



Do FDI and Exports Boost Economic Growth in Laos? A Study of Exports, FDI, and Control Variables Using the ARDL Approach

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Abstract: Currently, foreign direct investment (FDI) and exports to ultimately be significant driving forces in the economy of Laos. But their effectiveness hinges on the country's capacity to solve systemic problems and improve its absorptive capacity. Laos will therefore have to utilize these engines of growth effectively through diversification of FDI sources, a more diversified export sector, and macroeconomic stability. The ARDL method employs a robust approach to exploring such phenomena, and its application here presents useful findings for policymakers trying to encourage sustainable economic growth in Laos. Using World Development Indicators data from 1990 to 2022, this study presents the economic dynamics of the Lao PDR. The analysis examines the primary contributors to this positive correlation between real GDP (RGDPT), foreign direct investment (FDI), and the values of both exported goods and services (EXPR) while controlling for other possible variables of interest such as exchange rate (EXCH), inflation rate (INF), and labor force participation (LBFR). In addition, the adoption of the ARDL bounds testing approach is utilized to investigate the short- and long-run dynamics of economic growth. The results, FDI, and labor force participation are the most crucial driver of long run economic growth, while exports, exchange rate, and inflation do not have a statistically significant effect. Export, FDI, and labor force as short-term determinants positively contribute to economic growth, and there is a robust error correction mechanism to bring long-term equilibrium. Moreover, the ARDL model passes a series of diagnostic tests. Such findings offer important policy implications, suggesting the necessity for prudent economic planning that encourages investment diversification, promotes the competitiveness of trade, and fortifies macroeconomic stability. Laos can develop a more resilient economic system through more precise policy recommendations that this sector needs to be able to support the long-lasting, sustainable development of the Lao economy as a whole through these two dimensions (FDI and exports).

Keywords: Foreign Direct Investment (FDI), Exports and Economic Growth, Macroeconomic Stability, Autoregressive Distributed Lag (ARDL) Model, Labor Force Participation, and Sustainable Development Policies.

1. Introduction

In theory, trade openness and foreign direct investment (FDI) are now considered essential factors of economic growth in both developed and developing countries, as they enhance the growth of industry, create jobs, and give rise to technology transfer (Helpman & Krugman, 1985; Krueger, 1998). Yet their impacts differ by national policies, economic structures, and regional contexts (Rodriguez & Rodrik, 2001; Yanikkaya, 2003). The findings indicate that while the Lao PDR has opened up its economy to market-oriented reforms and participated in the global economy, empirical evidence regarding the role of FDI and exports in its economic growth — after considering inflation, exchange rates, and government

policies — is still sparse. [This study found that since Laos is heavily dependent on natural resource exports and its economic structure is unique, it is necessary to analyze more thoroughly how these factors interact with and affect sustainable development.]

Laos is a landlocked country in Southeast Asia that has transitioned from a socialist economic system to a more market-oriented economy (Ribeiro, McCombie, & Lima, 2004). The increasing integration of the country into the world economy, coupled with rising volumes of international trade patterns has made exports and imports a critical pillar for economic development and poverty alleviation (Frankel & Romer, 1999; Sunde, 2017). Despite the diverse literature supporting these findings, there is still a lack of empirical research on the contributions of exports and FDI to economic growth in Laos, making research in this area worthwhile.

The Focused of this study the key questions answered are:

1. How much do FDI and exports affect economic growth in Laos?
2. How do/ “Do more factors—ex. Inflation and Exchange rate, Human Capital, etc., moderate this relationship?
3. What policy responses can harness the dividends of trade and investment for sustaining long-term economic resilience?

The main aim of this study is to analyze how FDI and exports affect the economic growth of Laos through the Autoregressive Distributed Lag (ARDL) Model. Specifically, it seeks to:

1. Investigate the long-run and short-run relationships among trade openness, FDI, and GDP growth in Laos.
2. And find out how these factors are influenced by macroeconomic variables like inflation, exchange rates, and human capital “while macroeconomic variables such as GDP were seen to impact the economic sectors”.
3. Generate evidence-based knowledge for policy strategies designed to boost economic resilience and competitiveness.

Focusing on the economic context of Laos, which has been relatively under-researched empirically, this research fills a critical gap in the literature. While more general studies exist on overall FDI and trade directed toward developing country destinations, this research is particularly focused on the special position of Laos as a landlocked economy that is heavily dependent on natural resource exports. This research not only focuses on previously neglected control variables but also delivers a more thorough interpretation of the dynamics influencing the economic growth of the country. Policymakers are in constant search of effective strategies that would enable the maximization of FDI and exports, ensuring macroeconomic stability and sustainable development (Frankel & Romer, 1999; Sunde, 2017) and the results will help in reaching such a goal.

In addition, advanced econometric modeling will be utilized to examine long-tail and short-term dynamics, identify correlations, and test causality between trade activities and economic growth (Balassa, 1978; Chang, Kalyani & Loayza, 2009). This research will deliver comprehensive evidence to inform strategic decisions, enabling Laos to maximize its trade and investment opportunities for sustainable development.

2. Literature Review

2.1 Theoretical Foundations of Economic Growth

Development economics has as one of its main themes’ economic growth, with different theoretical approaches addressing which are its main drivers. Within the framework of the Solow-Swan model, savings and investment are the fundamental drivers of the model meant to explain longitudinal economic growth, and the model’s emphasis on capital accumulation has led academics to focus on FDI as a means to support domestic savings and accelerate economic growth (Solow, 1956). By contrast, the Romer model with endogenous growth depicts technological spillovers from FDI as an important factor driving productivity and innovation (Romer, 1990). These theories establish a basis for understanding the relationship between FDI, exports, and economic development.

Damage FDI’s economic growth is mostly controlled by endogenous growth theory, which leads to capital stock increase, knowledge transfers, and productivity improvements (Barro & Sala-i-Martin,

2003). Likewise, the role of exports in economic growth is suggested to be based on market expansion, economies of scale, and improvement in efficiency through competition (Balassa, 1978). Although several studies have empirically confirmed the effectiveness of FDI and exports on the improvement of economic performance in developing countries (Borensztein et al., 1998; Dollar & Kraay, 2004), their effectiveness is subject to contextual factors such as the institutional quality and the macro-economic stability. In the case of Laos, these factors need to be further investigated in relationship to their effect on economic growth to evaluate the magnitude of their effect.

2.2 The Impact of FDI on Economic Growth

However, in emerging economies, FDI is considered a significant driver of economic development. Multinational enterprises can stimulate capital inflows, knowledge transfer, and access to global markets, improving domestic firms' competitive advantages, as such resource allocation leads to greater productivity (Blomström & Kokko, 1998). As with many developing countries, foreign direct investment (FDI) is the key to economic development in Laos, where national savings are insufficient to support major infrastructure investments (Borensztein, De Gregorio, & Lee, 1998).

However, the FDI has not been always positive in its effect on economic growth. Though FDI can spur GDP growth via capital formation and employment, pain points include environmental degradation, negative knock-on effects, and concentration in hydro and mining. In addition, the positive impacts of FDI depend where governance, infrastructure, and human capital (Phimphanthavong, 2012; Sayavong & Toyoda, 2014).

Studies across Southeast Asia show mixed results about the role of FDI in growth. One example is a study by Vu and Noy (2009), which found that while FDI had a positive impact on Vietnam's economic growth, it only did so under strong institutional frameworks. Similarly, Alfaro et al. (2004) asserted that the positive effect of FDI on growth is conditional on financial market development. Laos has adopted policies to attract FDI over time, including the Investment Promotion Law which granted foreign investors various tax incentives (ADB, 2022). Although foreign direct investment (FDI) inflows have increased in sectors such as hydropower, mining, and construction (World Bank 2023), weak infrastructure and regulatory inefficiencies are still affecting their performance. Laos' potential for maximizing FDI's benefits, however, depends on its absorptive capacity (Chantasawat et al., 2004).

2.3 The Role of Exports in Economic Growth

Exports are crucial for economic development, generating foreign exchange and embedding economies in global value chains. According to empirical literature, export growth improves economic performance through economies of scale, innovation, and increasing foreign income (Helpman & Krugman, 1985). In Laos, trade agreements have also improved agricultural access to Chinese markets leading to increasing agricultural exports to China and new economic opportunities (Xaypanya, Rattanakhomfu, & Lim, 2015). However, Laos's dependence on a narrow span of export commodities—such as agricultural products, minerals, and hydropower—makes the country susceptible to external shocks. This concentrated structure makes them vulnerable, as external factors like global demand and commodity price changes have a direct impact on their economic stability (Borensztein, De Gregorio, & Lee, 1998). The export-led growth hypothesis postulates that an increase in exports has a stimulating effect on domestic production, boosts productivity, and ultimately spurs economic growth in the long run (Helpman & Krugman, 1985). Nevertheless, the export sector of Laos continues to be resource-dependent, rendering it vulnerable to external shocks (UNCTAD, 2021).

Recent research shows that to maintain growth, they must diversify their exports. Pholsena et al. (2020) that Laos' reliance on commodity exports imposes limits on its economic potential, but that greater cross-border trade with China and Vietnam could offer opportunities for diversification and resilience (IMF, 2023).

2.4 Empirical Analysis of FDI, Exports, and Economic Growth

FDI, exports, and their influence on economic growth have been investigated by employing econometric approaches in the empirical literature. The Autoregressive Distributed Lag (ARDL) model is a popular tool for analyzing the short- and long-run dynamics of a system when the variables are of mixed orders of integration (Pesaran et al., 2001). Evidence from Laos also supports the role of FDI and exports for the

promotion of economic growth but also highlights the need for a robust institutional framework and the construction of infrastructures (Phimphanthavong, 2012).

However, the literature also suggests that the gains from FDI and exports are mediated by the quality of governance, education, and infrastructure improvements. They may never realize their long-term positive effects without these factors (Rodriguez & Rodrik, 2001). To fill the research lacuna, this study develops the ARDL model by including these variables into the vector to offer a comprehensive examination of the dynamics of Laotian economic growth.

2.5 Control Variables and the ARDL Approach

To explore the dynamics between FDI, exports and economic growth in the case of Laos, control variables such as inflation, exchange rate and government expenditure should be included in the equation. These macroeconomic conditions have a crucial impact on economic performance and importantly dictate the degree to which FDI and exports support growth.

Pesaran et al. (1999) introduced the ARDL model. (2001), which makes this method particularly appropriate for developing economic contexts such as Laos, where data deficiencies preclude traditional econometric methods. The ARDL approach has been successfully used in recent studies of FDI, exports, and economic growth in developing countries (Khan & Hye, 2019; Rahman & Mamun, 2020). Using the ARDL model, this study examines the short- and long-term associations among these variables in Laos which can provide valuable policy implications.

2.6 Evaluating the Impact of FDI and Exports on Economic Growth in Laos

This section summarizes important findings for FDI, exports, and economic growth in Laos and presents hypotheses for empirical analysis:

2.6.1 Opportunities and constraints of FDI and growth in Laos

Laos is also a recipient of FDI, which is concentrated in resource-heavy sectors, such as hydro power, mining, and construction. However, FDI has different growth effects in different industries. Such FDI is concentrated in capital-intensive industries, resulting in limited downstream economic spillovers and putting jobs and skills outside the economy.

Hypothesis 1: Laos' economic growth is positively influenced by FDI.

2.6.2 Strengths and Risks: Exports as Growth Engine

Laos has an export sector that relies heavily on natural resources and as such, is also exposed to changes to commodity prices on the global market. Its dependency on several crucial markets, most notably China and Thailand, also poses a significant risk to the economy from an external perspective.

Hypothesis 2: There is a growth impact from exports on Laos.

2.6.3 Macroeconomic Stability and Control Variables

Inflation rate, exchange rate fluctuation and public expenditure serving as determining organizations affect each other and are interdependent and have an impact on economic stability factors that will result in growth and attract investment.

Hypothesis 3: Inflation has a strong impact on Laos' economic growth.

Hypothesis 4: Exchange rate fluctuations affect economic growth.

Hypothesis 5: The labor force promotes economic growth positively.

3. Materials and Methods

3.1 Research Design

3.1.1. ARDL Model Specification

The study will employ the Cobb-Douglas production equation to analyze the impact of various factors on economic growth.

$$GDP = AK^{\alpha}L^{\beta} \quad (1)$$

From the above production equation, we put the log on both parts of the equation to obtain the following new results:

$$RGDPT = \log A + \alpha \log K + \beta \log L \quad (2)$$

Model (2) above is logged and extended by including other important variables as shown in Equation below by gathering all factors influencing economic growth from the previous discussion, the Lao economic growth function can be written as:

$$RGDPT = f(\text{EXPR}, \text{FDI}, \text{LBFR}, \text{EXR}, \text{INF}) \quad (3)$$

A logarithmic approach for analyzing elasticities:

$$RGDPT_t = \beta_1 + \beta_2 \text{EXPR}_t + \beta_3 \text{FDI}_t + \beta_4 \text{LBFR}_t + \beta_5 \text{EXCH}_t + \beta_6 \text{INF}_t + \varepsilon_t \quad (4)$$

In these models, the dependent variable RGDPT means Robotic on the gross domestic product price. EXPR– value of goods and services exports, FDI – foreign direct investment, LBFR – total labor force, INF – inflation rate, EXCH – exchange rate. To this end, these models are intended to explore how these factors influence the economic growth of Laos.

3.1.2 ARDL model for the Economic growth generation

The Autoregressive Distributed Lag (ARDL) bounded testing approach was first introduced by Pesaran et al. (2001). The ARDL approach is valid if the selected variables are stationary at their respective orders, specifically I (0) and I (1). By contrast, despite being a widely used approach to measure the existence of a long-term relationship, the cointegration test developed by Johansen (1990) and Johansen and Juselius (1990) requires all variables selected to be stationary at I (1). However, the ARDL bound test does not meet this criterion. To analyze the economic growth of Laos, we recommend using the ARDL model.

$$\begin{aligned} \Delta RGDPT_t = & \beta_1 + \beta_{2i} \sum_{i=0}^n \Delta(\text{EXPR}_t - i) + \beta_{3i} \sum_{i=0}^n \Delta(\text{FDI}_t - i) + \beta_{4i} \sum_{i=0}^n \Delta(\text{LBFR}_t - i) + \beta_{5i} \sum_{i=0}^n \Delta(\text{EXCH}_t - i) \\ & + \beta_{6i} \sum_{i=0}^n \Delta(\text{INF}_t - i) + \beta_7(\text{EXPR}_{t-1}) + \beta_8(\text{FDI}_{t-1}) + \beta_9(\text{LBFR}_{t-1}) + \beta_{10}(\text{EXCH}_{t-1}) \\ & + \beta_{11}(\text{INF}_{t-1}) + \varepsilon_t \end{aligned} \quad (5)$$

RGDPT in these models is gross domestic production at a constant price. In equation (5), ε_t is a sign-change white noise error term, Δ is the first difference operator, n is the optimal number of lags, the short-run coefficients are β_2 to β_6 , and the long-run coefficients are β_7 to β_{11} . We used the F statistic of the bound test to check the existence of the long-term relationship. The null hypothesis: The variables are not correlated, or more technically, there is no association among them. If the F statistic goes beyond the upper limit, the null hypothesis will be rejected. Signifying that these variables are long-term cointegrated.

3.1.3 The following is the Error Correction Model

$$\Delta(RGDPT_t) = \beta_1 + \beta_{2i} \sum_{i=0}^n \Delta(\text{EXPR}_t - i) + \beta_{3i} \sum_{i=0}^n \Delta(\text{FDI}_t - i) + \beta_{4i} \sum_{i=0}^n \Delta(\text{LBFR}_t - i) + \beta_{5i} \sum_{i=0}^n \Delta(\text{EXCH}_t - i) + \beta_{6i} \sum_{i=0}^n \Delta(\text{INF}_t - i) + \lambda \text{ECT}_{t-1} + \varepsilon_t \quad (6)$$

λ serves as a stand-in for the adjustment rate in equation (6). It shows how quickly changes in the short term in the current year rectify long-term aberrations from the prior year. To confirm statistical significance, the error correction specification (ECT) is expected to display a negative sign and a p-value less than 5%.

- Stationarity Tests: To make sure the time series data is stationary, do tests such as the Augmented Dickey-Fuller (ADF) test.
- Cointegration Tests: To look for long-term equilibrium relationships between variables, use tests such as the Johansen Cointegration test.

3.2 Data and Empirical Methodology

3.2.1 Data Sources and Timeframe

To examine the long-term connections between the variables in question, this research utilizes secondary data collected from various sources. The dataset is derived from the World Development Indicator (WDI, 2024), covering the period from 1990 to 2022.

3.2.2 Variables

The variables used in this study are shown in Table 1, and they are all significant for understanding and analyzing the economic dynamics of the Lao People's Democratic Republic (Lao PDR). This analysis uses the World Development Indicator dataset to increase the accuracy and relevance of the empirical results. The dependent variable is GDP at Constant 2015 US\$ (RGDPT). The independent variables are Foreign Direct Investment (FDI) and the Value of Goods and Services Exports (EXPR). The exchange rate (EXCH), inflation rate (INF), and total labor force (LBFR) are considered as our control variables.

Table 1. presents the variables used in this study

Variables	Description	Source
RGDPT	Gross domestic production (constant 2015, US\$)	WDI
EXPR	Exports of goods and services (BoP, current US\$)	WDI
FDI	Foreign direct investment, net inflows (BoP, current US\$)	WDI
LBFR	Labor force, total	WDI
EXCH	Official exchange rate (LCU per US\$, period average)	WDI
INF	Inflation, consumer prices (annual %)	WDI

Source: World Development Indicator (WDI, 2024)

3.2.3 Description Variables

Data of 1990 through to 2022 are used, with full details on each variable presented in Table 2, which provides the number of observations, maximum and minimum values, standard deviations (STD), skewness, kurtosis and mean value. Discussion of the normal distribution, as the descriptive statistic between independent and dependent variables, found presented in Table 1 relates to the subsequent stage of the investigation.

Table 2. Description of Variables

	RGDPT	EXPR	FDI	LBFR	EXCH	INF
Mean	5.3E+08	2E+09	4E+08	47353	416.5	14.923
Median	4.6E+08	1E+09	2E+08	48259	86.11	6.9749
Maximum	1.1E+09	9E+09	2E+09	98395	4337	125.27
Minimum	9.3E+07	1E+08	4E+06	29944	-862.5	0.1412
Std. Dev.	3.2E+08	3E+09	5E+08	11322	1100	25.779
Skewness	0.38045	1.018	1.1078	2.806	2.429	3.3706
Kurtosis	1.70307	2.651	3.2488	14.09	8.666	13.73
Observations	32	32	32	32	32	32

Source: Author estimation, 2024

4. Results and Discussion

4.1 Unit Root Test and Lag Order Selection Criteria

Results on unit roots show that the ARDL bound test approach is appropriate for our investigation. As shown in Table 3, it turns out 1 variable (INF) is stationary at both level (I (0)) and first difference (I (1)), and the remaining 5 variable (RGDPT, EXPR, FDI, EXCH, and LBFR) are stationary at first d. (I (1)).

Table 3. Unit root results

Variables	Level		First Difference	
	Intercept	Intercept and Trend	Intercept	Intercept and Trend
RGDPT _t	-1.9059	-2.0424	-6.7956***	-6.8427***
EXPR _t	4.0501	0.6151	0.1176	-7.7244***
FDI _t	-1.4490	-2.4082	-5.6704***	-5.5239***

LBFR _t	-0.9611	-1.6971	-5.1195***	-4.6774***
EXCH _t	-1.5775	-1.3669	-4.4377***	-3.5210**
INF _t	-3.3521**	-3.7154**	-3.0543**	-2.9228

Note: ***, **, and * represent significance levels of 5%, 1%, and less, respectively.

Table 4. VAR Lag Order Selection Criteria results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2608.5	NA	2.01E+68	174.3001	174.5804	174.3898
1	-2481.37	194.943	4.86E+65	168.2243	170.186	168.8519
2	-2419.91	69.65162*	1.22e+65*	166.5272*	170.1703*	167.6927*

* Indicates lag order selected by the criterion, AIC: Akaike information criterion

4.2 The results of the ARDL model

4.2.1. Results of unit root tests.

The results of the unit root test for the variables we chose are displayed in Table 2. According to the goal of our research, this study recommends using the ARDL method for unit root analysis. There are some critical steps to be undertaken in the ARDL approach. The first step is determining whether non-stationary data can yield misleading results. To check the stationarity of the dataset, we used the Augmented Dickey-Fuller test.

4.2.2. Bounds test for cointegration

The cointegration bound test is used to check if the cointegration relationship is long-term or not. The unbounded long-term relationship between the variable in the equation can be confirmed, generalizing that, when the value of the calculated F-statistic is higher than the upper bound values of the critical points, thus leading to the rejection of the null hypothesis. According to the Pesaran et al. (2001) criteria, the calculated F-statistic presented in Table 5, which is equal to 5.3783, is greater than the upper bounds values at the 1%, 5%, and 10% significance levels.

Table 5. The especially results of the ARDL bounds test

F-Bounds Test		Null Hypothesis: No levels of relationship		
Test Statistic	Value	Significance Level	I (0)	I (1)
F-statistic	5.3783	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Note: ***, **, and * represent significance levels of 5%, 1%, and less, respectively.

4.2.3 The results of long-run relationship and error correction model

With such F-statistics exceeding the upper bound, we unambiguously reject the null hypothesis and confirm the cointegration between the long-run selected explanatory variables in our model (Schmidt et al. 2016). The appropriate lag structure for these variables was determined using the Akaike Information Criterion (AIC).

The long-run relationships identified in our ARDL model are presented in Table 6 below. The variable of interest "FDI" has a strong, positive, and statistically significant effect on Laos' economic growth, with a coefficient indicating that every one-unit increase of FDI in Laos contributes to a 0.9855-unit increase of economic growth, significant at a 10% level. The labor force is positively and significantly affecting the economic growth, where its coefficient is 35036.94 translating into a unit increase of labor force leading to 35036.94 unit increase in economic growth at the 10% significance level. Furthermore, washout is not statistically significant as is the case for the case study of Laos, for the export, exchange rate, and inflation.

Table 6. The particular results of the long-run

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXPR	-0.3222	0.1868	-1.7251	0.1016
FDI	0.9855*	0.5437	1.8124	0.0866
EXCH	155465.70	168875.10	0.9206	0.3694
INF	-2404404.00	4516124.00	-0.5324	0.6010
LBFR	35036.94*	18610.62	1.8826	0.0760
C	-111000000.00	764000000.00	-1.4566	0.1625

Note: ***, **, and * represent significance levels of 5%, 1%, and less, respectively.

The estimated results for both short-run and error correction models are provided in Table 7. The ECT has a coefficient of -0.3509 with p-value of 0.000 indicating the ECT is statistically significant at the 1% level. This means that about 10% of the total disequilibrium of the Laotian economy in the previous year will adjust toward long-term equilibrium with an adjustment rate of about 35.09% over the period.

In the short term, the exports have a positive effect on Laos's economic growth (a coefficient of 0.2899 indicates that a unit increase in exports in Laos causes an increase of 0.2899 units in economic growth and significant at 1% level); In a same way, the foreign direct investment (FDI) has a positive effect on Laos growth (a coefficient of 0.1744 indicates that a unit increase in FDI in Laos causes an increase of 0.1744 unit in Lao economic growth and significant at 5% level); In addition, labor force in Laos has a positive contribution to its economic growth (a coefficient of 5222.2160 that shows that a unit increase in labor force in Laos leads a 5222.2160 unit increase in Lao economic growth which is significant at 5% level).

However, at the 5% level, there has been an immediate and statistically significant negative impact of the labor force on economic growth over the last year.

Table 7. The specifically results of error correction model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXPR)	0.2899***	0.0492	5.8870	0.0000
D (EXPR (-1))	0.1613**	0.0729	2.2128	0.0401
D(FDI)	0.1744**	0.0702	2.4830	0.0231
D(LBFR)	5222.2160***	1889.5710	2.7637	0.0128
D (LBFR (-1))	-16301.2300***	4777.5800	-3.4120	0.0031
CointEq (-1)*	-0.3509***	0.0495	-7.0851	0.0000

Note: ***, **, and * represent significance levels of 5%, 1%, and less, respectively.

4.2.4 Diagnostic test results of the ARDL model

The Validation of the ARDL bound test model was performed through diagnostic tests and their results are presented in Table 8. These tests confirm that there are no issues with serial correlation or heteroskedasticity at the 5% significance level. Residuals obtained from the model follow a normal distribution. CUSUM and CUSUMSQ tests were used to assess stability in the model. In Figure 1, we see that the model calculates stable coefficients with the blue line at the 5% significance level lying within the red lines for both figures.

Table 8. Diagnostic test results of ARDL model

Types of tests	Statistical value	Prob
Normality	0.5894	0.7447
Serial Correlation	F (2,16) = 6.1148	0.0106
	Chi-Square (2) = 12.9965	0.0015
Heteroskedasticity	F (11,18) = 4.7683	0.0018
	Chi-Square (11) =22.3351	0.0219

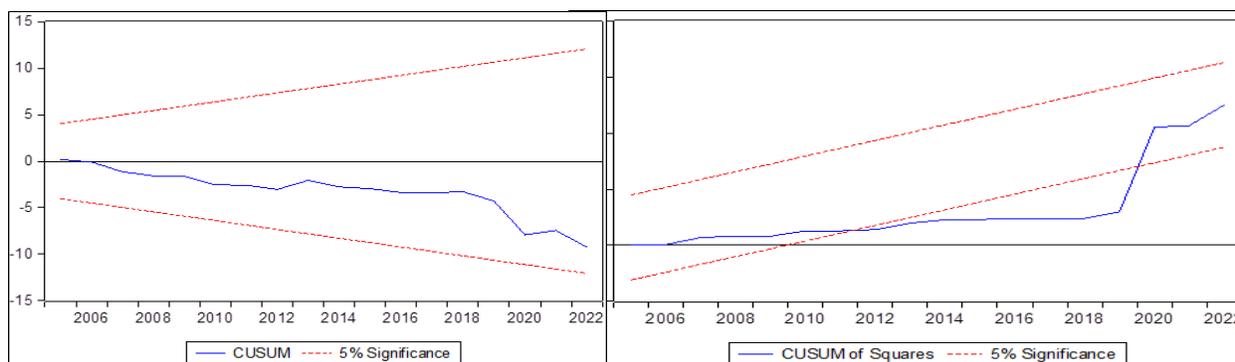


Figure 1 displays the outcomes of the CUSUM and CUSUMQ Square tests

4.3 Discussion

The results from this study provide sufficient knowledge of economic growth mechanisms for Laos and other similar developing countries. The main findings of our analysis are that FDI and labor force growth have positive and significant effects on economic growth. These are important findings that can assist with promoting sustainable growth in Laos and other developing economies, with increased FDI inflows and investment in human capital seen as corrective measures.

Ultimately, these interventions need to be scaled up, which calls for policymakers to focus on attracting and maintaining foreign investment by improving the business climate, developing infrastructure, and granting incentives to investors. And, on the other hand, pushing for education, skill development and labor market policies would help to tap into the full potential of the labor force that would fly productivity and economic growth. Such initiatives may prove helpful for countries with labor-intensive industries, or for those that have plans of industrialization.

On the contrary, the result of no long-run effect of exports on economic growth will urge for a rethinking of export orientation in the absence of other policies to complement it in Laos. Rather, Laos and similar economies should concentrate on developing sectoral and regional (or local) priorities where high-value FDI is drawn, comparative advantage created in strategic sectors, and productivity improved through technology and efficiency.

This research contributes to worldwide studies about the impact of FDI and exports in a developing country such as Laos. Although several related studies have provided insights into how trade liberalization and the resulting export growth led to significant improvements in economic performance (for instance, Edwards, 1993; Balassa, 1978), our results underline the fact that FDI serves as the strongest determinant of accelerating economic growth in the area of research defined in the introduction whereas exports fail to carry the anticipated positive long-term impact. This also will contribute to the global discourse by stressing the uniqueness of economic policies and growth strategies across cases in developing countries.

Additionally, it contributes to the literature on export-driven growth (Helpman and Krugman, 1985; Shan and Sun, 1998) by providing a comparison of Laos with those countries where growth has been primarily led by exports. It also poses a criticism of the generalization of trade openness and export-driven models put forth by Krueger (1998) and Frankel and Romer (1999) that propose a positive relationship between exports and economic growth globally. Our findings highlight the need to adapt growth strategies to the specific economic circumstances of individual countries, as emphasized by Rodriguez and Rodrik (2001) and Yanikkaya (2003).

Overall, this study provides an important contribution to the literature by better understanding the economic mechanisms at hand in Laos and also how trade, foreign direct investment, and the labor market is interrelated in developing countries. These observations, however, are limited to some very peculiar economies so they cannot drop policy decisions in the locations they may be tentative for, which means a one-size-fits-all policy of people-level economic emission might not yield the desired results.

5. Conclusion and recommendation

5.1. Conclusion

The Impact of FDI, Exports, and Labor Force on Economic Growth in Laos: Evidence from Autoregressive Distributed Lag Model (ADRL) Approach to Cointegration and Granger Causality Tests Based on time series data, the results show that foreign direct investment (FDI) and the labor force were major determinants of economic growth in Laos. Although the long-run impact does not show a statistically significant effect on exports, the overall evidence provides for the need for policy interventions focusing on FDI inflow and human capital development. These results indicate that in the case of Laos and the developing nations, nurturing a favorable business environment, and strengthening infrastructure, alongside education and skills development are key to sustainable growth.

This research contributes to the global discussion of economic development by showing that FDI can be a significant driver of economic growth in Laos but that the same does not hold for exports without complementary policies. These results add further evidence to the trade liberalization and growth literature (Edwards, 1993; Balassa, 1978), emphasizing the country-specific nature of the issue. Moreover, this study supports the work carried out by Rodriguez and Rodrik (2001) and Yanikkaya (2003) who suggest that each country's trade policies must be adapted and suited to its specific economic structure.

5.2. Limitations

In analyzing the study's implications for Laos's economic transformation, it is imperative to note that the research methodology is largely limited by its reliance on data from the World Development Indicators, which may not encompass the entirety of the so-called economic "miracle" presented over recent years. In addition, results may be unique to Laos, given variations in economic contexts, policies, and institutional environments that exist in other countries. The study examines data through 2022, and while that is still relatively recent, the economic environment is rapidly changing and the findings may change as the economy evolves. While control variables such as inflation and exchange rates were accounted for in the study, there could be numerous other factors, such as geo-political events or the global economic environment, that are left out of the model.

5.3. Recommendations

Outcomes from this research led to the following recommendations for the policymakers in Laos and similar developing countries:

1. FDI Attraction and Retention: Improving the business climate, forming political stability, and financial incentives are critical to achieving a favorable environment for foreign investment.
2. Human Capital Development: It will equip the countries to better utilize the capacity of their labor force and also nurture productivity growth.
3. Revisit Export Strategies: As the evidence shows no longer-term impact of exports on economic output in Laos, it may be prudent for policy-makers to adjust their approach and focus on sectors that will both attract high-value FDI and promote technological innovation for sustainable economic growth.
4. Market Liberalization: Liberalizing markets to remove barriers that hinder business operations and promote a competitive environment that attracts FDI can increase productivity and economic growth.
5. In addition to economic growth, this research has implications for advancing core Sustainable Development Goals (SDGs). By improving employment generation and productivity, strengthening inflows of foreign direct investment (FDI) also has a role in achieving SDG 8 (Decent Work and Economic Growth). Moreover, labor force participation and skill development policies can facilitate income augmentation and lessen impoverishment, by aligning with SDG 1 (No Poverty). Additionally, attracting investment in clean and renewable energy sectors will fall in line with (SDG 7 — Affordable and Clean Energy), sustainable industrialization, and reduction of environmental effects.

Thus, this study would provide not only actionable recommendations for Laos but would also provide a mirror for other developing countries with similar challenges. Values that underline a pressing need for a balanced economic policy that links FDI attraction to labor force development and export policy are the results reinforce that.

5.4. Direction for Further Study

Future studies might also look closely at the impact of FDI and exports on different sectors (such as agriculture, manufacturing, and services) to provide a more nuanced understanding of the channels of

expansion. A comparison across countries may help confirm results in the context of Laos and explore whether analogous trends in FDI and export growth are observable elsewhere in developing economies, particularly Southeast Asia or Sub-Saharan Africa. With technology and innovation becoming ever more central to global markets, further research could say whether FDI in technology and infrastructures of developing countries is conducive to long-run economic growth. It can be interesting to examine the role of institutional quality, governance, and policy framework to understand how these factors moderate the relationship between FDI, exports, and economic growth in different contexts.

Declaration of Conflict of Interest

The authors have no competing interests concerning the publication of this study.

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