Tittle: The Impacts of Trade Cost and Export Specialization on Export:

A Case Study-Lao PDR

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Abstract

Laos is the land-locked with small economy, to enhance export's competitiveness and sustainability is now being criticized the capacity of exports at present and in future. There seems less incentives for investors to produce the products and services for supplying the domestic market. Exporting their products overseas is a more attractive option. Due to the trade costs particularly for exports are still high as a result from the low infrastructure development and there is a lack of policies on specific potential products. Thus it induced a large proportion of FDI flow into only mining and hydropower sectors and changing export structure recently in Laos.

This paper hence focused on the investigation of the impacts of trade cost and export specialization on the export performance of Laos by applying two specific models, namely the aggregated model from 1986 to 2010 and the disaggregated model from 2001 to 2010. The augmented gravity model and unbalanced panel data were used with the GLS-SUR approach.

The findings confirmed that the level of infrastructure development (one of proxies represents the trade costs) in both trading countries is accelerating export activities in Laos. However, the magnitude of the importing country's infrastructure development has a stronger effect than that of the home country. Additionally, the transaction cost and geographical distance are also significant with negative effects on export. More importantly, export specialization is statistically significant such that a 10% change in specialization can potentially stimulate around 43% export growth.

Key Words: Export, Export Specialization, Infrastructure, Sustainability, and Trade Cost

1. Introduction

Export-led growth is still the strategy favored by the mainstream practitioners of economic development. The World Bank, for example, has been particularly consistent in fostering this view (World Bank report, 1983, 1987). As similar reports stressed the evidences advocating that export promotion represents the best option for less-developed countries attempting to grow and industrialize. The East Asian model of development which is characterized by an export-led growth strategy is hailed as an achievement of economic development (Cline, 1982; Dodaro, 1991; Perter and Mitchell, 1993).

In international trade, the cost of production and the trade cost are two crucial factors that can affect competitiveness and the sustainability[1] on an export growth particularly by developing countries raised by several researchers. Those issues must be explored in the current global trade situation to facilitate the entry of Lao PDR into the WTO and for it to implement the trade requirements set by the ASEAN fully. In deep, Laos is the land-locked country with a population of 6,288,037 people in 2011 (WDI). There is therefore less incentives for investors to produce the products and services for supplying the domestic market. Exporting their products overseas is a more attractive option. However, if the trade costs particularly for exports are still high and there is a lack of policies to enhance competitiveness and maintain sustainability, the flow of trade as well as investments will be induced in Laos.

As well-known, the cost of a product difference is dependent on some conditions, namely the differences in the access of technology or productivity (Ricardo, 1819); the difference of factor endowment (Heckscher-Ohlin, 1919), and cost difference due to the distinct increase return to scale as stated in the new trade theory (Krugman and Helpman, 1985). These assumptions emphasize the conceptual opportunity cost of production.

A few decades ago, there were extensive studies on the gravity model which succinctly explained international trade flow. The common variables used consist of the distance between the importing and exporting countries which captures the transportation cost and the GDPs of both countries inferred in the demand and supply sizes. However, there are several authors who argue that distance alone could not explain the transportation cost effectively (Limao and Venables, 2001 and Kuwamori, 2006). Consequently, trade cost[2] is an acceptable proxy because it consists of several factors in terms of policy and environmental facilities to play the important role on bilateral trade more effectively.

There are empirical evidences support that trade flows are affected not only by trade specialization (neoclassical trade theory), but also by the trade cost (new trade theory). However, there is a dearth of studies that tackle both aforementioned issues on the impact of the on export analyzed simultaneously. For a country to participate in an international trade system effectively it is necessary to understand the magnitude of the trade cost and specialization products and assess their impacts for a full realization of the gains from trade to enhance its competitiveness and sustainability, especially Laos's case

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[1] The concept of sustainability originated from the context of renewable resources (Lele, 1988). The best known quotation from the Commission's report speaks of "development which meets the needs of the present without compromising the ability of future generations to meet their own needs". Hence the context of sustainable export is that products can be produced and exported at present and in the future.

[2] Trade cost imposed by policies consisting of tariff, non-tariff barriers and quota and by environments including to transportation cost and infrastructure.

To enhance competitiveness in the case of Laos, the following questions should be assessed as follows: (1) Do the trade costs and export specialization have any effect on the export performance of Lao PDR? and (2) if so, how can the trade costs be reduced and while maintaining export sustainability? The main objectives are to examine the role of new trade theory-trade cost and neoclassical trade theory-export specialization in explaining export performance of Laos PDR; then to provide policy implication options for a small land-locked economy to enhance its competiveness along with sustainability.

For the rest of paper is organized as follows, the reviews of the definitions of the terminology used, particularly trade cost is described in section 2. Literature reviews is discussed in Section 3. Section 4 contains an overview of the relevant issues related to Laos. The methodologies and the data source used in the study are described in section 5 which is then followed by the results in section 6. Finally, Chapter 7 contains the conclusion and policy implication.

2. Trade Cost

Generally, it is very complicated to identify and measure the real costs involved in trade between countries. Nevertheless, there are many studies on trade costs which define the costs incurred in each geographical region. In deep, the main costs were incurred in the exporting country, and the additional costs were incurred in the importing country. Broadly speaking, trade costs include all costs incurred in getting a good to a final user other than the marginal cost of producing the good itself. Anderson and Wincoop (2004) stated that the trade costs in industrialized countries can be broken down into transportation costs (21%), border-related trade barriers (44%) and retail and wholesale distribution costs (55%). According to De (2007), the trade costs consist of only two main components as shown in Figure 2.1. First, costs are imposed by policy consisting of tariff, non-tariff and quota. Second, costs are imposed by the environment such as transport and infrastructure costs.

If T_{ei} denote the unit cost of trade for a particular good from country e to country i (end user), it can be assumed and determined by:

$$T_{ei} = f(x_{eit}, X_e, X_i, X_t, \omega_{eit}) \tag{2.1}$$

where X_{eit} denotes a vector of observable characteristics related to the journey involved in the transport of goods from the export country e to the import country i through transit country t and ω_{eit} represents all unobservable variables.

One of the observable and desirable characteristics of the journey is whether the countries involved share a common border as this will reduce transport cost due to a shorter travelling distance which results from the sharing of a road network. In addition, neighboring countries are more likely to have transit and agreements that reflect transit times and translate into lower shipping and insurance costs. Consequently, the higher volume of trade between neighboring countries dramatically increases the possibility for backhauling thus allowing the fixed costs to be shared over trips. For X_e, X_i and X_t which are elements of the vector of characteristics for country e, i and t respectively, infrastructure components is designed to measure the costs of travel in and through a country. Therefore, improvements on the infrastructure are expected to result in a decrease of transport and other relevant costs.

The average observable trade cost rates can be approximated by a log linear function as shown in Equation 2.2.
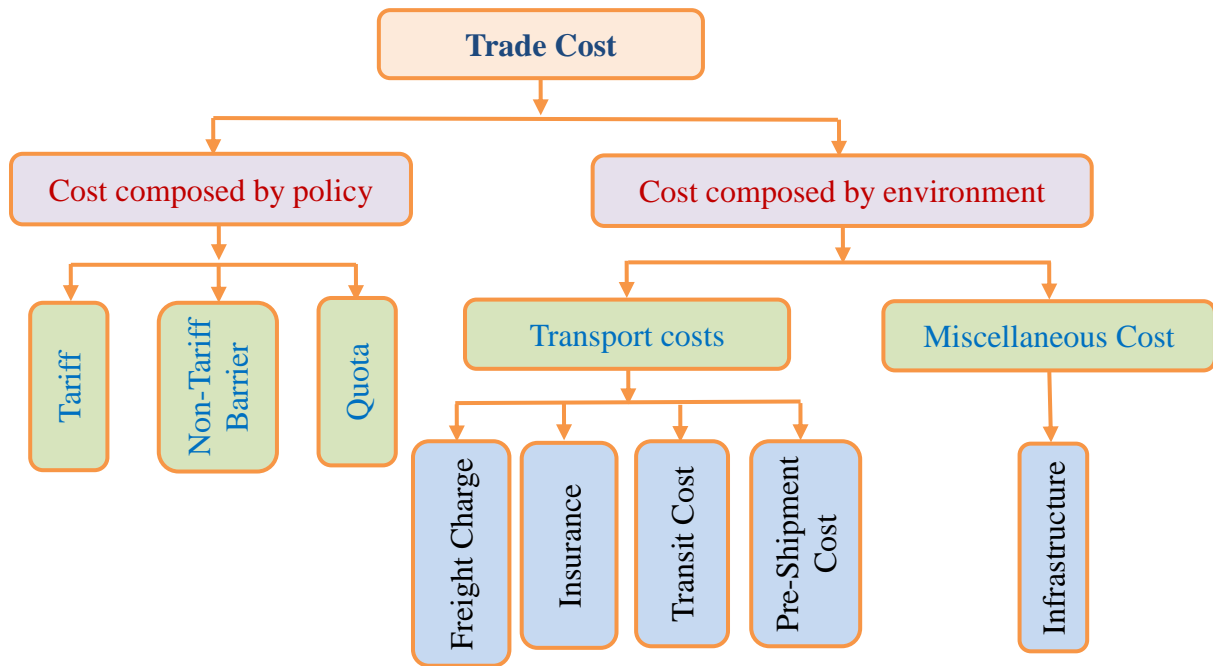
Figure 2.1. The policy and environment cost components of the trade cost
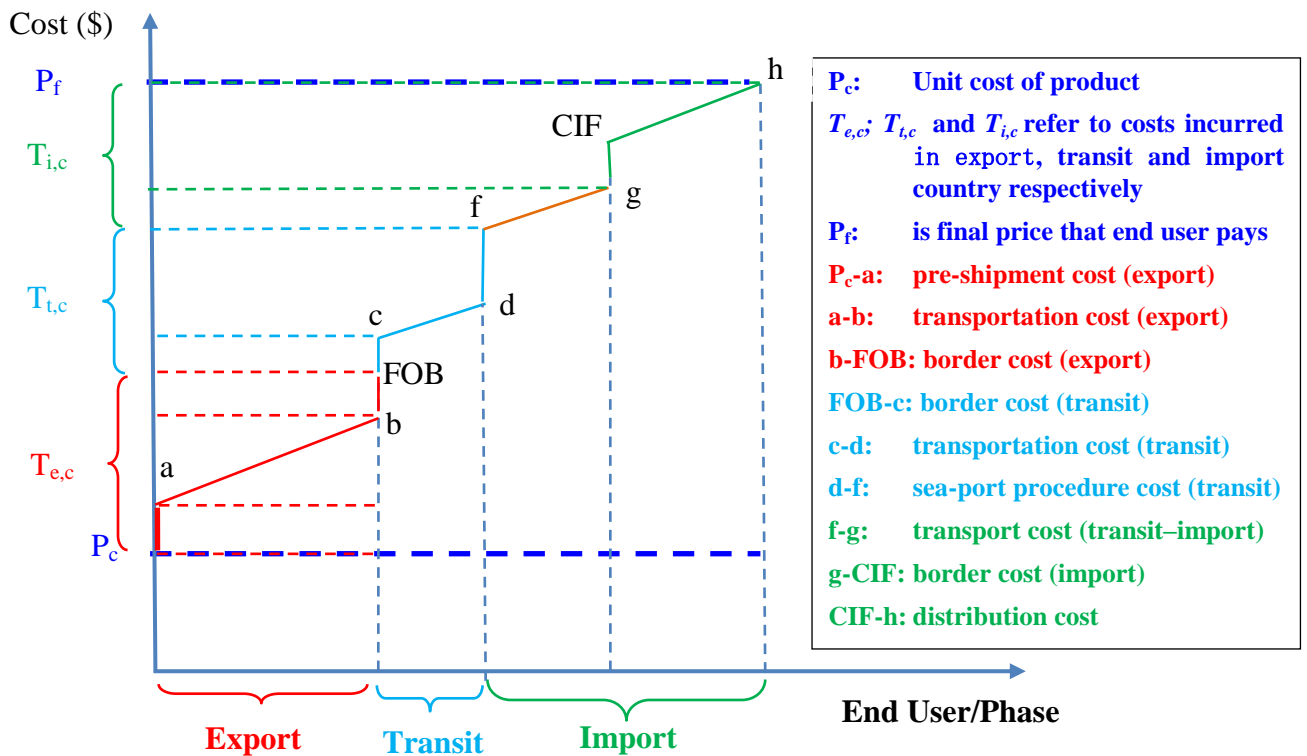
Source: De (2007)

Pc: Unit cost of product

$T_{e,c}$; $T_{t,c}$ and $T_{i,c}$ refer to costs incurred in export, transit and import country respectively

Pf: is final price that end user pays

Pc-a: pre-shipment cost (export)

a-b: transportation cost (export)

b-FOB: border cost (export)

FOB-c: border cost (transit)

c-d: transportation cost (transit)

d-f: sea-port procedure cost (transit)

f-g: transport cost (transit–import)

g-CIF: border cost (import)

CIF-h: distribution cost

Figure 2.2: The components of the export trade costs on export for the case of Laos which is a landlocked economy

Source: Drawn by author

$$Ln \; T_{ie} = \alpha + \beta \; x_{eit} + \gamma \; Ln \; X_i + \delta \; Ln \; X_e + \delta \; Ln \; X_t + \omega_{eit} \tag{2.2}$$

As shown in Figure 2.2. for trade costs in a landlocked country, where the unit cost of production is $\$p_c$ per unit in the home country, the end user in the importing country generally pays P_f which is equal to $\$(p_c+T_{e,c}+T_{t,c}+T_{i,c})$; where T denotes the cost incurred, c refers to the commodity and e, t and i refers to the exporting, transiting and importing countries respectively. To avoid confusion, if a product is exported to its neighboring countries, the $T_{t,c}$ term should not be considered, but if a product is exported to third-party countries[3] the cost occurred in the transiting country $T_{t,c}$ must be included. In terms of marginal cost, $T_{e,c}$ is the cost incurred in the home country as the FOB per unit price $\$ \; p_c$ of the commodity c, which indicates the behind-the-border costs of exports consisting of pre-shipment costs from point p_c to a and the transportation costs from point a to b and the border (home, b to FOB) cost. $T_{t,c}$ refers to the cost incurred in the transiting country as f per $(p_c+T_{e,c})$ dollars or per FOB which includes the transiting country border cost (FOB-c), transportation cost (c-d) and the loading and port cost (d-f).

To facilitate identification, phase f to g which refers to the transport cost from the transiting country to the border of the importing country, was gathered as a partial cost incurred in an importing country in order to simplify the definitions.

Lastly, $T_{i,c}$ denotes the cost incurred in the importing country of h per $(p_c+T_{e,c}+T_{t,c})$ dollars of imported goods. It consists of three components: (1) f-g which is the transport cost from the transiting country to the border of the importing country, (2) its border and residual costs arising from the explicit beyond-the-border costs of the importing country like tariffs, insurances, customs, port procedures and exchange rates (g-CIF) and (3) the implicit beyond-the-border costs which consist of all other costs incurred such as, internal transport procedures, storage and importing distribution costs to the final users at h.

There are significant variations in the trade costs and resistance factors against trade of an exporting country towards different factors. These variations lie in the exporter's, transit's and importer's ability to reduce the trade costs which are in turn dependent on several factors. First, these variations rely on the levels of the management skills and cost efficiencies of the relevant government sectors involved in facilitating exports and affects the pre-shipping and border costs. Second, government policies which discriminate against certain commodities or countries because of political frictions as similarly the foreign policy orientation of the exporting country significantly increase the behind-the-border trade costs. The export of certain agricultural commodities for example requires special licensing and treatment from specific relevant government institutions, while the export of other commodities does not. The cost of delay and licensing procedures in such cases would affect the exports of those commodities.

Third, the transportation costs for exports to certain countries may be significantly higher than others due to specific bilateral factors like lack of infrastructure, road and communication network, etc. In addition, the relative costs of transport, storage, and shipment for certain commodities might be significantly higher than the costs for other commodities. For instance, the processing and storage costs of perishable agricultural commodities like meat, fruit and vegetables are significantly higher per unit value of goods as compared to costs on industrial and manufacturing products like electronics, apparel, etc. (Christ and Ferrantino, 2011).

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[3] Any importing country except neighboring countries

Finally, the specific technical restrictions imposed by an importing country would result in higher costs of post-production processing than the costs on similar goods in other countries. These technical barriers-to-trade (TBT) refer to the additional processing required for a commodity before it can be exported to a particular country to comply with the discriminating standard requirements from the other trade partners. Moreover, some categories of goods are subject to more technical restrictions than others, which result in the higher post-production trade costs of these goods. In addition, in a transiting country, border issues, sea-port efficiency, tariff and infrastructure can affect the volume of commodities to the countries to which these goods are exported.

3. Literature Review

3.1 Trade cost issues

There are several evidences that point to the impact of trade cost on trade performance particularly on export. These evidences were obtained from estimation of gravity models. Limao and Venables (2001) used the gravity model to estimate the shipment cost, concluded that a median landlocked country has 55% higher transport costs than the median coastal economy. Additionally, a landlocked status reduces trade of central Asian countries by as much as 80% (Raballand, 2003). Djankov et al., (2006) noted that the length of time for transporting goods for export is highest for landlocked countries, and showed that an additional day's delay is associated with a 7% decline in exports of perishable agricultural products. In contrast, the a one-day reduction in delays before a cargo sails to its export destination is equivalent to reducing distance to the trading partners by about 70 km.

Evidences that the high cost of transportation impede trade growth are rife in the case of Uganda. Rudaheranwa (2009) concluded that the high transport cost which due to the poor infrastructure was a barrier to international trade. Transport costs remained a significant trade barrier, equivalent to an effective protection of over 20% and an implicit tax on exports of over 25% (and up to 50% on air freight).

Khan and Kalirajan (2011) used the gravity model to examine the impact of trade costs in Pakistan. They noted that the growth of exports between 1994 and 2004 was mainly due to the reduction of trade costs in its partner countries. The analysis their study, however, was also limited because the main variables considered to capture trade cost included the tariff rate, bilateral real exchange rate and distance only.

By using a gravity model, McCallum (1995) estimated the loss in trade volume when goods are transported from the US to Canada and compared it to the losses incurred when the products cross the provincial borders within Canada. The results indicated that the beyond-the–border trade costs were higher than the behind-the–border trade costs even for countries that are highly integrated through the North American Free Trade Agreement (NAFTA).Using several assumptions and specifications, McCallum (1995) found that the trade between USA and Canada was lower than trade within the borders of Canada by as much as 2200% (Anderson and Wincoop, 2003).

Milner and Zgovu (2006) used the export supply function to analyze the case of Malawi, a landlocked African country. Their results illustrated that natural barriers[4] were more important constraints on export supply rather than border import taxes. However,

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[4] Natural barriers consist of geographic status (e.g. land-locked), distance, etc.

their analysis of the effects of natural barriers on trade was not exhaustive.

A developed infrastructure and the logistics sector play highly substantial roles in international trade by lowering the trade costs as illustrated in Bougheas et al.(1999), Limao and Venables (2001), De (2006, 2007), and Brookes (2008). Higher trade costs impede realization of the gains from trade liberalization. Gains from trade depend not only on the tariff liberalization, but also on the quality of infrastructure and related services. Furthermore, the effective rate of protection provided by transport costs is in many cases higher than that provided by tariffs (World Bank, 2001).

Baltagi et al. (2003) emphasized the use of the gravity model and unbalanced panel to analyze bilateral trade among US, Japan and the EU15, with their 57 trading partners from 1986 to 1997. In the aforementioned study, the CIF and FOB ratio was used as a proxy to the transaction cost between importing and exporting country. The N-T-T and Linder's hypothesis were confirmed in their empirical study by applying fixed effect. It must be noted that the omission of one interaction may result in biases of estimation.

3.2 Export specialization issues

There have been several indications of comparative advantage which can explain trade performance. The classical theory on international trade was first proposed by Adam Smith in his seminal book "The Wealth of Nations", published in 1776, where the concept of absolute advantage was first introduced. Then in 1819, in his book "On the Principles of Political Economy", David Ricardo gave an important contribution the concept of comparative advantage. The concept of the trade model was first discussed by Heckscher-Ohlin in a book published in 1919 where they concentrated on factor endowments. In the 1970's and 1980's, the new trade theory was introduced and advocated by Krugman and Helpman (1985).

Newly-industrialized countries (Hong Kong, Korea, Singapore and Taiwan) gained a lot from market shares in the international market due to their strategy of specializing in products whose demand were rapidly growing in the 1980s (Perter and Mitchell, 1993). The researchers attributed the success of the NICs in their export endeavors for other countries to recognize and appreciate the role of product specialization. These observations support that a successful economic development is influenced to a large extent by product specialization.

The East Asian model of development can be generalized as an export-led growth strategy (Cline, 1982). Furthermore, Love (1984) illustrated that "export performance in most countries is relatively more sensitive to domestic factors, particularly the ability to compete in the world market, than to other factors (such as market condition)".

Dorado (1991) who investigated the comparative advantage of exports and growth by employing cross-section analysis for less-developed countries found a strong correlation between economic growth and the proportion of manufactures and processed primary products. The findings revealed that the level of development is a crucial determinant of the degree of manufacturing and processing in a country's export basket. The results also suggest that the composition of exports affects economic growth as well. Thus export promotion with high production efficiency enables the manufacturers of processed goods to be more competitive in the world market.

4. Overview of the Relevant Issues in Laos

4.1 Trade Performance

To achieve the goals of the 7th National Social Economic Development Plan (NSEDP)[5], one of policies considered was to frame export as the country's engine for growth and development. Consequently, Lao PDR has joined the ASEAN in 1997, the Greater Mekong Sub-Region (GMS) in 1992. Recently, Laos has been negotiating its WTO accession at the global level. Lao PDR has also been given a favorable trade preference by the United States as stipulated in the Normal Trade Relationship agreement since 2004. Furthermore, Lao's exporters have recently received the Generalized System of Preferences (GSP) from 36 countries including the European Union. Hence, [6]Laos has broadened its trade relations with more than 60 developed and developing countries.

The country's main trading partners are the neighboring countries of Thailand, China and Vietnam with export shares of 29.04%, 15.02% and 15.03% in 2009 respectively. Most of the exports were agricultural products, wood products, garment and electrical energy in the 1990s. Since 2000, the changes of export structure of Lao PDR wrought by the slow rate of infrastructure development and policy concerns which resulted to a boom in the mining and hydropower sectors, as seen in 2010, comprising 58.61% and 16.15% of the total export shares respectively. One of the reasons for the changes may be the high trade cost in Laos. There is therefore less incentive for investors to focus on low value-added products like agricultural and some manufacturing goods for export (Record and Nghardsaysone, 2010; Neary, 2009 and Pugel, 1981). Hence, since 2000 FDIs have flowed in the hydropower and mining sectors, for instance, approximately 60% of the total (Ministry of Planning and Investment of Laos, 2009). Thus the Lao government should be cautious and reconsider its policies to foster sustainable exports growth.

4.2 Infrastructure Development

To enhance economic and trade development, the infrastructure and logistics which are needed to facilitate and drive various economic activities must be developed to lower the trade costs. Therefore, the Lao government sought to transform the country's status from a landlocked to land-linked economy. In year 2004 the Lao-Thai Transit Agreement was finally ratified after its initial proposal in 1999. Laos also signed a similar agreement with Vietnam. Besides bilateral discussions, Laos has joined two strategic economic groupings which emphasize to provide the frameworks for improving logistics, namely; the ASEAN[7] and the GMS[8] frameworks. However, Laos still has not implemented the appropriate infrastructure improvements (Record and Nghardsaysone, 2010) and it suffers from geography.

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[5] The 7th NSEDP's ambitious plan consists of six major points: rapid growth, stability and sustainability; comprehensive basic infrastructure, especially in the rural areas, connecting them to regional and global trade; improving governance efficiency, transparency, and solving all obstacles; achieving the country's MDGs; international integration; and openness to trade.

[6] Ministry of Industry and Commerce, 2009. *Market Access Opportunities for Lao PDR*, Foreign Trade Policy Department

[7] ASEAN Framework: the first is to facilitate goods in transit signed in 1998; the second is signed the agreement on multimodal transport in 2005 and the third is ASEAN roadmap for the integration of the ASEAN logistics sector in 2007.

[8] Great Mekong Sub-Region, GMS framework. The most current update was the signing of the GMS Cross border Transport Agreement (CBTA) in 2007.
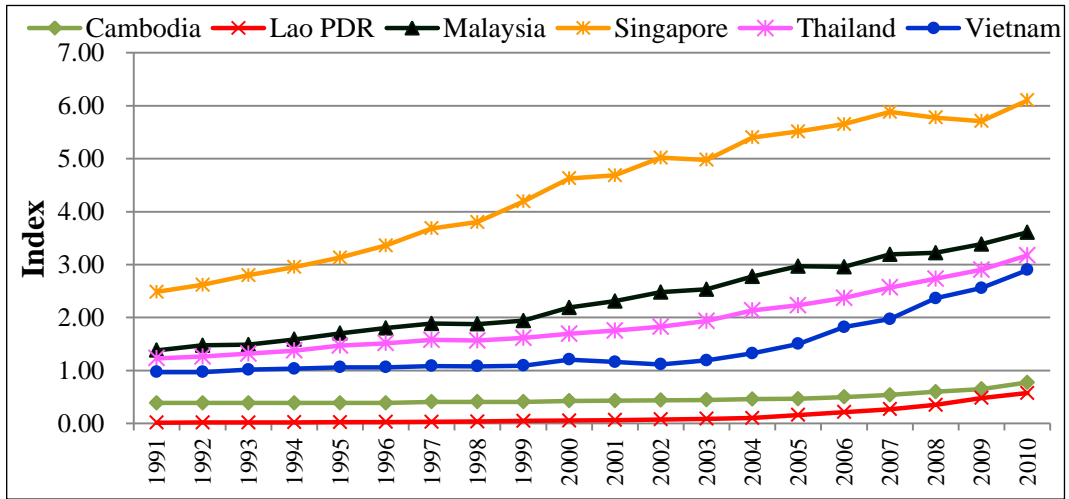
Figure 4.1 Comparison of infrastructure development in Lao PDR and its surrounding
        countries from 1991-2010

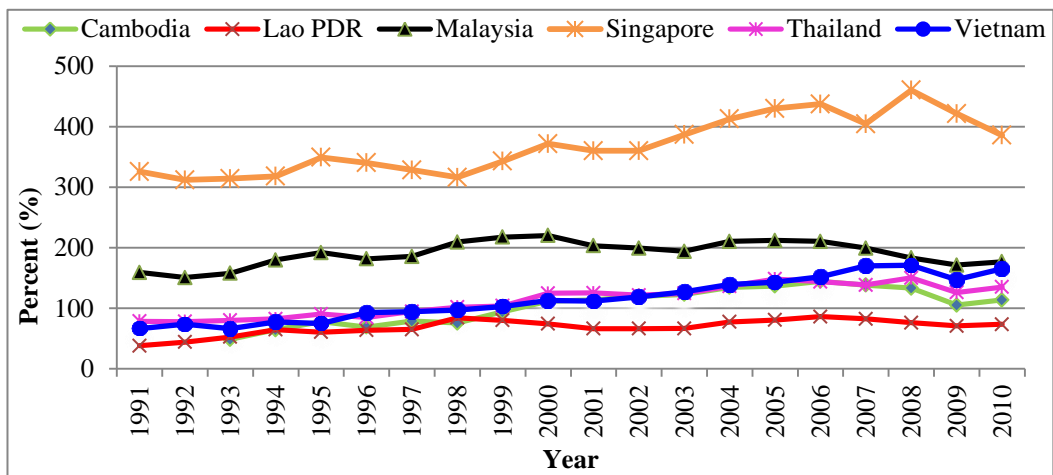Source: WDI databases (2011) and calculated by author

Figure 4.2 Comparison of the trade-to-GDP ratio of Laos and its surrounding countries

Source: WDI database (2011)

When compared to the other countries in the region (Fig. 4.1)[9], Laos has the lowest
infrastructure development. These observations can be correlated to the effect of
infrastructure performance on the trade-to-GDP ratio or trade openness (Fig. 4.2). There
appears to be a correlation between the level of infrastructure development and higher
economic development as well as broader trade. Thus a few decades, the Lao government
emphasized its investments on infrastructure by extensively constructing the road networks
and linking them with regional logistics development. However, the government's budget

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[9] To generate this index by using UNDP Max-Min approach with 8 indicators were assigned as follows: 1. Rail
    way length density (km per square km of surface area), 2.Road length density (km per sq. km of surface area),
    3.Air transport freight (million tons per km), 4.Air transport, passengers carried (percentage of total
    population), 5.Aircraft departures (per airport), 6.Fixed line and mobile phone subscribers (per 100 people),
    7.Internet users (per 100 people), and 8.Electric power consumption (kw/h per capita).

invested in infrastructure development ratio to GDP is seemingly a small amount such only 4.4% on average from year 2005 to 2009 reported by the MOF[10]. Consequently, infrastructure development must be prioritized because of its considerable potential for socio-economic development.

5. Methodology and Data

5.1 Export specialization Index

To determine the potential products for export specialization, several approaches can be applied (e.g Balassa, 1965; Lafay, 1992, etc.). In this work developed from Lafay (1992), the Lafay index (LFI) was used because it is appropriate and can be easily applied in an empirical study. Furthermore, *LFI* is its boundary value which controls the effects of cyclical factors on trade flows in the short run (Caselli and Zaghini, 2005). In addition, the *LFI* also considers the import side and weight of that product.

The *LFI* defines a country's trade specialization with regards to a specific commodity as the difference between the trade balance of that commodity and the country's overall trade balance, weighted by the commodity's share of total trade. The *LFI* formula used in this study is

$$LFI_{c,t} = \left[\frac{(X_{c,t} - M_{c,t})}{(X_{c,t} + M_{c,t})} - \frac{\sum_{c=1}^{N}(X_{c,t} - M_{c,t})}{\sum_{c=1}^{N}(X_{c,t} + M_{c,t})} \right] \cdot \left[\frac{(X_{c,t} + M_{c,t})}{\sum_{c=1}^{N}(X_{c,t} + M_{c,t})} \right] \quad (5.1)$$

Where *X, M, c, t* and *N* denote export, import, commodity, year and number of commodities respectively, for each commodity c; the $LFI_{c,t}$ index takes values between (+) 50 and (−) 50, which represent the boundaries in the case of full trade specialization and full de-specialization, respectively.

5.2 Empirical Analysis

This paper separates analysis of the aggregated and disaggregated models with the augmented gravity model as developed in Bougheas et al. (1999), Limao and Venables (2001), Baltagi et al (2003), De (2006, 2007. The unbalanced panel data, generalized least square (GLS)[11] -transforming from OLS by the first-order autoregressive approach and seemingly unrelated regression-SUR (Zellner, 1962 and Wooldridge, 2002. Pp 163-167) were used to produce robust results. The results of this study are symptomatic of the lack of efficiency of the OLS estimators; hence, transformation to the GLS and the application of the SUR are implied. An inherent problem with the transformation method is the presence of disturbances which are correlated across the equations. The transformation approach yields unbiased and consistent estimates for each of the equations, while remaining the correlations of the disturbances with inefficient estimations. The SUR methods can help solve this problem to achieve greater efficiency estimations.

This study attempts to subtract the products with low trade cost (i.e. mining and electricity) from the models to avoid the biased estimations. Assumed that they are less sensitive with trade cost, if they were included in the data set, the model would be outlier and result of the higher variance of residual. The models were separated because of their inherent gaps in analysis and complement with each other.

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[10] The data is derived from "Lao PDR Economic Monitor" in various issues by World Bank office, Vientiane.
[11] Please refer to Gujarati, 2004, Pp. 477-478 to transfer from OLS to GLS approach

Extensive empirical studies suggest that when panel data is used for analysis, the fixed or random effects must be considered by using the Hausman Test[12] to compare the random and fixed estimators which one is appropriate. In summary, both the fixed and random estimators extremely finalize and imply to get robust results. Hence, in this work based on the classical assumption of econometrics and the data set, the GLS approach like random effect is satisfactory for the analysis.

5.2.1 The Aggregated Model (Model 1)

Laos was a single export country to 24 of its trading partner countries (Appendix 2) from 1986 to 2010. Since there are essentially no costs incurred for export, electricity can be subtracted from the data set in this model. While, the export values of mining cannot be deducted from the data set because of data not available in detail. The main components of trade costs (T_{ei}) represented in this work consist of the infrastructure development index (trade mobility infrastructure, TMI) the inverse of the trade cost, the transaction cost (TRC) and geographical distance (DIS) as shown in Eq.5.2.

$$EX_{ei} = \varphi(GDP_e)^{\emptyset_1}(GDP_i)^{\emptyset_2}(T_{ei})^{\tau}(\varepsilon_{ei}) \qquad (5.2)$$

or $\quad \text{Ln}EX_{ei} = \emptyset_0 + \emptyset_1 \text{LnGDP}_e + \emptyset_2 \text{LnGDP}_i + \tau(\beta \text{Ln}x_{eit} + \gamma \text{Ln}X_i + \delta \text{Ln}X_e + \delta \text{Ln}X_t) + \mu_{ei}$

where the second equation is obtained by taking the natural logarithms and substituting the equation for the trade cost from Eq. 2.2. This can then be expressed as:

$$\text{Ln}EX_{ei,t} = \beta_0 + \beta_1 \text{Ln}GDPT_{ei,t} + \beta_2 \text{Ln}DGDPC_{ei,t} + \beta_3 \text{Ln}TMI_{i,t} + \beta_4 \text{Ln}TMI_{e,t} +$$
$$\beta_5 \text{Ln}RER_{ei,t} + \beta_6 \text{Ln}TRC_{ei,t} + \beta_7 \text{Ln}Dis_{ei} + \varepsilon_{ei,t} \qquad (5.3)$$

For a detailed definition for each of these variables please refer to next section

5.2.2 The Disaggregated Model (Model 2)

This model (Eq. 5.4) examines the product level exported from Laos to its 12 main trading partners by selecting the top ten products exported (4 digit, HS) to each country from 2001 to 2010. This model excludes mining and electricity because both commodities have low trade costs compared to the other products and to avoid bias in estimation.

$$\text{Ln}EX_{ei,c,t} = \beta_0 + \beta_1 \text{Ln}GDPT_{ei,t} + \beta_2 \text{Ln}DGDPC_{ei,t} + \beta_3 \text{Ln}TMI_{i,t} + \beta_4 \text{Ln}TMI_{e,t} +$$
$$\beta_5 \text{Ln}RER_{ei,t} + \beta_6 \text{Ln}(LFI_{c,t}+5) + \beta_7 \text{Ln}DIS_{ei} + \varepsilon_{ei,t} \qquad (5.4)$$

Data Sources, Definitions and Sign Expectation of Variables

For aforementioned models, *e* and *i* refer to the exporting and importing country, respectively, *c* is the commodity, *t* denotes the year and Ln refers to the logarithmic form. Each monetary variable is reflected in real terms with base year 2000.

◆ **Ex** refers to the real export values from Laos to its trading partners (CIF value) in US dollars by reflection of the GDP deflator taken from WDI (2011). Export data is derived from the DOTs for the aggregated model, while the disaggregated model was obtained from COMTRADE.

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[12] Please refer to Wooldridge, 2002, Pp. 288-291

◆ **GDPT** denotes the sum of the real GDP for both the importing and exporting countries that reflects the economic sizes both demand and supply sizes. The summation of the GDPs for the two countries might appear irregular thus the following explanation. Unfortunately, the GDP for both the importing and exporting countries are strongly correlated to the Trade Mobility Infrastructure. In the classical assumption econometrics, hence, the combination of the GDPs represents a proxy of the economies of the two trading countries is needed. The data is derived from WDI and this variable is expected to hold a positive sign as suggested by Baltagi et al., (2003).

◆ **DGDPC** is difference of the real GDPs per capita or the difference of the relative factor endowments between Laos and its partner country. Linder (1961) observed that countries with similar demands will trade similar goods. Krugman and Helpman (1985) and Baltagi, (2003) determined that a negative sign is associated with this variable vis-a-vis export. Krugman (1980) further noted that countries with inequalities in their incomes will trade less with each other. DGDPC can be written in terms of the absolutely logarithmic scale as follows: $LnGDPPC_{ei,t} = |LnGDPPC_{e,t} - LnGDPPc_{i,t}|$. The data used was obtained from WDI (2011).

◆ **TMI** computed as $TMI_{k,t} = \sum_{x=1}^{8} \left\lfloor \frac{(Actual_{x,t} - MIN_x)}{(MAX_x - MIN_x)} \right\rfloor$ denotes the trade mobility infrastructure. The equation was developed by the UNDP (derived from De, 2006) where k and t denotes the country and time, respectively. The x values refer to the 8 indicators[13]. Limao and Venables (2001) and De (2006, 2007) designated a positive sign for the TMI. The main data was derived from the WDI, while some of the missing data was collected from the specific websites of the countries.

Infrastructure measures are used as a proxy to measure a country's characteristics to enhance the movement ability of merchandise in inverse of trade costs. To assess the impact of infrastructure facilities on bilateral trade, TMI which is composed of eight infrastructural variables for each individual country, was used. In theory the FOB and CIF prices are borderline values and thus it would seem that one's own and one's trading partner's infrastructures as defined should not affect these rates.

◆ **RER** is the bilateral real exchange rate of the Lao currency against each of its partner country's currency. It is defined as $RER_{ei,t} = \left| \frac{NER_{e/USD}}{NER_{i/USD}} \right| x \left| \frac{CPI_i}{CPI_e} \right|$; where $NER_{e/USD}$ and $NER_{i/USD}$ refer to the nominal exchange rate of an exporting and importing country's currency against the US dollar respectively. The data was derived from IFS CD-ROM and WDI. RER is expected to have a positive effect on export.

◆ **TRC** is the transaction cost defined as the ratio $[(CIF_{ie,t}/FOB_{ei,t}) = (IM_{ie,t}/ EX_{ei,t})]$ where the CIF consists of the cost, insurance and freight recorded by world markets (*i*) for imported products from Laos (*e*) and simultaneously the FOB (free on board) recorded by Laos exported products to the world markets (*i*) in a particular year. This ratio does contain information about the cross sectional variations in border issues-the border cost. If the ratio is high, the volume of exports will be lesser. The data was derived from the Direction of Trade Statistics CD-ROM (2011). Limao and Venables (2001), Baltagi et al., (2003) and De (2006, 2007) indicated that the TRC has a negative impact on export.

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[13] Please refer to footnote 9th

To estimate TRC more accurately, two main data issues must be resolved. First, partner countries with the missing data are dropped from the analysis. Second, ratio values which are less than 1 (i.e. FOB >CIF) are dropped as well. An important point suggested by Limao and Venables (2001) is that all trading partners with zero trade reported or those that have no trade can be assumed to have too high trading costs hence, both the exporting and importing countries will not profit from trading with each other. Thus, for countries with reported zero trade, the transaction cost of trading is assumed to be the maximum available value calculated in the data set.

◆ **LFI** is the export specialization index defined in Equation 5.1. It is one of the proxies used to determine whether or not a product has a potential for export. If the LFI is desirable based on the Lafay index, it can be assumed that the product has a low opportunity cost of production. Indeed, the export specialization index is a representative proxy to estimate the rough cost of production. LFI is predicted to have a positive effect on export and data was derived from the UN-COMTRADE.

◆ DIS is the geographical distance between the capital of Laos to the capitals of the importing countries. The greater the distance, the higher the transaction and transportation cost, thus a negative relationship is expected.

◆ ε_t is the random disturbance which is assumed to be normal, and identically distributed (IID) with E($\varepsilon_{ei,t}$) = 0 and Var($\varepsilon_{ei,t}$) = $\sigma^2 > 0$.

6. Estimation Results

The results of the estimations are as shown in Table 5.2. Both heteroskedasticity and autocorrelation were detected and remedied in the specification models by finalizing the test of Breusch-Pagan test for detecting Heteroskedasticity and Breusch-Godfrey test for detecting Autocorrelation. The tests confirm that there are no those problems exist.

6.1 Aggregated Model (Model 1)

The results for the aggregated model (Table 5.2) revealed that the sum of the GDPs of two countries is significant at the 1% level, that is, it supports the theory that an increase of demand and supply can stimulate export. However, the difference of GDP per capita is not significant in explaining the export performance of Laos which may be due to the high proportion of the natural resource product in data set.

When bilateral real exchange depreciation occurs, the imported products appear cheaper than the goods produced locally. This results in an increase in the demand for imports to substitute for the locally-produced products. In this work, the result from the aggregated model is not consistent with theory. When the bilateral real exchange rate is appreciating, the export volume maintains an increasing trend. This may be explained in part by the fact that since the year 2000, a major proportion of the exported products are obtained from natural resource. Furthermore, the worldwide demand for mining products such as gold and copper has remained high. Even if the real exchange rate is appreciative, it has no much effect as the demands on natural resources. Its coefficient however is very low, such that a 10% appreciation of the RER increases the export by only 0.75%.

The infrastructures development indexes (TMI) of both the importing and exporting countries have statistically significant (positive) effects on export at the 1% and 5% levels respectively. These results imply that when infrastructure is improved, the costs related to product delivered might diminish. When the TMI of the importing (exporting) country

increases by 10%, it can raise the exports of Laos by 5.57% (3.71%).

The transaction cost and distance were absolutely negative at the 1% significance level. A large transaction cost or a high ratio of the CIF/FOB indicates the border costs will be high. A 10% increase of the CIF/FOB ratio can result in a decrease in exports by as much as 10%. Similarly, if the trade partner imposes higher relevant delivery costs, a decrease in exports is expected.

6.2 Disaggregated Model (Model 2)

The focus has been mostly on the agricultural and manufacturing products where the contributions of both the electrical energy and mining products were deducted to isolate the impact of sensitive commodities. In general, the results were satisfactory and consistent with the theories. Given a more precise view of the results, GDPs were also found to be significant at a 1% level. If the GDPs increase by 10%, the exports will increase by 4%.

The difference of GDP per capita has a completely negative effect on export at the 1% significance level. This finding supports the observation that countries with inequalities income will trade less with each other, confirming Linder`s (1961) and Krugman and Helpman's (1985) hypotheses. Countries with similar relative factor endowments, whose taste and preference can be inferred to be similar, will trade more with each other. A 10% shift in income inequality results in a decrease in exports by 6.8%.

The bilateral real exchange rate was associated with trade theory at the 5% significance level. Conducting the analysis at the by-products level was seemingly more sensitive in terms of the relative price change compared to the aggregated model including natural resources. The result shows that the depreciation of the local currency against the trading partner's currency by 10% leads to an increase in exports by 1.3%.

The infrastructure development index (TMI) at both the home and importing countries were statistically significant at the 5% and 10% levels, respectively. These results suggest that the development of infrastructure can influence the relevant trade costs reduction. In the case of Laos, however, the empirical results indicate that the infrastructure development of the importing country has a stronger effect on export than in the home country. It was obviously clear that a 10% improvement on the importing (exporting) country's infrastructure development can accelerate the growth of exports of Laos to 8% (2.5%). These findings are in agreement with the results in Banomyong (2008), Bougheas et al. (1999), Brooks (2008), Limao and Venables (2001), De (2006, 2007).

One of the most important variables is the export specialization index (LFI). It plays a crucial role in accelerating the spillover of the export performance and can advocate trade theories as well. The LFI described in Equation 5.1, proxies for the export potential of a particular product to infer the opportunity cost for a particular commodity production in comparison with another product produced elsewhere. Thus, A 10% increase in specialization can significantly lift the export volumes by up to 42.5%.

The distance variable is statistically significant at the 1% level. This implies that the farther away the trading partner is located, the higher the transport and transaction costs that are incurred. In fact, a 10% increase in the distance results in a 7.8% exports reduction.

Table 6.1. The results of the model estimations

Dependent variables are LNEX$_{ei,t}$(1) &LNEX$_{ei,c,t}$(2)		
Variable	**LNEX$_{ei,t}$ (1)^a**	**LNEX$_{ei,c,t}$ (2)^b**
Intercept (C)	1.172***(0.392)	0.194(0.610)
LNGDPT$_{ei,t}$(sum of economies size)	0.755 ***(0.076)	0.396***(0.116)
LNDGDPC$_{ei,t}$(different GDP per capital between e and i)	-0.068(0.125)	-0.680***(0.241)
LNRER$_{ei,t}$(bilateral real exchange rate)	-0.075***(0.035)	0.125 **(0.038)
LNTMI$_{i,t}$(infrastructure index i)	0.557 *** (0.211)	0.795 *(0.444)
LNTMI$_{e,t}$(infrastructure index e)	0.371 **(0.173)	0.243**(0.130)
LNTRC$_{ei,t}$(transaction cost)	-0.986***(0.088)	-
LNLFI$_{c,t}$(export specialization index)	-	4.249***(0.573)
LNDIS$_{ei}$(distance from e to i)	-1.141 ***(0.122)	-0.779***(0.173)
R^2	0.310	0.236
BP "Critical value"; n*R^2_r^{2}~x^2	24.21"24.458"	16.678"24.458"
BG "Critical value"; (n-ρ)*R^2_r~x^2	10.529"10.828"	9.9150"10.828"
Observations (N)	489	869

Note: Numbers in parentheses are standard error. *; ** and *** refer to the significant at 10%, 5% &1% representatively. $(1)^a$ and $(2)^b$ refer to equation 4.3 (model 1) and 4.4 (model 2) respectively. *r* refers to residual. **BP** is Breusch-Pagan test for detecting Heteroskedasticity, **BG** is Breusch-Godfrey test for detecting Autocorrelation, if both values are less than critical value, conclusion there are no those problems exist.

7. Conclusions and Policy Implication

7.1 Conclusions

There are extensive studies associated with this work which suggest that infrastructure development is an essential variable that can be quantified by the inverse of the trade cost. Improvements in infrastructure result in the reduction of transportation cost and other relevant costs. As shown in Table 5.1, both models confirm the assertion that the level of infrastructure development not only in the home country, but also in the importing country can accelerate export. While, the magnitude of the infrastructure development level in the importing country has a stronger effect on exports than that of the home country. The distance and transaction costs which are the components of the trade costs, have absolutely significant negative effects on export. One of importance, the empirical results insists that export specialization play an important role in boosting exports.

The sum of the GDPs of Lao and a trading country can determine the export growth with high statistical significance in both the aggregated and disaggregated models. On the other hand, the different factor endowment could not explain export in the aggregated model, while it is statistically significant in the disaggregated model. Interestingly, the bilateral real exchange rate in the disaggregated model indicates that the demand is relatively more sensitive to price than in the aggregated model.

7.2 Policy Implication

The results in this study which were generally consistent with the trade theories, as well as evidences from East Asian models of economic growth (Cline, 1982), etc. suggest that a country must identify and export the products that use its relatively abundant factor intensively and import the products that use its relatively less abundant factor intensively in order to gain from trade. Therefore, the Lao government should raise its specific priorities and concentrate on producing commodities with potential for export.

In term of sustainability, it is recommended that the government should prioritize to specialization products, while to maintain the growth of exports in the long term without relying too much on natural resources[14] especially the mining sector[15], its policies that advocate sustainability of the renewable resources should be clear. Furthermore, the government must also institute programs that will promote the natural products to high quality and value-added products especially in the manufacturing and agricultural sectors.

It is obviously observed that natural resource products exported mostly are less processed. To absorb particular mining sector contribution, government should encourage and facilitate investors to invest on semi-transforming or produce products in order to create value added, as well as create job opportunity, even though it is exported only raw materials or without any process.

Even though Lao PDR's growth remained robust in 2011 (World Bank, 2011) with a projected growth of 8.6%, around 3.6% of this is attributed to products from the country's natural resources, while about 1% point each comes from manufacturing and agricultures. This trend is caused by the shortage of experienced and skilled labor since most workers received no training and had no specific skills. Most workers finished or attended primary and lower secondary schools only (UNDP, 2006; GTZ et al., 2009; and ERIT, 2010). The garment and wood processing sectors need semi-skilled and skilled labors. This demand must first be satisfied by instituting policies that advocate support for technical and vocational schools in order to improve the labor skills and raise a sufficient labor supply. In addition, specific trainings their respective enterprises should be given to the workers for the improvement of the knowledge and skills in particular areas.

The wood products sector has also encountered deficiencies in raw materials since its inputs are mostly obtained from forests. Thus, the government should work closely with the firms concerned to draw concrete and long term sustainability plan for their source operations. The government can provide land accession[16] along with the necessary technical assistance. Furthermore, the importation of new machinery to upgrade the firms' capability should be also facilitated by granting soft loans.

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[14]From a macroeconomic perspective, the instability which might have resulted from the negative effects of the Dutch Disease (Benjamin N.C., et al., 1989; Davis, 1995; Usui, 1996); income contribution and other aspects should be avoided by maintaining export growth based on the concept of sustainability (Brundtland Commission, 1987; Lele, 1988; Redclift, 1992; etc.).

[15]The LFI indicated that the mining sector has a very high potential for export specialization; however, in the sustainable context, it will not work. What the government can do is to utilize sources from the mining sectors and distribute them to the other sectors which also have a potential for export specialization for maintain income contribution whose products can be sustainable.

[16]According to ERIT's survey incorporated with ERIA team, 2010 reported that firms require accessing the land to plant trees for supply as the input, but it is still constraint.

Even though the Lao economy is traditionally-based on agriculture, most of its agricultural products are exported in their primary forms with less processing, hence the commodities produced are lack diversity. Each of the agricultural products (HS 4 digit) that Laos has exported to its main trading partners is in very small proportion compared to the same products that those countries have imported from the world[17]. Therefore, the government should encourage and attract foreign as well as domestic investments to increase product diversity though the post-harvest processing of agricultural products. New technologies and techniques[18] should be promoted to increase the productivity as well.

Besides focusing on producing renewable products, The Lao government can also participate in regional linkages to shift from a land-locked to a land-linked economy with its neighboring countries along with infrastructure development in order to deliver goods through borders and transit countries more smoothly. Furthermore, alternative transport modes, such as like air freight, are needed to support trade expansion activities. The empirical estimation results suggest that the transaction cost (TRC) associated with the infrastructure of the importing country significantly affects the export performance of Laos. They should be gradually eliminated to lessen the effects of border issues via transiting countries; the increase in export volume can be more effectively stimulated.

8. Limitation of study

Trade cost is a critical issue and consists of several components of infrastructure. However, due to limitations on data availability, not all indicators were included in the models. For instance, trade policy is also composed of the tariff, details on border issues, institutional efficiency, and others which were not included in this study.

The computed values for the proxy to the transaction cost variable which is the ratio of the CIF to the FOB may be irregular for some of the countries considered in the analysis. This is especially true for countries where, for several years, the CIF values were smaller than the FOB.

Since the cost of production could not be directly measured, its analysis was based on the conceptual comparative advantage or the export specialization index. Another source of error could be the fact that the product quality was not considered in terms of international trade.

The aim of this study was to have a broader and more exhaustive understanding of issues that are related to exports in Laos. However, due to the limitations mentioned above and the non-inclusion of other variables because of econometrics assumptions, the results obtained may not thoroughly reflect the actual situation. Further studies which consider the aforementioned limitations must be performed to get more accurate results.

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[17]The share is less than 1 percent calculated from COMTRADE data from 2001 to 2010.
[18]According to ERIT's firms survey in northern part of Laos in July, 2010, illustrates that firms have few technical assistance and support of new technique and assistance from local officials as well as Sola, 2009.

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Appendix

Appendix 1. The list of product items exported to the 12 countries in the disaggregate model

Code	Product label	Code	Product label
0106	Live animals, nest	6107	Men's underpants, pajamas, bathrobes etc,
0704	Cabbages and cauliflowers, fresh …	6108	Women's slips, panties ; etc
0901	Coffee	6109	T-shirts, singlet and other vests, knitted …
1005	Maize	6110	Jerseys, pullovers, cardigans, etc
1006	Rice	6111	Babies' garments, knitted or crocheted
1008	Buckwheat, millet and canary seed	6112	Track suits, ski suits and swimwear; etc
1207	Oil seeds	6115	Panty hose, tights, stockings ; etc
1212	Locust beans	6201	Men's overcoats, capes, wind jackets etc
1301	Lac; natural gums, resins, gum-resins & balsams	6202	Women's overcoats, capes, wind-jackets etc
2005	Prepared or preserved vegetables	6203	Men's suits, jackets, trousers etc & shorts
2517	Pebbles, gravel, Brocken…	6204	Women's suits, jackets, dresses skirts etc & shorts
2520	Gypsum; anhydrite; plasters	6205	Men's shirts
3301	Essential oils; etc	6211	Track suits, ski suits and swimwear; other garments
3923	Plastic packing goods ; etc	6212	Brassieres, girdles, corsets, braces, suspenders, etc.
4001	Natural rubber, balata ; etc	6402	Footwear, outer soles and uppers of rubber or plastics
4402	Wood charcoal	6403	Footwear, upper of leather
4403	Wood in the rough	7113	Articles of jewelry & parts thereof
4407	Wood sawn; etc	8112	Beryllium, chromium, germanium, etc
4409	Wood continuously shaped along any edges	8429	Self-propel bulldozer, angle dozer ; etc
4419	Tableware and kitchenware of wood	8504	Electric transformer, static converter
6101	Men's overcoats, capes, etc	8509	Electro-mechanical domestic appliance; etc
6103	Men's suits, jackets, trousers etc;	8516	Electric instantaneous water heater; etc
6104	Women's suits, dresses ; etc	8544	Insulated wire/cable
6105	Men's shirts, knitted or crocheted	8703	Cars (incl. station wagon)
6106	Women's blouses & shirts; etc	9404	Mattress supports; mattresses, quilts, etc

Appendix 2. The trading partner-countries which import products from Laos for both the aggregated and disaggregated data models

- **Aggregated Data:** Australia, Belgium, Canada, China, China-Hong Kong, Denmark, France, Germany, Ireland, Italy, Japan, Korea, Malaysia, Netherland, Nigeria, Norway, Singapore, Spain, Sweden, Switzerland, Thailand, United Kingdom, United States, and Vietnam

- **Disaggregated Data:** Belgium, China, Demark, France, Germany, Japan, Korea, Netherland, Thailand, United Kingdom, United States, and Vietnam

Appendix 3. The ordinary correlation matrix for the aggregate and the disaggregate models

Aggregate Data, Model 1						
	LNGDPT	LNDGDPC	LNRER	LNTMIi	LNTMIe	LNTRC	LNDIS
LNGDPT	1.0000						
LNDGDPC	0.3586	1.0000					
LNRER	0.0780	0.4316	1.0000				
LNTMIi	0.4489	0.6253	0.2010	1.0000			
LNTMIe	0.0975	-0.1872	-0.1690	0.4607	1.0000		
LNTRC	0.0050	0.0005	-0.0971	0.0452	0.0486	1.0000	
LNDIS	0.3725	0.4487	0.3194	0.3303	-0.0112	-0.0287	1.0000

Disaggregate Data, Model 2						
	LNGDPT	LNDGDPC	LNRER	LNTMIi	LNTMIe	LNLFI	LNDIS
LNGDPT	1.0000						
LNDGDPC	0.5894	1.0000					
LNRER	0.5081	0.5056	1.0000				
LNTMIi	0.4405	0.7153	0.4124	1.0000			
LNTMIe	0.0274	0.0912	0.0720	0.2563	1.0000		
LNLFI	0.0080	0.0326	0.0078	0.0506	0.2384	1.0000	
LNDIS	0.6231	0.7740	0.5797	0.7152	0.0033	0.0134	1.0000

Appendix 4. The method of generalized least squares (GLS)

The following procedure is for a two-variable regression model:

$$Y_t = B_1 + B_2 X_t + u_t \tag{1}$$

Assume that the error term follows the AR (1) scheme, namely

$$u_t = \rho u_{t-1} + \varepsilon_t \tag{2}$$

When ρ is known

If (1) holds true at time t, it also holds true at time (t-1)

$$Y_{t-1} = B_1 + B_2 X_{t-1} + u_{t-1} \tag{3}$$

Multiplying (3) by ρ,

$$\rho Y_{t-1} = \rho B_1 + \rho B_2 X_{t-1} + \rho u_{t-1} \tag{4}$$

Subtracting (4) from (1) gives

$$Y_t - \rho Y_{t-1} = B_1(1 - \rho) + B_2(X_t - \rho X_{t-1}) + u_t - \rho u_{t-1} \tag{5}$$

$$Y_t^* = Y_t - \rho Y_{t-1} \; ; \; B_1^* = B1(1 - \rho) \; ; \; X_t^* = (X_t - \rho X_{t-1}) \text{ and } \varepsilon_t = (u_t - \rho u_{t-1})$$

Hence: $\qquad Y_t^* = B_1^* + B * 2X_t^* + \varepsilon_t \tag{6}$

Appendix 5.   The concept of seemingly unrelated regression (SUR)

The basic setup of SUR is based on following set of equations:

$$Y \quad = \quad X\beta + \varepsilon \tag{1}$$

$$\hat{\beta} \quad = (X'X)^{-1} X'Y \tag{2}$$

$$\text{(kx1)} \quad \text{(kxk)} \quad \text{(kxn)(nx1)}$$

Equation (2) is the fundamental result of the OLS theory in matrix notation.

The problem is the presence of disturbances which are correlated across the equation (the cross section N). OLS will yield unbiased and consistent estimates for each separate equation. However, because the approach ignores the correlations of the disturbances the estimates will not be precise.

Estimate via GLS yields:

$$\widetilde{\beta} = (X'\Omega^{-1}X)^{-1} (X'\Omega^{-1}y) \tag{3}$$

SUR can help to solve this problem by using the equations either in succession or autoregressively, in order to achieve greater efficiency in the estimates. The inclusion of Ω^{-1} improves the efficiency of the estimates, especially when the disturbances are highly correlated.

Calculation Process:

1.   Estimate via OLS, obtain residual

2. Estimate $\hat{\Omega}$ (variance-covariance of regression disturbances unknown; the variances appear along the diagonal and covariance appear in the off-diagonal elements)

Appendix 6. Comparison of data with and without GLS Transformation

	A(1)	B(1)	A(2)	B(2)
Using GLS approach: Depend variable are $LNEX_{ei,t}(1)$ &$LNEX_{ei,c,t}(2)$				
Variable	A(1)	B(1)	A(2)	B(2)
Intercept	4.979***	1.172***	4.366*	0.194
	(0.477)	(0.392)	(2.332)	(0.610)
$LNGDPT_{ei,t}$	0.837***	0.755 ***	0.160**	0.396 ***
	(0.015)	(0.076)	(0.080)	(0.116)
$LNDGDPC_{ei,t}$	-0.4138***	-0.068	-0.574***	-0.680 ***
	(0.046)	(0.125)	(0.172)	(0.241)
$LNRER_{ei,t}$	-0.0907***	-0.075 ***	0.139 ***	0.125 **
	(0.009)	(0.035)	(0.035)	(0.038)
$LNTMI_{i,t}$	0.357***	0.557 ***	0.827 ***	0.795 *
	(0.072)	(0.211)	(0.282)	(0.444)
$LNTMI_{e,t}$	0.756***	0.371 **	0.260 ***	0.243**
	(0.068)	(0.173)	(0.096	(0.130)
$LNTRC_{ei,t}$	-0.338***	-0.986***	-	-
	(0.081)	(0.088)	-	-
$LNLFI_{c,t}$	-	-	4.431 ***	4.249 ***
	-	-	0.490	(0.573)
$LNDIS_{ei}$	-0.906***	-1.141 ***	-0.519 ***	-0.779 ***
	(0.038)	(0.122)	(0.173)	(0.173)
R^2	0.759	0.310	0.206	0.236
BP (critical value); $(n*R_r^2) \sim x^2$	59.329 (24.458)	24.218 (24.458)	137.429 (24.458)	16.678 (24.458)
BG (critical value); $(n-p)*R_r^2 \sim x^2$	335.544 (10.828)	10.529 (10.828)	617.137 (10.828)	9.915 (10.828)

Note: *A and B* means the model before transforming and after transforming respectively. 1 and 2 refer to aggregated model and disaggregated model respectively. Numbers in parentheses are standard error. *; ** and *** refer to the significant at 10%, 5% &1% representatively. r refers to residual. **BP** is Breusch-Pagan test for detecting Heteroskedasticity and **BG** is Breusch-Godfrey test for detecting Autocorrelation if both values are less than critical value, those insist no Heteroskedasticity and Autocorrelation problems exist.