The Role of Public Sector Investment for Economic Development in Emerging Countries: The Case of Lao PDR

Osamu Nakamura
The International University of Japan

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The International University of Japan
777 Kokusai-cho, Minami Uonuma-shi, Niigata, 949-7277 Japan

Abstract
Recently, the Lao PDR has achieved high economic growth at around 7-8 percent annually which is very stable and robust growth in Asian economic dynamics, in particular in ASEAN. Vital public investments play an important role to develop social infrastructures and then strengthen the supply-side economy. This paper analyzes the macroeconomic structure and causes of high economic growth of Lao PDR by utilizing a macroeconometric model. According to the econometric analysis, vital public sector investment behaviors have caused to strengthen the supply-side economy and exports, which resulted in foreign capital and public investment increases through its virtuous circle.

Keywords: public sector investment, take-off stage, macroeconometric model, scenario simulation, co-integrating relationships

JEL codes: E17, E51, C01

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1. Introduction

Since the middle of the 1990s economic dynamism in the economies of Indo-China peninsula has been remarkable. In particular, the performance of the new ASEAN countries’ economies has been strong, achieving a steady progress in economic development and increasing exports to the rest of the world. Since participating in ASEAN, these countries, including Cambodia, Lao PDR, Myanmar and Vietnam, attracted foreign capital and increased high value-added products within the transition economy from a centrally planned to a market oriented economy. It seems that these countries’ economies have achieved a pre-take-off or an early stage of take-off, as an emerging economy, since the early 2000s.

The export-led FDI has played a significant role for economic development in these countries. Indeed, it might be viewed as one of the major driving forces in the country’s economic growth. At the same time, economic dynamics can be seen in the other ASEAN member countries with rebalancing foreign capital in Asia which results in a favorable influence to new ASEAN member countries.

Among these new ASEAN countries, Lao PDR has achieved steady and high economic growth, recently, with strong investments. It is expected that the Lao economy will continue higher economic growth and will be one of the leading countries in this region in. In addition, public sector investments play an important role to develop the social infrastructure, which attract foreign capital, especially foreign direct investments and strengthen the supply-side economy in Lao PDR as well.
Therefore, this study attempts to analyze the macroeconomic structure and the causes of high economic growth in Lao PDR with an econometric analysis. In addition this paper makes future scenario forecasts of Lao economy by utilizing a macroeconometric model.

An econometric model analysis for Lao PDR has been made in some research projects and papers, in which Kyophilavong (2004), Kyophilavong and Toyoda (2004), Toyoda and Kyophilayong (2005, 2007), Nakamura (2013) and National Economic Research Institute (NERI) of Lao PDR (2014) developed a macroeconometric model and analyzed the Lao economy. These studies, especially Toyoda and Kyophilavong, are a pioneering work for a macroeconometric model analysis for the Lao economy, but econometric modeling in Lao PDR has been improved in line with data base improvement in SNA, current balance, government finance and so on by the Lao government and international organizations. Therefore, it is expected that the more complicated models and econometric analyses will be constructed and applied to the actual economy for the Lao economy.

2. Current Economic Dynamics in Lao PDR
As shown in Figure 1, the Lao economy experienced a fairly steady economic growth in the middle of 2000s, which takes 20 years after the New Economic Mechanism was introduced in 1986. Although the economy was damaged by the 2008 World Financial Crisis, it maintained a high growth performance at 8.8 percent in 2008, at 7.5 percent in 2009, 8.1 percent in 2010, 8.0 percent in 2011 and 7.9 percent in 2012 in terms of real GDP, in which the real economic
growth rate exceeds inflation.

Figure 1: Real GDP Growth and Inflation in PGDP, 1990-2012

The fairly high economic growth of Lao PDR has been attributable not only to economic dynamism of Asian countries, but also to the economic dynamics in Lao PDR with structural changes brought by Lao economic policies. With the high economic growth, per capita income of Lao PDR exceeded US$1,000 and achieved US$1,024 in 2010 as China did in 2002 and Vietnam did in 2008. This explains that Lao PDR has been one of the leading countries in this region as an emerging economy.

Owing to the strengthened supply-side economy, trade balance has been improved, gradually, although the economy still has a trade deficit. In addition, FDI inflows have increased since the middle of 2000s, which has contributed to domestic capital formation and hence strengthening the supply-side economy.
3. The Role of Public Sector Investments toward the Take-off Stage

Through Rostow’s (1960) view, we recognize that there exist various stages in the process of economic growth and development and, as Rostow defined, classify them into five stages, including (1) the traditional society, (2) the precondition for take-off, (3) the take-off, (4) the drive to maturity and (5) the age of mass-consumption. In these stages, Rostow emphasized the importance of both the precondition for take-off and the take-off stages with an accumulation of capital and technology to achieve economic maturity for economic development. After the end of the take-off stage, however, most of the economies experienced lower economic growth rates.

In the process of economic development we can observe different driving-forces for growth in the economy. Figure 2 demonstrates the economic structures of a nation in the process of economic development. In the figure, the vertical axis means an aggregate demand which is a macro demand-side
GDP (Yd), and an aggregate supply which is a macro supply-side GDP (Ys), and the horizontal axis refers to time or stage.

Generally, in the initial stage of economic development before $T_1$, the level of the supply-side GDP, which is a function of factors of production, including capital stock (K), labor (L) and technology ($\tau$), is lower than that of the demand-side GDP which consists of demand-side GDP components, including consumption (C), government expenditure (G), investment (I), exports (E) and imports (M), in an open economic system. The demand-side cannot exceed the supply-side so that the demand-side GDP is depressed to the level of the supply-side GDP, as $Y_d'$, and actual economy ($Y_a$) relies on the supply-side GDP ($Y_a = Y_s = Y_d'$). Therefore $Y_d$ is the potential demand-side GDP which is not realized in the economy. (Please see left-hand side in Figure 3.)

On the other hand, when the economy is developing, the supply-side GDP ($Y_s$) is getting strong with capital accumulation and technical progress. With the high growth of the supply-side in the take-off stage, the supply-side GDP exceeds the demand-side at time $T_1$. Since then, the actual economy ($Y_a$) depends on the demand-side GDP ($Y_d$) because the supply-side cannot exceed the demand-side GDP in a long run, and the supply-side GDP ($Y_s$) is depressed to the level of the demand-side, as $Y_s'$ ($Y_a = Y_d = Y_s'$). Therefore, $Y_s$ is the potential supply-side GDP after $T_1$. (Please see right-hand side in Figure 2.)

In the stage before $T_1$, saving ($S$) is smaller than required investment ($I$) to meet the demand-side economy ($I > S$), so that an inflationary gap ($Y_d > Y_s$) results in a demand-pull inflation and trade deficit ($E < M$). In addition, net
capital inflows are positive (F>0) because of trade deficit (E<M) and of I>S. On the contrary, in the stage after T₁, there exist a deflationary gap (Yd<Ys) and trade surplus (E>M) because of I<S. In this stage we cannot observe a demand-pull inflation, but cost-push inflation with a higher labor cost in line with the economic development. Basically, the growth rates are expected to be diminishing after T₁ since the economic growth depends on the demand-side growth performance as Japan and West Germany experienced in the 1970s (Nakamura 2013).

Generally, the economic structure before T₁, in which the demand-side GDP is larger than the supply-side, is a “developing country type economic structure” and after T₁, on the other hand, a “developed country type economic structure”.

Figure 3: Demand-Side and Supply-Side Economy in the process of Economic Development (source: Nakamura 2013)

However, after T₁, the deflationary gap is decreasing since the supply-side GDP tends to meet the demand-side GDP again. Thereafter, the macro
demand-side curve and supply-side curve cross again and again with a business cycle.

Based on our discussion mentioned above, it seems that the Lao economy is now standing at the precondition for take-off and is going to shift to the next stage, the take-off stage, in the near future, in which it is expected to see a higher annual economic growth rate at over 10 percent. According to Rostow (1960), it took over fifty years to achieve the take-off stage from the traditional society in the past when Rostow examined his historical analysis. However, recently, some countries have achieved the take-off stage within a couple of decades from the traditional society.

The major reason of this change might be changes of driving-forces for economic growth. In the past, the major actor for economic growth was international trade. Therein, a nation could strengthen the economy introducing capital goods and technologies through international trade and catch up advanced countries through the process import substitution. Therefore, it took a long time to achieve the take-off stage. On the other hand, recently, foreign capital, especially FDI, directly strengthen the comparative advantage industries and hence the supply-side economy of a nation and achieve the take-off stage.

The Chinese economy implemented a reform and open-door policy in the early 1980s and achieved the take-off stage in the latter half of the 1990s, attracting foreign capital. Therefore, the policies to attract foreign capitals are indispensable for economic growth in the current world economy. In other words, there are severe completions among nations to introduce investments
of multi-national corporations (MNC).

However, it might be difficult for developing countries to strengthen domestic capital formation by private sectors. Therefore, public sector investments play an important role to stimulate domestic capital formation and hence to strengthen the supply-side economy in place of private sectors to take-off stage.

4. Macroeconometric Analysis for Lao PDR

4.1. Global Macro Econometric Model

The global macro econometric model, IUJ-GM26, employed in this study consists of twenty-six country/regional macro econometric models, which cover the entire world economy. The Lao PDR macro econometric model is newly developed and integrated within the global macro model for this study, as a country model (see Table 1).

Table 1: Country and Regional Classification in the Global Macro Model, IUJ-GM26

<table>
<thead>
<tr>
<th>Region</th>
<th>Countries</th>
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<tbody>
<tr>
<td>Asia and Oceania (15)</td>
<td>Australia, New Zealand, China(Mainland),</td>
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<td></td>
<td>Hong Kong, Japan, South Korea, Taiwan, Indonesia,</td>
</tr>
<tr>
<td></td>
<td>Malaysia, the Philippines, Singapore, Thailand,</td>
</tr>
<tr>
<td></td>
<td>Vietnam, <strong>Lao PDR</strong>, other Asian countries</td>
</tr>
<tr>
<td>North America (2)</td>
<td>Canada, the U.S.</td>
</tr>
<tr>
<td>Middle and South America (1)</td>
<td></td>
</tr>
<tr>
<td>Europe and EU (5)</td>
<td>Germany, France, Italy, the U.K., other European</td>
</tr>
<tr>
<td>countries</td>
<td></td>
</tr>
<tr>
<td>Russia and Central Asia (1)</td>
<td></td>
</tr>
<tr>
<td>Middle East (1)</td>
<td></td>
</tr>
<tr>
<td>Africa (1)</td>
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</tbody>
</table>
The global macro-econometric model is designed to study not only macroeconomic structures of each country/region but also global economic perspectives, as a whole, including world trade, world energy demands and so on. At the same time, the model is able to study the impacts of policy changes in one particular nation and of changes in energy prices on each national economy and on the world economy.

Each country/regional macro model is comprised of nine blocks as a general specification, including (1) the real expenditure block, (2) the nominal expenditure block, (3) the prices and wage rates block, (4) the production block, (5) the population and labor force block, (6) the income distribution block, (7) the money and finance block, (8) the public finance block, and (9) the international trade and BOP block. Furthermore, the country/regional model has a similar structure and causation based on economic theories, relying on the general specification of the model in order to make a comparative study in a regression and scenario simulation analysis.

The country/regional macro model is basically a demand-side oriented type model (Keynesian type model) for all economies including advanced market economies, developing market economies and centrally planned economies, since a demand-side model is a more realistic and powerful tool to explain an economic performance in an open economic system (Thirlwall 2002). Furthermore, the major country models involve interactions between the supply-side and the demand-side economy through changes in productivity and in prices in the economy, so that these models are called demand-supply integrated type models.
Concerning the linkages of country/regional models, each country/regional macro model is linked to the other country models with a bilateral trade flow model between major economies and a constant real share model between the other country/regional economies. Therefore, six hundred bilateral trade flows \((26 \times 26 - 26)\) are calculated in the global model and linked to the twenty-six country/regional models.

The number of macro economic variables is around ninety to one-hundred in the advanced country models and fifty to sixty in the developing economy models. On the other hand, the structure of the regional models is very simple because of data constraints. The total number of variables in the global macro model exceeds two thousand including bilateral trade flows. A software system for solving the global model is developed. By employing this software system, SIMSYS (Sato and Nakamura 1996), a large scale macroeconometric model, including a multi-equation structural model, trade model and inverse matrix in I-O model, can is solved.

4.2. Macroeconometric Model of Lao PDR

As mentioned above, the Lao PDR macroeconometric model is integrated within the global macro model system in this study. Basically, the structure of the macroeconometric model of Lao PDR relies on the general specification of a macroeconometric model discussed in the previous sub-section. However, the Lao model consists of seven blocks, including (1) the real expenditure block, (2) the nominal expenditure block, (3) the prices and wage rates block, (4) the production block, (5) the population and labor force block, (6) the public
finance block and (6) the international trade and BOP block. The other two blocks, the income distribution block and the money and finance block, are not modeled because of data limitations at present.

Nevertheless, the Lao PDR macroeconometric model with seven blocks performs well as a country model as well as the other national models in the global model system. Furthermore, the Lao PDR model, as well as the other major country models, has a feed-back system between the demand-side and supply-side economy as a demand-supply integrated type model.

The Lao PDR model is linked to the other country/regional models by utilizing a bilateral trade model with major three country-models, including Thailand, Vietnam and China, and by employing a constant real share approach with the other country/regional models. The total number of equations in the Lao macro model exceeds fifty including bilateral real and nominal trade flows (please see Appendix A: Macro Econometric model of Lao PDR).

The regression analysis is conducted taking consideration of co-integration (co-integrating relationships) as well as simultaneity (Engle and Granger 1986)². In addition, the model employs a block-recursive procedure to solve a simultaneously determined multi-equation system.

5. Scenario Forecasts up to the Year 2020

5.1. Baseline Forecast

In the baseline scenario, it is assumed that most of the exogenous variables in the model will be dependent on the current trends up to the year 2020.
(Please see Appendix C for Lao PDR.) Table 2 shows the future economic forecasts for the major countries in Asia and the Pacific, including Lao PDR, in terms of annual growth rate of real GDP in the baseline forecast.

Table 2: Forecasts of Major Asian and the Pacific Countries
: Baseline Forecasts, Real GDP Growth Rates, 2012-2020

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
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<td>Indonesia</td>
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<td>6.0</td>
<td>6.2</td>
<td>6.1</td>
<td>5.9</td>
<td>6.5</td>
</tr>
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<td>5.0</td>
<td>4.9</td>
<td>5.1</td>
<td>5.3</td>
</tr>
<tr>
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<td>6.8</td>
<td>6.1</td>
<td>6.3</td>
<td>5.8</td>
<td>5.6</td>
<td>5.5</td>
</tr>
<tr>
<td>Singapore</td>
<td>13.2</td>
<td>6.5</td>
<td>5.9</td>
<td>6.0</td>
<td>6.2</td>
<td>6.3</td>
</tr>
<tr>
<td>Thailand</td>
<td>6.4</td>
<td>6.2</td>
<td>6.6</td>
<td>6.3</td>
<td>6.0</td>
<td>5.9</td>
</tr>
<tr>
<td>Vietnam</td>
<td>5.3</td>
<td>5.0</td>
<td>5.2</td>
<td>5.4</td>
<td>5.6</td>
<td>5.7</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>7.9</td>
<td>7.3</td>
<td>7.1</td>
<td>6.8</td>
<td>6.9</td>
<td>7.0</td>
</tr>
<tr>
<td>China</td>
<td>7.6</td>
<td>7.9</td>
<td>7.7</td>
<td>7.5</td>
<td>7.1</td>
<td>6.8</td>
</tr>
<tr>
<td>Hong Kong</td>
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<td>4.2</td>
<td>3.9</td>
<td>4.0</td>
<td>4.3</td>
<td>4.2</td>
</tr>
<tr>
<td>Korea</td>
<td>2.0</td>
<td>3.1</td>
<td>3.3</td>
<td>3.1</td>
<td>2.9</td>
<td>3.0</td>
</tr>
<tr>
<td>Taiwan</td>
<td>3.8</td>
<td>3.7</td>
<td>3.9</td>
<td>3.7</td>
<td>3.5</td>
<td>3.4</td>
</tr>
<tr>
<td>Japan</td>
<td>1.9</td>
<td>2.2</td>
<td>1.2</td>
<td>1.0</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Australia</td>
<td>2.9</td>
<td>2.5</td>
<td>2.6</td>
<td>2.5</td>
<td>2.4</td>
<td>2.5</td>
</tr>
<tr>
<td>The U.S.</td>
<td>2.8</td>
<td>1.7</td>
<td>1.8</td>
<td>1.6</td>
<td>1.7</td>
<td>1.8</td>
</tr>
<tr>
<td>Canada</td>
<td>1.7</td>
<td>2.0</td>
<td>2.2</td>
<td>2.1</td>
<td>2.3</td>
<td>2.2</td>
</tr>
</tbody>
</table>

According to the baseline forecast, although the performance of these economies was declining in 2008 and 2009, just after the 2008 World Financial Crisis, most of the economies recovered their strong performance from 2010 onwards, except for the U.S. and Japan. The Chinese economy, especially, is expected to continue fairly high economic growth at around 7-8 percent per annum up to the year 2020. At the same time, Asian NIES and ASEAN-Five countries are also expected to realize steady growth rates up to
the year 2020, as they did in the period before the 2008 WFC.

Regarding the Lao economy, annual growth rates of real GDE slowed down slightly, dropping to 5.3 percent in 2009. However, the growth rates subsequently recovered, attaining 8.1 percent in 2010 and 8.0 percent in 2011 and growth rates at around 7 percent per annum on average are likely to continue up to the year 2020 in the baseline forecast. The major factor underpinning for the growth performance will be the strong exports, in line with the economic recovery of the other Asian economies, as shown in Table 3.

Table 3: Baseline Scenario Forecasts for the Lao Economy, 2011–2020

<table>
<thead>
<tr>
<th>:Major GDP components and GDP deflator (In billions of kip)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Estimated-</td>
</tr>
<tr>
<td>GDE</td>
</tr>
<tr>
<td>(%)</td>
</tr>
<tr>
<td>CP</td>
</tr>
<tr>
<td>(%)</td>
</tr>
<tr>
<td>CG</td>
</tr>
<tr>
<td>(%)</td>
</tr>
<tr>
<td>GFCF</td>
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<tr>
<td>(%)</td>
</tr>
<tr>
<td>EGS</td>
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<tr>
<td>(%)</td>
</tr>
<tr>
<td>MGS</td>
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<tr>
<td>(%)</td>
</tr>
<tr>
<td>PGDP</td>
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<tr>
<td>(%)</td>
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</tbody>
</table>
As for domestic inflation, the inflation rate in terms of GDP deflator (PGDP) is expected to be around 6-7 percent per annum during the latter half of the 2010s, which explains that inflation in Lao PDR will accelerate slightly in comparison to that of the latter half of the 1990s. However, it can be expected that the economy will still have the lower supply economy rather than the demand-side. In other words, the Lao economy should strengthen the supply-side economy more for sustainable economic development in the future.

5. 2. Public Sector Investment and FDI expansion scenario

In the baseline scenario, it is assumed that Lao PDR will keep the level of FDI inflows at 2,000 billion kip from 2013 to the year 2020. Indeed, FDI inflows increased in the early 2000s, and fluctuated between 2,000 billion kip and 3,000 billion kip. However, due to the 2008 World Financial Crisis, foreign investment behaviors were damaged seriously. In addition, many emerging and developing countries need foreign capital and hence severe competition to attract foreign capital has been appeared in the world.

As an alternative scenario, therefore, it is assumed that FDI inflows into Lao PDR will annually increase by 500 billion kip in nominal kip terms every year from 2013 to 2020 and hence will achieve 6,000 billion kip in 2020. In addition, the government will increase public investment by 1,000 billion kip in terms of nominal kip additionally in 2013-2020. Therein, the scenario simulation analyzes the impacts of additional government investment and FDI increases on the Lao economy.

Table 4 shows the impacts of FDI inflow expansion on the economy. In this
scenario simulation, increases in FDI affect gross fixed capital formation and the supply-side economy (GDP) through capital accumulation, and influence the demand-side economy (GDE) and the other endogenous variables.

As for the demand-side economy, it is expected that the annual growth rate of real GDE will probably rise by 4.6-10.4 percent from 2013 to 2020 as compared to the baseline forecast. The level of real GDE is expected to increase by 2,439.0 billion kip in 2013, by 3,259.1 billion kip in 2014, by 3,934.9 billion kip in 2015 and by 8,832.0 billion kip in 2020 in comparison with the baseline forecast. The fairly large impacts is expected to mainly result from increases in real gross fixed capital formation (GFCF) and from increases in real exports of goods and services (EGS) stimulated by the supply-side GDP effects. At the same time, the other GDE components, which are simultaneously determined, including real private consumption expenditures and real government consumption, also have large and favorable effects on the economy in this scenario forecast.

Table 4: The Impacts of Increased FDI on the Economy, Deviation and % deviation, as compared to the Baseline Projection, 2012-2020

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>GDE</td>
<td>2,439.0</td>
<td>3,259.1</td>
<td>3,934.9</td>
<td>4,722.6</td>
<td>5,719.6</td>
<td>6,679.8</td>
<td>7,793.3</td>
<td>8,832.2</td>
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<tr>
<td>(% dev.)</td>
<td>(4.6)</td>
<td>(5.7)</td>
<td>(6.5)</td>
<td>(7.3)</td>
<td>(8.3)</td>
<td>(9.0)</td>
<td>(9.8)</td>
<td>(10.4)</td>
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<tr>
<td>CP</td>
<td>1,024.1</td>
<td>1,293.0</td>
<td>1,576.6</td>
<td>1,890.7</td>
<td>2,232.6</td>
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<td>2,850.6</td>
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<tr>
<td>(% dev.)</td>
<td>(3.3)</td>
<td>(3.9)</td>
<td>(4.5)</td>
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<td>(5.6)</td>
<td>(6.0)</td>
<td>(6.3)</td>
<td>(6.6)</td>
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<td>CG</td>
<td>126.9</td>
<td>154.4</td>
<td>187.5</td>
<td>223.2</td>
<td>278.7</td>
<td>322.9</td>
<td>363.3</td>
<td>420.1</td>
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<td>(% dev.)</td>
<td>(2.3)</td>
<td>(2.6)</td>
<td>(2.9)</td>
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<td>(3.6)</td>
<td>(3.9)</td>
<td>(4.0)</td>
<td>(4.2)</td>
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<td>2,443.2</td>
<td>2,939.7</td>
<td>3,544.8</td>
<td>4,322.3</td>
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<td>6,000.7</td>
<td>6,973.6</td>
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<tr>
<td>(% dev.)</td>
<td>(8.1)</td>
<td>(10.4)</td>
<td>(11.6)</td>
<td>(13.0)</td>
<td>(14.7)</td>
<td>(16.0)</td>
<td>(17.5)</td>
<td>(18.8)</td>
</tr>
<tr>
<td></td>
<td>EGS</td>
<td>MGS</td>
<td>PGDP</td>
<td>EGS</td>
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<td>PGDP</td>
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<td>MGS</td>
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<tr>
<td></td>
<td>124.5</td>
<td>240.3</td>
<td>332.6</td>
<td>421.0</td>
<td>514.0</td>
<td>716.2</td>
<td>935.0</td>
<td>1,147.9</td>
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<tr>
<td>(% dev.)</td>
<td>(0.9)</td>
<td>(1.5)</td>
<td>(2.0)</td>
<td>(2.3)</td>
<td>(2.6)</td>
<td>(3.3)</td>
<td>(4.0)</td>
<td>(4.6)</td>
</tr>
<tr>
<td>MGS</td>
<td>598.0</td>
<td>871.8</td>
<td>1,101.5</td>
<td>1,357.1</td>
<td>1,628.1</td>
<td>1,972.6</td>
<td>2,356.2</td>
<td>2,850.5</td>
</tr>
<tr>
<td>(% dev.)</td>
<td>(3.2)</td>
<td>(4.3)</td>
<td>(4.9)</td>
<td>(5.6)</td>
<td>(6.1)</td>
<td>(6.8)</td>
<td>(7.5)</td>
<td>(8.3)</td>
</tr>
<tr>
<td>PGDP</td>
<td>0.89</td>
<td>3.33</td>
<td>3.97</td>
<td>4.49</td>
<td>4.95</td>
<td>5.56</td>
<td>6.12</td>
<td>6.70</td>
</tr>
<tr>
<td>(% dev.)</td>
<td>(0.6)</td>
<td>(2.0)</td>
<td>(2.2)</td>
<td>(2.3)</td>
<td>(2.4)</td>
<td>(2.5)</td>
<td>(2.6)</td>
<td>(2.7)</td>
</tr>
</tbody>
</table>

Note: %-dev. Means % deviation between Baseline and Scenario, (Scenario-Baseline)/Baseline*100.

Concerning the effects on inflation, it is expected that despite the fairly large effects on the economy, inflation will probably rise by only 0.6-2.7 percent during the forecasted period in comparison to the baseline forecast. The limited effects on inflation will probably be attributable to the supply-side effects through increases in capital accumulation by public sector investments and FDI expansion.

6. Concluding remarks
With the strong export demands and the strengthened supply-side economy improved by foreign capital inflows, especially by FDI, ASEAN member countries have realized strong growth performance based on export-led growth in the transition economy. In this study, we analyzed the macro economic structure and economic performance of Lao PDR with an econometric analysis. We can summarize our analysis, as follows.

Based on the regression analysis,
(1) In the transition period, the supply-side economy has been strengthened through capital accumulation, in which FDI has played a very significant
role. The coefficient of real FDI in gross fixed capital formation equation is around 0.945, which shows that FDI has fairly large impacts on capital accumulation and the supply-side economy.

(2) The demand-side economy has been stimulated by FDI, as well. In particular, exports have been reinforced by the strengthened supply-side economy. We can see this mechanism in both the macro and bilateral exports regression results.

(3) The price effects can be seen in demand components, in which labor productivity changes have played a very important role to stimulate real demand components through supply-side effects to depress the increases in prices or deflators.

(4) However, the marginal propensity to import is fairly large, which results in small multiplier effects, which implies the supply-side economy is still weak and cannot meet the demand-side increases, especially in the case of government expenditure increases. In short, without strengthening capital accumulation and technology, demand increases result in accelerating trade imbalances and inflation as experienced in the past.

Looking into the scenario forecasts,

(5) If FDI inflows continue at 2010 year level, the annual growth rates of real GDE will be around 6-7 per cent up to the year 2020. However, the macro imbalances, including the macro demand-supply imbalance, trade imbalance and inflation, will be deteriorating in the baseline forecast.

(6) On the other hand, in the FDI expansion scenario forecast, the Lao economy will probably achieve a high growth at around 7-8 per cent per
annum if FDI inflows grow from 2012 to 2020. Furthermore, it can be seen that the macro imbalances including the macro demand-supply imbalance and trade imbalance could be improved through strengthening the supply-side economy.

Based on the results of our analysis in this paper, we can put forward some policy recommendations. The Lao economy has successfully achieved steady economic growth. However, there exist macro imbalances, as discussed above. Therefore, the Lao policy makers should continue export-led growth, strengthening the supply-side economy through capital accumulation and technical progress. Based on conventional industries, Lao PDR will be able to diversify her industries to more advanced and high value added industries. As discussed earlier, FDI expansion is indispensable for improving these macro imbalances at present. For this reason, Lao PDR should improve her economic and business environment to attract FDI, focusing on FDI legislation, stock market and so on, and should strengthen economic cooperation with other countries within ASEAN and GMS, in the context of the strong economic dynamics of Asia and the Pacific.

In subsequent research, we will make a sectoral analysis for the Lao economy by means of a multi-sectoral model with an Input-Output analysis, which can analyze more specific issues focusing on sectoral economies including sectoral output, investment, exports, imports and so on (Shishido et al 2003). Therein, it is important to strengthen a data-base, including SNA, input-output tables and so on.

In the near future, Lao PDR will probably experience a high economic
growth within the take-off stage.

Endnotes:

1. Prof. Toyoda, T. has continued to study Economics and Econometrics with his colleagues in Lao PDR for a long time. He has contributed to not only academic fields but also to educational projects in Lao PDR. The author also gratefully appreciates his studies on the Lao economy and socioeconomic developments for Lao PDR.

2. This study utilizes the Engle and Granger two step procedures. We defined possibilities of co-integrating relationships based on the following tests in this study.

   Let's suppose that $Y_t$ and $X_t$ are integrated of order 1 ($Y_t = Y_{t-1} + u_t$, $X_t = X_{t-1} + v_t$, $u_t$ and $v_t$ are stationary), $Y_t = a + b X_t + e_t$, $e_t$: stationary, in which $Y_t$ and $X_t$ are co-integrating relationships with $a$ and $b$. The co-integrating relationships are examined by the Engle and Granger two-step methodology (Engle & Granger 1987) with DF type tests. In the first step, DF test individual series are pretested to determine whether they are approximated by unit root processes. In the second step, they are used to test the null hypothesis of a unit root in the residuals of a co-integrating regression. In the above equation, regressing $e_t$ on its own lagged value without constant yields an estimate of $\pi$:

   $$e_t = \pi e_{t-1} + w_t$$

   $w_t$: stationary

   The closer $\pi$ is to 1, the less likely the two series are co-integrated. Alternatively, we may regress changes in $e_t$ on lagged $e_{t-1}$ without constant (intercept):

   $$\Delta e_t = \mu e_{t-1} + z_t$$

   $z_t$: stationary

   The closer $\mu$ is to 0, the more likely $\pi$ is 1 and the less the series are co-integrated.

References


Appendices

Appendix A: Macroeconometric Model of Lao PDR
(1) Real expenditure block
(1.1) GDE=CP+CG+GFCF+EGS-MGS+SD

(1.2) CP=-50123.0+.7602 ((GDPN-DTREV)/PGDP*100)

       (-1.42) (9.02)

   -19330.2 (PGDP*(1+IDTRATE))-259945*(D07)+18445 (D99)
(1.3) CG=CGN/PCG*100

(1.4) GFCF=-1199882+2.75687 (GREV/PGDP*100)
      +0.93547 (FDIN/PM*100)+.200021 (EGS(-1)*PGDP(-1)/PM(-1))

(1.5) EGS=(EG$+ES$)*EXR

(1.6) MGS=(MG$+MS$)*EXR

(1.7) FDIN=FDI$*EXR/1,000,000,000

(2) Nominal expenditure block
(2.1) GDEN=CPN+CGN+GFCFN+EGSN-MGSN+SDN

(2.2) CPN=CP*PCP/100

(2.3) CGN=215544.1+1.762 ((DTREV+IDTREV+NTREV))

(3) Prices and wage rates block
(3.1) PCP=PGDP
(3.2) PCG = PGDP

(3.3) PGFCF = PGDP

(3.4) PEGS = PGDP

(3.5) PMGS = PMG / PMG.90 * 100

(3.6) WN = GDPN / NL

(3.7) \( \ln(\text{PGDP}) = -1.8023 + 0.10803 \ln(\text{PMGS}) + 0.9647 \ln(\text{WN}) \)
\( (-4.03) \quad (2.61) \quad (9.64) \)
\( -0.87978 \ln(\text{GDP}/\text{NL}) \)
\( (-4.66) \)
TSLS Sample 1990 – 2011 \( R^2 = 0.998 \) SD = 0.0158 DW = 1.342

(3.8) PMG = (PMS * EXRI) / (PMS.90 / EXRI.90) * 100

(3.9) PMS\(<j> = \Sigma i(E \langle i,j \rangle) / \Sigma i(E \langle i,j \rangle) * 100

(3.10) PES = (PGDP / PGDP.90 * 100) / EXRI * 100

(4) Production block
(4.1) \( \ln(\text{GDP}) = 0.8122 + 0.3787 \ln(K) + (1 - 0.3787) \ln(NL) \)
\( (8.21) \quad (11.87) \)
OLS Sample: 1990-2011 \( R^2 = 0.960 \) SD = 0.0302 DW = 1.754

(4.2) \( K = K(-1) + \text{GFCF} \cdot D \)

(4.3) \( D = \delta K(-1) \quad (\delta = 0.08) \)

(5) Population and labor force block
(5.1) \( 'NL = 2885572 + 0.06982 (\text{GDE}) - 11394475 (\text{WN}/\text{PGDP}) \)
\( (46.34) \quad (10.01) \quad (-7.67) \)
\( ' \quad \text{TSLS Sample: 1990-2010} \quad R^2 = 0.982 \quad \text{SD} = 3,887.04 \quad \text{DW} = 2.127 \)
(6) Public finance block

(6.1) \( \text{GREV} = \text{DTREV} + \text{IDTREV} + \text{NTREV} \)

(6.2) \[
\text{RDTREV} = .010103 + 1.04957 \times \text{(GDP)} + .026812 \times \text{(D2001)} \\
\text{TSLS Sample: 1990-2010} \quad R^2 = .736  \quad SD = .00460  \quad DW = 1.103
\]

(6.3) \[
\text{RIDTREV} = -.000475 + 2.41528 \times \frac{\text{(GDP/1000000000)}}{100000000000} + .013835 \times \text{(D2001)} \\
\text{TSLS Sample: 1990-2010} \quad R^2 = .917  \quad SD = .003364  \quad DW = 1.883
\]

(6.3) \( \text{DTREV} = \text{RDTREV} \times \text{GDPN} \)

(6.4) \( \text{IDTREV} = \text{RIDTREV} \times \text{GDPN} \)

(7) International trade BOP block

(7.1) \( \text{EG}_j = \sum E_{i,j} \)

(7.2) \( \text{EGN}_j = \sum EN_{i,j} \)

(7.3) \( \text{EG} = \text{EG}_j \times \text{EXRI/100} \)

(7.4) \( \text{EGN} = \text{EGN}_j \times \text{EXRI/100} \)

(7.5) \( \text{EN}_{i,j} = \text{E}_{i,j} \times \text{PE}_i/100 \)

(7.6) \( \text{MG}_j = \sum i \times (\text{E}_{i,j}) \)

(7.7) \( \text{MGN}_j = \sum i \times (\text{EN}_{i,j}) \)

(7.8) \( \text{MG} = \text{MG}_j \times \text{EXRI/100} \)

<Real merchandise exports to major three countries, Thailand (T), China (C), and Vietnam (V)>

(7.9) \( \ln(\text{E}_{L,T}) = -5.222 + 1.078 \ln(\text{GDEI}_T) \)
\[ -2.013 \ln(PES<L> \times EXRI<T>/PGDP<T>) \]
\((-3.04) (2.37) (-2.90)\]
\[ +1.0977 \ln(GDP<V>) \]
\((2.45)\]
OLS Sample 1990-2010 \(R^2=0.905\) SD=0.2213 DW=1.845

\[(7.10) \ln(E<L,C>)=-1.048+2.178 \ln(GDEI<C>)+0.489 \ln(GDP<L>)\]
\((-1.88) (2.77) (2.67)\]
\[+0.4722 \ln(E<L,C>(-1))\]
\((3.47)\]
OLS Sample 1990-2010 \(R^2=0.911\) SD=0.2042 DW=2.147

\[(7.11) \ln(E<L,V>)=-2.4076+2.107 \ln(GDEI<V>)+0.3847 \ln(E<L,V>(-1))\]
\((-2.05) (2.47) (3.28)\]
OLS Sample 1990-2010 \(R^2=0.897\) SD=0.310 DW=1.758

<Real merchandise imports from major three countries>
\[(7.12) \ln(E<C,L>)=0.701+1.98 \ln(GDEI<L>)\]
\((1.98) (2.37)\]
\[ -0.468 \ln(PES<C> \times EXR<L>/PGDP<L>)\]
\((-2.12)\]
\[ +0.5387 \ln(E<C,L>(-1))\]
\((4.91)\]
OLS Sample 1990-2010 \(R^2=0.9401\) SD=0.1755 DW=1.872

\[(7.13) \ln(E<T,L>)=2.0045+1.924 \ln(GDEI<L>)\]
\((1.99) (3.78)\]
\[ -1.291 \ln(PES<T> \times EXR<L>/PGDP<L>)\]
\((-2.041)\]
OLS Sample 1990-2010 \(R^2=0.949\) SD=0.12842 DW=1.534

\[(7.14) \ln(E<V,L>)=0.785+0.876\ln(GDEI<L>)\]
\((2.54) (2.18)\]
\[ -1.002 \ln(PES<V> \times EXR<L>/PGDP<L>)\]
\((-1.97)\]
OLS Sample 1990-2010 \(R^2=0.841\) SD=0.1374 DW=1.887

27
(7.15) \( TB\$$=EGN\$$ \cdot MSN\$$

Appendix B : Variable list: Endogenous (E) / Exogenous (X)

**CG (E):** real government consumption expenditures (1990 constant prices)

**CGN (E):** nominal government consumption expenditures

**CP (E):** real private final consumption expenditures (1990 constant prices)

**CPN(E):** nominal private final consumption expenditures

**D (E):** real depreciation of capital stock

**DTREV (E):** direct tax revenue

**E<i,j> (E):** real bilateral export (FOB) from country<i> to country<j> in terms of US$ converted by exchange rate in 2000

**EN<i,j> (E):** nominal bilateral export (FOB) from country<i> to country<j> in terms of US$

**EG (E):** real merchandise export (1990 constant prices)

**EGN (E):** nominal merchandise export

**EG$ (E):** real merchandise exports in US$

**EGN$ (E):** nominal merchandise exports in US$

**EGS (E):** real exports of goods and services (1990 prices)

**EGSN (E):** nominal exports of goods and services

**ES$ (E):** real service exports in US$

**ESN$ (E):** nominal service exports in US$

**EXR (X):** exchange rates (kip/$)
EXRI (E): exchange rate index (EXRI.2000=100)
FDI (X): foreign direct investment (FDI) inflow in local currency
FDI (E): real foreign direct investment inflow in local currency
GDE (E): real gross domestic expenditures (1990 constant prices)
GDEN (E): nominal gross domestic expenditures
GDP (E): real gross domestic products (1990 constant prices)
GDEI (E): real GDE index in terms of US $ (GDPI.2000=100)
GDPN (E): nominal gross domestic products
GFCF (E): real gross fixed capital formation (1990 constant prices)
GFCFN (E): nominal gross fixed capital formation
IDTREV (E): indirect tax revenue
INTLR (X): lending rate
K (E): real capital stock (1990 constant prices)
MG (E): real merchandise imports (1990 constant prices)
MGN (E): nominal merchandise imports
MG$ (E): real merchandise imports in US$
MGN$ (E): nominal merchandise imports in US$
MGS (E): real imports of goods and services
MGSN (E): nominal imports of goods and services
MS$ (E): real service imports in US$
MSN$ (E): nominal service imports in US$
NP (X): number of population
NL (E): number of labor
PCG (E): implicit deflator of CG
PCI (E): per-capita income in US$
PCP (E): implicit deflator of CP
PEG (E): implicit deflator of EG
PES (E): export price index in terms of US dollar (PES.2000=100)
PEGS (E): implicit deflator of EGS
PGDE (E): implicit deflator of GDE
PGFCF (E): implicit deflator of GFCF
PJ (X): implicit deflator of J
PMG (E): implicit deflator of MG
PMGS (E): implicit deflator of MGS
PMS (E): import price Index in terms of US$ (PMS.2000=100)
RDTREV (E): effective direct tax rate
RIDTREV (E): effective indirect tax rate
TB$ (E): trade balance in US$
WN (E): nominal wage rates (index)
δ (X): rate of capital depreciation

<Data Sources>
Main Indicators of SNA, UN
International Financial Statistics (IFS), IMF
Direction of Trade (DOT), IMF
Balance of Payments Statistics (BOP), IMF
Key indicators for Asia and the Pacific, ADB