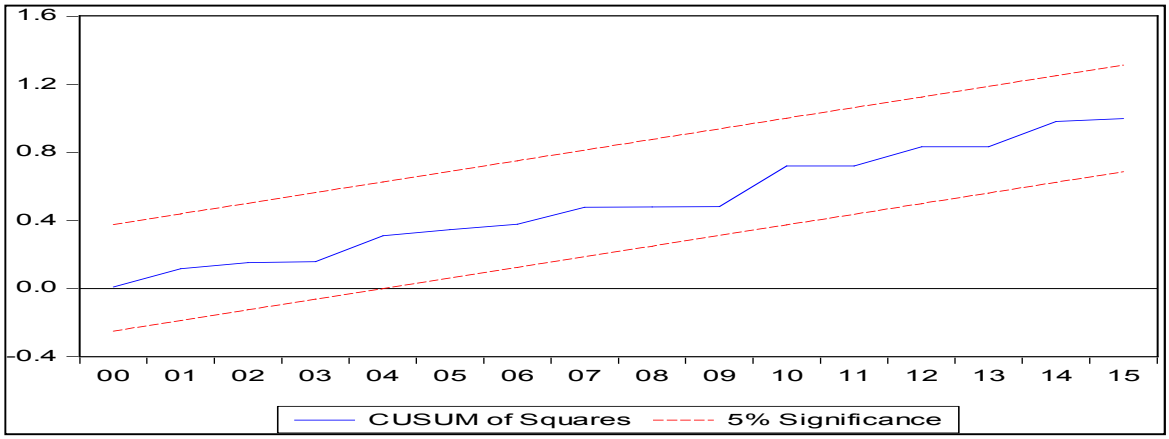
One more important step of the econometric analysis is to diagnose the perfectness and stability of the designed model to make the model more reliable to be implementation. This empirical study employs differenced diagnostics and stability tests to ensure the robustness of the estimations, including serial correlation, residuals distribution, and heteroscedasticity. The stability of the coefficients can be checked through Cumulative Sum (CUSUM) and Cumulative Sum of Square (CUSUMSQ) given by Brown et al.(Brown, Durbin, & Evans, 1975). The diagnostic tests are presented in Table 4.5, which indicates that both in the long-run and short-run estimations are free from serial correlation, non-normality of the error term, and free of heteroscedasticity. Those diagnostic probability values are bigger than 5% level of significance, which means the null hypothesis of serial correlation, normality and heteroscedasticity have been rejected. Consequently, the perfectness of the model has been confirmed.

Moreover, the stability testing technique of Cumulative Sum (CUSUM) Figure 4.1 and Cumulative Sum of Square (CUSUMSQ) Figure 4.2 are moving within the critical bound of 5% during the period, which suggests for the stability of the ARDL parameters both long-run and short-run of the estimated model. According to a variety of diagnostic tests can be concluded that there is no serious problem in the estimated model. Therefore, both of the long-run and short-run models are fit very well to explain the impact of foreign direct investment and trade openness on economic development in Lao PDR.

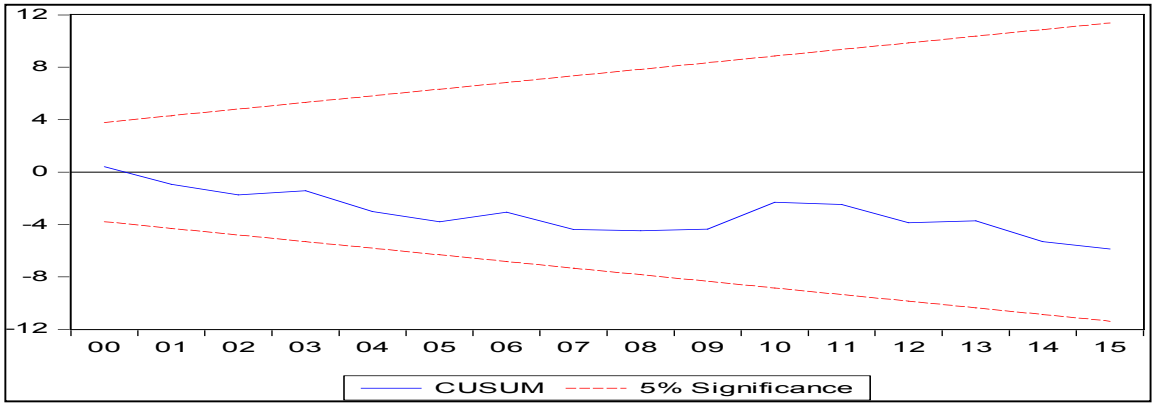
Table 4.5 Diagnostic test.

ARDL(1,0,0,0,2)		
Diagnostic	**Statistic-value**	**Probability**
R-squared	45.74931	-
Durbin-Watson	2.139576	-
Auto-correlation	F(2,14)	0.2101
Normality	N/A	0.3392
Heteroscedasticity	F(7,16)	0.9663

Source: Author's caculation



Source: Author's caculation
Figure 4.1 CUSUM test



Source: Author's caculation
Figure 4.2 CUSUMSQ tests.

4.5 Variance decomposition and impulse response function.

Autoregressive distributed lag ARDL was an appropriate choice to measure the impacts of independent variables on the dependent variable in general, but it does not explain how much those independent variables response to innovation in other variables both in the long-run and short-run. It does not explain the Granger causality of others variable in the model. Instead of Granger causality analysis, which can be utilized if all variables integrated into first difference I(1), the variance decomposition and impulse response function developed by (H. Hashem Pesaran, 1998) has been employed to show how much the percentage of one variable is explained by the innovation of the other variables. (Engle & Granger, 1987) Proposed that variance decomposition does not only explain the causality relationship between variables, but it also explains the Granger causality of another variable out of sample. However, variance decomposition provides a better result in the vector regressive regression or

VAR environment than another method. Therefore, VAR estimation is utilized to investigate the variance decomposition.

Table 4.6 presents the results of variance decomposition of 10 periods in the shock block to check the explanation of one variable to other variables, which indicates that gross domestic product per capita GDP can be explained 6.81% by Foreign direct investment, 1.5% by capital formation and 5.28% by trade openness and 84.7% is explained by innovative shock of its variable. The variance decomposition confirmed the result of the long-run and short-run model that economic development was explained by foreign direct investment, trade openness, capital formation and Asian financial crisis. The contribution of economic development, capital formation, trade openness and Asian financial crisis to foreign direct investment is roughly 16%, 33%, 9% and 12% respectively. The rest of 28.09% is explained by its innovation. The contribution of economic development, foreign direct investment, capital formation and dummy variable of Asian financial crisis on trade openness is 9.12%, 20.06 %, 30.28% and 8.81% respectively. Other 31.71% is explained by its own innovation. The other contribution of economic development, foreign direct investment, trade openness, and Asian financial crisis on domestic investment or capital formation is accounted for 19.970112%, 6.9052%, 5.49287% and 15.785%. The rest of 52.44725% is explained by its innovation and finally, the contribution of economic development, foreign direct investment.

Table 4.6 Variance decomposition

Variance Decomposition of LOG(GDP):

Period	LOG(GDP)	LOG(OFDI)	LOG(CP)	TR	DUMY
1	100	0	0	0	0
2	89.05674	0.826174	2.755531	3.480543	3.881008
3	90.80531	0.461051	1.937108	4.353468	2.443068
4	88.26866	1.385802	1.747921	6.279217	2.318404
5	87.50158	2.428484	1.338768	6.523654	2.207513
6	86.22706	3.4695	1.185124	6.246758	2.871558
7	86.0446	4.14085	1.010583	5.710188	3.093775
8	85.52812	4.987008	0.894436	5.444237	3.146194
9	84.79471	5.914807	1.120108	5.281709	2.888667
10	83.64951	6.815923	1.587759	5.332605	2.614205

Variance Decomposition of LOG(OFDI):

Period	LOG(GDP)	LOG(OFDI)	LOG(CP)	TR	DUMY
1	0.24711	99.75289	0	0	0
2	14.45369	64.04345	17.64561	2.898522	0.958729
3	20.10829	51.84606	19.5497	6.728902	1.767042
4	19.72343	45.58033	21.83806	9.12832	3.729858
5	19.72774	38.65208	26.17358	8.135427	7.311171
6	17.03829	31.66026	31.53829	7.716617	12.04654
7	16.30431	30.02721	31.72497	9.051009	12.8925
8	16.17778	29.9367	31.09751	9.93511	12.8529
9	16.12845	29.26102	31.79493	10.18706	12.62855
10	16.06812	28.09299	33.44003	9.711732	12.68713

Variance Decomposition of LOG(CP):

Period	LOG(GDP)	LOG(OFDI)	LOG(CP)	TR	DUMY
1	28.16523	0.04022	71.79455	0	0
2	20.17612	9.185761	59.84982	2.945019	7.843281
3	22.89261	6.642171	52.19288	3.338403	14.93393
4	21.96263	5.037896	52.89093	3.985445	16.12309
5	22.06087	4.939666	52.13847	4.353748	16.50725
6	21.51974	6.227611	51.3628	4.747987	16.14186
7	20.7969	7.069904	51.45726	4.943076	15.73286
8	19.97012	7.204738	52.44458	4.745131	15.63544
9	19.24232	7.083306	53.08896	4.791807	15.7936
10	19.36936	6.905282	52.44725	5.49287	15.78524

Variance Decomposition of TR:

Period	LOG(GDP)	LOG(OFDI)	LOG(CP)	TR	DUMY
1	12.62274	0.000233	13.50483	73.8722	0
2	10.11858	11.54642	33.57253	36.27211	8.490366
3	8.587973	20.15584	29.59408	34.33745	7.324661
4	8.525246	20.47811	29.94116	33.94164	7.113843
5	8.65395	20.15874	29.4906	33.12296	8.573749
6	9.233827	19.84497	29.47447	32.74774	8.698988
7	9.217355	19.94381	29.40734	32.63555	8.795945
8	9.129027	20.08665	29.6951	32.30668	8.78254
9	9.162097	20.21192	29.90114	32.00326	8.721584
10	9.120523	20.06837	30.28155	31.71538	8.814178

Variance Decomposition of DUMY:

Period	LOG(GDP)	LOG(OFDI)	LOG(CP)	TR	DUMY
1	0.132928	7.171179	33.89919	3.117939	55.67876
2	6.505708	7.886389	38.98525	10.55356	36.06909
3	6.238521	7.534576	40.6677	10.1885	35.37071
4	6.574389	8.43896	42.06319	9.584925	33.33854
5	8.126807	9.649045	41.90583	9.159328	31.15899
6	8.392681	9.208481	42.69182	9.010527	30.69649
7	8.455165	9.040161	43.05589	8.94579	30.503
8	8.247973	8.830214	43.05672	9.050733	30.81436
9	8.243927	8.720787	42.59042	9.822422	30.62245
10	8.623757	8.689091	42.18811	10.17903	30.32001

Source: Author's caculation

5. Conclusion and recommendation.

This paper is design to measure the impact of foreign direct investment and trade openness in economic development in Lao PDR for the period of 1990-2015. It implements an Autoregressive Distributive Lag (ARDL) model to cointegrate the existence of long-run association among variables and the Vector error correction model (VECM) for the short-run. The result of an empirical model based on the bounds testing approach (ARDL) indicates that there exists the association relationship between a dependent and explanatory variables. The joint F-statistic of 11.59 is bigger than the upper bounds critical value of 4.37, implying that the null hypothesis of no cointegration has been rejected.

This empirical study confirms that foreign direct investment and trade openness plays a crucial role in economic development in Lao PDR, particularly, in the long run. This results consistent with a widespread believe belief that FDI can positive productivity for the host country. Especially in the least developed like the Lao PDR. As the results, the Lao authority should take the FDI promotion policy and international trade policy into account of economic development frameworks to lead Lao PDR graduate from the least developed country in the near future.

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