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Evaluation of Macroeconomic Policy in Laos

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Phouphet Kyophilavong

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Phouphet KYOPHILAVONG*

Abstract

Macroeconomic stability is one of the most important factors in maintaining high economic growth, especially in a transitional economy like Laos. The Government of Laos (GoL) seems to prioritize growth over macroeconomic stability in order to escape from Least Developed Country (LDC) status by 2020. However, there are very few studies on this issue in Laos in terms of quantitative analysis. Therefore, the main objective of this study is to evaluate the impact of macroeconomic policy, especially growth and stability policies on the economy. A simple macroeconomic model was developed for this simulation, whose results show that stability policy has a more positive impact on the economy than growth policy. Therefore, in order to maintain high growth, it is important for the GoL to implement stability policy by controlling prices through a tight money supply and a stable exchange rate.

Keywords: macroeconomic policy, macroeconomic model, GDP and Price.

JEL Classification: E17; E52; C01

1. 0 Introduction

The development goal of Lao People's Democratic Republic (Laos) is to liberate the country from the group of Least Developed Countries (LDCs) by the year 2020¹. To achieve this national goal, the National Economic Development Plan (NEDP) and the National Poverty Eradication Programme (NPEP) were implemented. The main NEDP target is to maintain high economic growth with macroeconomic stability (GoL, 2006).

* Visiting researcher at Economic Research Center, Graduate School of Economics, Nagoya University, and Associate Professor at the Faculty of Economics and Business Management, National University of Laos. Phouphet20007@hotmail.com

¹ According to UNDP(2007/2008), in terms of human development index, Laos was ranked as 130th out of 177 countries. GDP per capita was US\$580 in 2007 (WB, 2008). 34 percent of population live below the poverty line (NSC, 2003)

Since introducing the New Economic Mechanism (NEM) in 1986, Laos has maintained high growth. The average growth during 1990-1995 was about 6 %, and the average inflation rate in the same period was about 15 % (table 1). However, during the Asian Financial Crisis (AFC) in 1997-1998, Laos was facing high depreciation of its currency (kip) and hyperinflation: the kip had depreciated about 70 % against the U.S. dollar and inflation had reached 150 % in 1999. In addition, agricultural production and Foreign Direct Investment (FDI) also decreased during that period². It was not only the AFC which caused economic instability in Laos, but also poor macroeconomic management (Okonjo-Iweala et al, 1999). Therefore, it is vital for the GoL to improve its macroeconomic management abilities in order to maintain growth with macroeconomic stability.

However, there are some arguments over whether the GoL should prioritize growth or macroeconomic stability³. If the GoL gives priority to macroeconomic stability, a tightening monetary policy and an appreciated exchange rate policy are indispensable. On the other hand, if the GoL gives priority to economic growth, loosening the money supply and a depreciated exchange rate policy are vital. However, due to the lack of quantitative studies on this issue⁴, it is still not clear whether the GoL should prioritize growth or macroeconomic stability, and what would be a sound macroeconomic policy for Laos. Therefore, the main objective of this paper is to use a simple macroeconomic model to evaluate the impact of growth and stability policies and to identify a macroeconomic policy for the Lao economy.

2. 0 Economic Reforms

2. 1 Economic Reforms and Development Goals

² However, the Lao economy have recovered from AFC since 2002; the average GDP growth during 2000-2006 was 6.5 %, the inflation rate was less than one digit and the exchange rate was stable (table 1). More detailed discussion of the impact of AFC on Lao economy see Keomixay et al (1999).

³ According to Esterly (1993) and Bleaney (1996), macroeconomic stability is good for growth. IMF (2006) and WB (2007) also point out that macroeconomic stability is one of the most important priorities for Laos.

⁴ For macroeconomic management and impact of macroeconomic policies see Kyophilavong (2003) and Kyophilavong and Toyoda (2004; 2008), Toyoda and Kyophilavong (2005; 2007).

After the 1975 communist revolution, Laos set up a centrally-planned economy under which domestic prices, foreign trade and trade among provinces were strictly controlled by the State (Bourdet, 1995 and Ljunggren, 1993). Since 1986, Laos has implemented various reforms under NEM, which include the following vital components: (i) the promotion of private production through improved incentives, (ii) the upgrading of institutional infrastructure to improve market economy operation, (iii) the strengthening of Lao competitive advantages through trade liberalization and future specialization, and (iv) the establishment of price stability through macroeconomic policy measures (Bourdet, 1995; Ljunggren, 1993).

The national development vision for the year 2020 is to have graduated from LDC status through sustainable development that balances social and environmental concerns (GOL, 2006). In order to achieve these national development goals, the GoL has set up the National Economic Development Plan (NEDP) and the National Poverty Eradication Programme (NPEP). The main targets of the 6th NEDP (2006-2010) are to maintain GDP growth (real) at about 7 to 8%; keep the inflation rate at less than 10 %; stabilize the exchange rate; ensure that budget deficit is 6 % of GDP; ensure the trade deficit is 6 % of GDP; and reduce poverty to 20- 25 % (GOL, 2006).

2.2 Financial Reforms

Prior to 1988, the State Bank conducted both central and commercial banking activities. The State Bank's principal operations were to accept deposits from State Owned Enterprises and provided credit to them under the central government's economic plan; to act as the government's treasury; and to manage the supply of currency (Kyophilavong, 2007).

During this period, the principal aim of monetary policy was to help fulfill the development plan. The monetary policy framework was operated through direct monetary instruments⁵;

⁵ Such as credit ceilings, interest rate control throughout 1979-85, and directed credit.

the mono-banking sector was influenced by the fiscal needs of the Government.⁶ (Kyophilavong, 2007).

In 1988, the Government began major reforms aimed at transforming the financial system in line with the objectives of the NEM. With a view to making the banking sector more market oriented and improving the mobilization and allocation of resources, the State Bank was reorganized into a two-tier system, with central banking separated from commercial banking. The proper central banking activities of the State Bank were formally separated with the enactment of the Central Bank Law in 1990, which established the Bank of Lao PDR (BOL) as a central bank, and assigned it primary responsibility for exercising control over monetary and financial developments by developing indirect instruments⁷. Under the two-tier banking system, commercial banks have played their roles by providing banking services such as mobilizing deposits and allocating credit. However the Lao banking sector is also relatively small when compared to the size of the Lao economy. The ratio of total assets of the banking system to GDP is about 25.8%; the ratio of deposit to GDP was 19%; and the ratio of bank loans to GDP was 8.8% in 2006 (Kyophilavong, 2007).

2.3 Fiscal Reform

During the pre-reform period, the Lao economy was divided between a large state sector, including public enterprises at the central and provincial levels, and a non-state sector, including cooperatives and private farms and enterprises (Bourdet, 1994). The Lao budget structure looked like those of other socialist countries in which the public sector played an important role in terms of both the revenue and the expenditure sides. During that period, Laos experienced large budget deficits which were financed by external sources, mainly from socialist countries in the form of commodity assistance, project loans and grants.

⁶ Many of these loans were non-performing or past due. Technical review of commercial bank portfolios undertaken with Asian Development Bank (ADB) support in 1992 found that on average of 47 percent of total loans were past due and an additional 34 percent were non-performing (ADB, 1992).

⁷ BOL introduced reserve requirement rates in October 1990; opened a formal credit window (1992-1994); commenced to regularly auction treasury bills in March 1994 and discount window for T-bills in May 1994; removed all interest rate ceilings in 1991; and eliminated rate guidelines on deposit and lending rates in 1992-93, (Otani and Pham, 1996)

Fiscal reforms have been one of the components of NEM since 1986. These fiscal reforms have addressed the revenues and expenditure sides of the budget and consist of three main components. The first and most important component was the reform of the tax system. The second was the establishment of an allocation and a total level of public expenditure. The third was a reform of the institutional framework and an upgrading of administrative capacity and procedures to facilitate the implementation of the revised budget policy (Bourdet, 1994). These reforms are mainly supported by international organizations such as the World Bank (WB), International Monetary Fund (IMF), and Asian Development Banks (ADB); these organizations continue to support fiscal reforms in order to resolve lingering issues.

3.0 Policy Framework

3.1 Monetary policy framework

Under the two-tier system, BOL has fully implemented monetary policy. At the beginning of the banking sector evolution, it was still unclear whether a monetary policy framework operated. Monetary instruments had been applied through the mixture of direct and indirect tools without clear monetary channels and objectives (Kyophilavong, 2007).

BOL had relied on direct instruments, including interest rate control (both on lending and deposit rates) during the 1990s and a credit ceiling (as % of total loans outstanding) to limit and target credit expansion from 1995 to 1996. However, indirect instrument such as reserve requirements⁸ and market operations⁹ were introduced in 1999. Subsequently, BOL adopted a monetary policy framework as an IMF-supported program (2001-2005). According to this monetary policy framework, price stability is an ultimate goal of the BOL's policy implementation, which also supports economic growth in order to reduce poverty. This policy involves implementation of monetary and exchange rate policies

⁸ According to Dalalay (2006), before 1995, the reserve requirement ratio did not separate between kip and foreign currency; it was 5% in 1985, 10% in 1994 and 12% in 1995. The reserve requirement ratio for kip and foreign currency has been introduced since 2000; it was 6% (kip), and 12% (foreign currency) in 2000; 8% (kip) and 15% (foreign currency) in 2002; and 5% (kip) and 10% (foreign currency) in 2006.

⁹ The instrument of open market operation included BOL bill and Treasury bill.

within the confines of a framework that establishes floors for international reserves and ceilings for net domestic assets of the central bank. BOL conducts monetary policy by using the Quantity Theory of Money theoretical framework to set the annual growth rate of the money supply as an intermediate target in line with the rate of growth and price stability. Reserve money and interest rates are closely monitored as operational targets in order to attain the intermediate target. A reserve requirement rate, BOL bills, treasury bills, bank rates and refinancing facilities are main the monetary policy instruments¹⁰.

3.2 Exchange rate policy framework

Before economic reform in 1986, there existed seven different exchange rates¹¹, ranging from 10 to 400 Kip/US\$ dollar under a fixed exchange rate regime. Lao authorities began a dramatic reform of the exchange regime in September 1987 (Otani and Pham, 1996). According to Prime Minister Decree No. 18/CCM dated July 1989, a managed floating exchange regime was adopted. Under this regime, the official rate was adjusted proportionally to be in line with the parallel market rate. For example, a benchmark was set for BOL to maintain a spread of less than 10 percent between the official rate and market rate. In tandem with these policy initiatives, various reforms of the financial sector were undertaken. The government allowed non-bank foreign exchange dealers in 1990 and restrictions on deposits in foreign currency were also abolished (Otani and Pham, 1996). In addition, the difference between the official rate and the market rate was reduced to 2 percent under the enhanced IMF structural adjustment program. Under the managed floating exchange rate regime, BOL currently determines the daily reference rate of Kip against US\$. This reference rate is calculated by a weighted average of

¹⁰ Under the BOL Law No.5, all the key monetary and exchange rate policies have to be approved by the Government. Applying instruments has to be approved by the Governor. The Monetary Policy Department directly monitors and adjusts the above tools in order to achieve policy targets. The Banking Operation Department mainly operates those tools that work together with financial institutions.

¹¹ These included a symbolic official rate of 10 kip per U.S. dollar; a commercial rate of 95 kip per U.S. dollar, at which most transactions by state enterprises were made; and several rates close to the then-prevailing parallel market rate of roughly 400 kip per U.S. dollar, which applied to transactions by the prefecture of Vientiane (Otani and Pham, 1996).

previous foreign exchange transactions of commercial banks and market rates¹². This reference rate is modified corresponding to particular conditions (Kyophilavong, 2007).

3.3 Fiscal policy framework

The main objective of the fiscal framework, based on NEDP, is to support growth and reduce poverty (GoL, 2006). In order to achieve these aims, the GoL set an increase in total investments; the target of total investment was set at 32 % of GDP and the ratio of budget deficit to GDP was set at 5.8 % (GoL, 2006). Therefore, government income sources and effective government expenditures are keys for achieving fiscal policy objectives, and so in early 2005, GoL adopted a comprehensive medium-term Public Expenditure Management Strengthening Program that focuses on strengthening Public Financial Management systems and building the capacity of the Ministry of Finance and Provincial Finance Department. These programs have been supported by international organizations.

4.0 Macroeconomic Condition and Issues

Since the NEM was introduced in 1986 until the AFC occurred in 1997, Laos had been achieving high rates of economic growth with low inflation. The average economic growth rate was about 6.5 % during 2000-2006 and the inflation rate has been maintained at one digit since 2005; it was about 4.5 % in 2007 (table 1). Since 2005, the exchange rate has appreciated; it was 9,670 kip per US\$ in 2007 compared to 10,655 kip per US\$ in 2005. Laos has an agriculture-based economy; in a total GDP of 2.8 US\$ billion, agriculture accounted for 44% of GDP, industry for 30% and services for 26% in 2005 (WB, 2008). However, since 2003, the industry sector has grown more than 10%, which has caused the agriculture share of GDP to decline.

¹² Like monetary policy, the key exchange rate policies have to be approved by the Government. The Monetary Policy Department also responds directly to adjusting the reference exchange rate daily. The Banking Operation Department calculates the BOL exchange rate and uses it as a reference for foreign exchange in the interbank market amongst financial institutions.

Even though Laos has been maintaining high economic growth with low inflation and a stable exchange rate, there are still serious macroeconomic issues to overcome. Firstly, Laos is basically facing chronic twin deficits in both government spending and international trade deficit. The budget deficit to GDP was 2.5% in 2007 (fiscal year), compared to 4.4% in 2005 (fiscal year) (WB, 2008). Current account balance deficit to GDP was 17.8% in 2005 compared to 17.4% in 2007¹³ (IMF, 2008). These deficits are mainly financed by Official Development Assistant (ODA), FDI, and remittances. In particular, the fiscal issue is very serious in Laos. If the budget deficit continues to expand, it will cause an accelerating inflation rate and devaluation of the kip, and could lead to economic instability like the period during the AFC (Okonjo-Iweala et al, 1999). Secondly, there is a huge gap between savings and investment. The saving rate is low in Laos for two main reasons: low incomes—GDP per capita was about US\$580 in 2007—and the underdevelopment of financial sectors. The banking sectors are occupied by state commercial banks, which lack the ability to perform the full banking functions¹⁴. Thirdly, Laos is also facing a high burden of external debt, which had accounted to more than 60 % of GDP in 2007.

Laos is currently dependent on foreign savings to cover budget deficits. If Laos becomes too dependent upon foreign finance, especially to meet its debt obligations, it could cause a foreign debt crisis¹⁵. Therefore, it is important to consider macroeconomic issues first before building a macroeconomic model to identify the impact of macroeconomic policy.

5.0 Issues of Macroeconomic Management

5.1 Monetary policy

Nevertheless, the implementation of monetary policy still has a number of shortcomings. The four main reasons for the constraints on monetary policy in Laos are as follows.

¹³ However, the trade deficit has narrowed since 2003 due to increased exports of gold and copper coupled with the high price of minerals.

¹⁴ More details of financial issues in Laos are discussed in Kyophilavong (2008).

¹⁵ More detailed discussion of the roles of government in transition, global integration and economic development in Laos see Hara (2002).

Firstly, the Lao economy is a partially dollarized economy¹⁶. Therefore, the monetary authorities can not conduct their policy effectively (BOL et. al, 2002). Secondly, the lengthy and opaque decision-making process makes implementing monetary policy inefficient. According to BOL law, all key monetary policies and action plans have to be approved by the government (BOL et. al, 2002), which is time consuming¹⁷. Thirdly, the undeveloped financial situation limits the effectiveness of implementing monetary policies. BOL has very limited monetary policy instruments with which to conduct an effective monetary policy. The bond market is still at an early stage of development; its volume is too small to operate an open market operation effectively. Lastly, BOL lacks business expansion funds and general reserve accounts to compensate for the losses from implementing monetary policy (BOL et. al, 2002).

5.2 Exchange rate policy

Under the managed floating exchange rate policy, the exchange rate has shown significant stability; it was fluctuating around 10,000 kip per U.S. dollar during 2005-2006 and moving in line with market rate no more than 0.5 percent. However, the exchange rate mechanism has some limitations. The range of the exchange rate set for commercial banks is too small¹⁸, limiting flexibility in the foreign exchange market and leading to a dis-incentive to develop inter-bank market. This also creates an informal market for speculation (Kyophilavong, 2007). To stabilize the value of the Kip, BOL intervened in the foreign exchange market in order to adjust the exchange rate by selling and buying foreign currency. However, foreign reserves were quite small during the AFC, so the intervention was not effective. In addition, as with monetary policy, the long process of decision-making is an important constraint in implementing exchange rate policy. However, recently the foreign reserves are increasing and the decision-making process has improved.

5.3 Fiscal policy

¹⁶ In 2005, more than 60 percent of bank deposits are in foreign currencies. For more detail discussions of dollarization in Laos see Menon (2006), and Furukawa (2002).

¹⁷ However, the decision making progress has been improving since the AFC.

¹⁸ More study is need on the effect of the range of reference rate on foreign exchange markets in Laos.

Fiscal policy plays an important role in achieving the national goal of maintaining high growth and reducing poverty. While the GoL is continuing to reform the fiscal system, some issues need to be considered. Firstly, there is lack of qualified staff and modern office equipment for monitoring and checking traders (Lathouly, 2000). Secondly, GoL will implement of a Value Added Tax (VAT) which is currently planned for 2009; this will require close coordination between the Tax, Customs and Treasury Departments (WB, 2008). Thirdly, GoL is financing budget deficits by foreign sources such as external debt and grants; it is important to consider domestic finance by improving the quality and quantity of treasury bills. In addition, the high burden of external debt might cause a debt crisis and macroeconomic instability.

6.0 Building a Macroeconomic Model of Laos

6.1 Literature reviews

At this time, due to lack of interest and data limitations, there are only a few studies on macroeconomic models for the Lao economy. Kyophilavong (2003) developed a pioneer macroeconomic model, called LAOMACROMODEL-1, which consists of 32 equations (17 definitions). This model took into consideration demand and supply sides, and divided trade between Thailand and other trading partners. The main purpose of building this model was to analyze the impact of macroeconomic policies, the accession of ASEAN Free Trade Area (AFTA), and FDI. Because this was an early model, some issues needed to be addressed and updated in LAOMACROMODEL-1; therefore Kyophilavong and Toyoda (2004) modified and developed LAOMACROMODEL-2. This model consists of 11 behavior equations, 12 definitions and 3 statistic equations, and was built to analyze the impact of macroeconomic policies and the ODA on the Lao economy. This paper uses LAOMACROMODEL-2 as the basis for evaluating the macroeconomic management of Laos.

However, this model is different from Kyophilavong and Toyoda (2004) and Toyoda and Kyophilavong (2005) in several respects. Firstly, there are some adjustments in general price function. As inflation is strongly linked with the exchange rate in Laos, the

exchange rate¹⁹ (kip/US\$) has been added to the general price function as a proxy of import price. Secondly, this paper focuses on the impact of mixed-policy, which combines monetary policy, exchange rate policy and fiscal policy together.

6.2 Characteristics of the model

The key distinguishing features of the model are as follows. Firstly, time series data and the market economy mechanism are the two most important hypotheses being used to build this model. Laos continues to reform its market economy, so even though the economic structure is different from the economic structure of capitalist countries²⁰, it is assumed that the Lao economy has basically the same structure as capitalist countries. Secondly, the current Lao economy is facing supply-side issues, and the Lao economy has faced demand-side issues such as high inflation and the devaluation of kip in the past. Therefore, a Lao model must focus on both demand- and supply-side issues. In this model, the ratio of supply-side GDP and demand-side GDP are used to determine general price function. In addition, the demand and supply are also adjusted accordingly by general price mechanism. Thirdly, Laos is an agricultural country, with about half of GDP from the agriculture sector²¹. From this viewpoint, the author has divided the supply-side into agricultural GDP and non-agricultural GDP in order to analyze agricultural structure change.

I used the Two Stage Ordinary Least Square (2 SLS) method to estimate behavior equations and the Newton method to solve the model equations. The data used in this model is mostly based on information from IMF, WB and ADB²². The model flowchart²³ is shown in Figure 1. Before running the simulation, I evaluated the model by conducting

¹⁹ The exchange rate is an endogenous variable which is linked to general price in the previous model.

²⁰ The intervention of government in financial sectors is strong, and state-owned commercial banks have a high share in terms of assets, deposits and loans.

²¹ The share of agriculture to GDP has declined since 2002 due to the implementation and export of mining and hydropower sectors. See more details of the impact of these resource sectors on the Lao economy in Kyophilavong and Toyoda (2008).

²² The main reason for using data from international agencies in model building is that there are some inconsistencies of GoL's data. In addition, the availability of GoL's data is low. For details of the main variables see table 2. Due to the limited availability of data to build the model, I have made modifications and adjustments to the data set by using various assumptions and estimation methods. See more details in Kyophilavong and Toyoda (2005).

²³ More detail of equations and estimation result of behavior equation is shown in appendix 1 and 2.

final test²⁴. The final test result shows that the percentage of Root Mean Squared Percent Error (RMSPE) in important variables such as GDP and prices were low, which confirms that this model can be used for simulation and forecasting.

7.0 Evaluation of macroeconomic management

7.1 Simulation Design

As mentioned in previous sections, there are various challenges to conducting macroeconomic policy effectively in Laos²⁵. However, I assume that these impacts are small. Here, growth-priority policy refers to GDP growth. There are two instruments of growth-priority policy: expanding the money supply to increase domestic investment and depreciating the exchange rate to increase exports. On the other hand, stability-priority policy refers to price stability. The two instruments of stability-priority policy include tightening the money supply and stabilizing the exchange rate.

In order to identify the impact of these policies on Lao economy, I combine three policies: monetary policy, exchange rate policy and fiscal policy (table 4). I make assumptions about the three policies as follows. Fiscal policy refers to a decrease or increase of 100 billion kip of government investment. Monetary policy refers to a decrease or increase of 100 billion kip in the money supply. Exchange rate policy refers to a decrease or increase of 5 percent of exchange rate (Kip/US\$). Based on the combination of the three policies, I generated eight simulation scenarios in table 5.

Within the eight simulation scenarios, scenario five refers to growth-priority policy. This policy includes an expansion of the money supply and a depreciation of the exchange rate; expansion of government investment is also included in this policy. On the other hand, scenario seven refers to stability-priority policy. This policy includes decreasing the money supply and appreciating the exchange rate; again, the expansion of government

²⁴ See the results in table 3.

²⁵ There are mainly three issues for limiting macroeconomic policy as discussed in previous section. Firstly, Laos has high degree of dollarization. Secondly, monetary authority lacks effective indirect monetary policy instruments. Thirdly, there is an informal exchange rate market which shows the limitation of conducting exchange rate policy effectively.

investment is also included. It is important to note that the two policies are different only in changing the money supply and exchange rate perspectives.

I chose the period from 1993 to 1996 as shock periods for two reasons. Firstly, macroeconomic variables during this period were quite stable compared to other periods. Secondly, I want to avoid the influence of the AFC. The effect of simulation scenarios²⁶ on the Lao economy refers to changing endogenous macroeconomic variables such as real GDP, prices, private consumption, exports, imports etc which are calculated from difference between shock simulation (C) and base case simulation (B).

7.2 Simulation results

The impacts of each simulation scenario are shown in table 6. Out of the eight policy scenarios, scenario seven exerts the highest impact on increased GDP, indicating that the government should prioritize stability²⁷. The average increase in GDP is 7.1 %. In the first simulation period, GDP increases by 6.8 %; it increases by 7.3 % in the second period and 7.3 % in the third period. At the same time, the average increase in price is 1.8 %. There is a 5.4 % increase of general price in the first period and 1.5 % in the second one, but a 1.6 % decrease in the third period. The declining money supply and the appreciation of the exchange rate lead²⁸ to declining prices. Then, declining prices increase real macroeconomic variables which increase the demand side of GDP. In addition, the increase in government investment has two effects on GDP. Firstly, it increases demand-side GDP through increasing domestic investment. Secondly, it increases supply-side GDP through increasing capital stock.

²⁶ Effect= (C-B)*100/C. C refers to value of shock simulation shock. B refers to value of base case simulation.

²⁷ There, it is very important to note that we omit constraints of expansion of fiscal policy in this model. We assume that sources for financing fiscal deficit are from external sources such as ODA and debt. However, the two variables are exogenous variables in this model.

²⁸ The appreciation of the exchange rate also has a negative impact on growth through declining exports. See a more detailed discussion of the impact of exchange rates on the Lao economy in Kyophilavong and Toyoda (2008).

On the other hand, scenario five, which refers to growth priority policy, has a negative impact on real GDP. GDP declines by an average of 7.7 %. In the first simulation period, GDP decreases by 7.6 %; it decreases by 7.9 % in second period and 7.7 % in third period. At the same time, the average price increase is 0.6 %. In the first period of simulation, price declines by 5.1 %, in second periods there is no change, and in third period it increases by 3.4 %. According to the simulation results, a growth-priority policy surprisingly results in the most negative impact on the Lao economy. Conversely, a stability-priority policy yields results that have the highest positive impact on growth.

8. 0 Conclusions

The two main objectives of this paper are to evaluate the impact of growth and stability priority policies and to identify the most effective macroeconomic policy for Laos using a macroeconomic model simulation.

From the simulation results, we conclude that growth-priority policy that expands the money supply and depreciates the exchange rate does not bring high growth as expected. Instead, it actually has a negative impact on growth. On the other hand, stability-priority policy that decreases the money supply and appreciates the exchange rate has a positive impact on growth. It is clear that stability-priority policy is better than growth-priority policy. Therefore, in order to maintain high growth with price stability, the GoL should focus on stability-priority policy that prudently controls the money supply and stabilizes the exchange rate, and increase government investment²⁹.

It is important to note that this model, unlike macroeconomic models in the developed countries, has some unique characteristics that highlight features of the Lao economy. However, the model is limited by data constraints and because it is an early-stage model. Firstly, this model neglects the influence of polarization. Secondly, some important

²⁹ Here, it is important to note that expansion of fiscal policy might accelerate inflation and cause macroeconomic instability. Empirical studies show that fiscal deficit is highly correlated with inflation, especially in developing countries. For detailed discussion of issues of fiscal deficit see Edwards and Tabellini (1991), Ashra et al (2004) and Woodford (2001).

macroeconomic variables such as external debt and ODA were neglected. Thirdly, monetary sectors did not include more detail in this model³⁰.

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³⁰ As mentioned in the previous sector, Lao financial system is underdeveloped, so it is difficult to include detailed financial variables in the model. However, it is a challenge for future study.

References

- ADB (Asian Development Bank). (1992). *Final report on the portfolio review of the banking system of the Lao PDR*, (ADB TA project 1296-Laos), Manila : Asian Development Bank.
- Ashra, S., Chattopadhyay, S., & Chaudhuri, K. (2004). Deficit, money and price: The Indian experience. *Journal of Policy Modeling*, 26.
- Bleaney, M. (1996). Macroeconomic stability, investment and growth in developing Countries. *Journal of Development Economics*, 48.
- Bourdet, Y. (1994). Fiscal policy under transition: The case of Laos. *Europe-Asia Studies*, 46 (6).
- Bourdet, Y. (1995). Macroeconomic stabilisation under transition. *Communist Economies and Economic Transformation*, 4 (4).
- BOL (Bank of Laos), ADB (Asian Development Bank), and WB (World Bank). (2002). *The banking and financial sector of Lao PDR: Financial sector note*. Vientiane: Bank of Laos, Asian Development Bank, and World Bank.
- Dalaloy, V. (2006). *Strengthening financial and banking sector*. Paper presented at the Donor's Working Group on Lao PDR Macroeconomic Issues and Private Sector Development. Vientiane: Bank of the Lao PDR.
- Esterly, W. (1993). Fiscal policy and economic growth: An empirical investigation. *Journal of Monetary Economics*, 32.
- Edwards, S. and Tabellini, G. (1991). Explaining fiscal policies and inflation in developing countries. *Journal of International Money and Finance*, 10.
- Hara, Y. (2002). Roles of the government in transition, global integration and economic development in Lao PDR. In State Planning Committee and Japan International Cooperation Agency (Eds.) *Macroeconomic support policy for socio-economic development in the Lao People's Democratic Republic Vol.1*, Tokyo: Japan International Cooperation Agency.
- Menon, J. (2006). Would you like to pay in Dollars, Baht, or Kip? Economic consequences of multiple currencies in the Lao People's Democratic Republic. *Journal of Greater Mekong Subregion Development Studies*, 3 (2).
- IMF (International Monetary Fund). (2006). Lao People's Democratic Republic (Staff

- Report for the 2005 Article 4 Consultation). Washington D.C: International Monetary Fund.
- IMF (2008), *IMF Executive Board Concludes 2008 Article IV Consultation with the Lao People's Democratic Republic*, International Monetary Fund. Available at <http://www.imf.org/external/np/sec/pn/2008/pn08109.htm>
- Furukawa, H. (2002). Dollarization in the Lao PDR: It's development and current situation. In Joint Research Project Workshop, State Bank of Vietnam and JICA (Eds.) *Dollarization and its effect on monetary and foreign exchange rate policies and the development of financial systems: Vietnam, Lao PDR and Cambodia*, Hanoi: Japan International Cooperation Agency.
- Government of the Lao PDR. (2004). *National growth and poverty eradication strategy*. Vientiane: Author.
- Government of the Lao PDR. (2006). *Sixth national socio economic development plan (NEDP) for 2006 to 2010*. Vientiane: Ministry of Planning and Investment.
- Kyophilavong, P. (2003). *Analyzing the Lao economy – Macroeconomic model approach*, (Doctoral dissertation, GSIC, Kobe University, 2003).
- Kyophilavong, P. (2007). *Monetary and exchange rate policies in the Lao PDR*, Paper presented at Report Finalization Workshop Part One, Monetary and Exchange Rate Policies in Cambodia, Lao PDR and Vietnam, The Scope for Regional Cooperation, Bangkok, Thailand: the Asian Development Bank.
- Keomixay, S., Sisouphantong, B., Leebouapao, L., Sone, P., and Souksavath, P. (1999). "Case Study of the Lao Peoples's Democratic Republic", Development Analysis Network (Eds.) *Impact of the Asia financial crisis on the Southeast Asian transitional economies*. Conference Papers, Phnom Penh, Cambodia: Development Analysis Network.
- Kyophilavong, P. & Toyoda, T. (2004). An econometric analysis of the Lao economy – Simulation using macroeconomic model. In Amakawa, N. & Yamada, N. (Eds.) *Laos: Transformation to the market economy under a single-party regime* Kenkyu Soshu (Institute of Developing Economies Research Series No.545). Chiba, Japan: JETRO.

- Kyophilavong, P. & Toyoda, T. (2008). "Impacts of foreign capital inflows on the Lao economy. In Toyoda, T. (Ed.) *Empirical research on trade and finance in East Asia*, (Research Series) Hiroshima: Hiroshima Shundo University.
- Lathouly, P. (2000). *Macroeconomic policies and institutions in the Lao People's Democratic Republic*, Vientiane: the Bank of Laos.
- Ljunggren, B. (1993). Market economies under communist regimes: Reform in Vietnam, Laos and Cambodia. In Ljunggren, B (Ed). *The challenge of reform in Indochina*. Boston: Harvard University Press.
- NSC (National Statistic Center). (2003). The households of Lao PDR: Social and economic indicators. In NSC (Ed.) *Lao expenditure and consumption survey 1997/98*. Vientiane: National Statistic Center.
- Okonjo-Iweala, N., Kwakwa, V., Beckwith, A., and Ahmed., Z. (1999). Impact of Asia's financial crisis on Cambodia and the Lao PDR. *Finance & Development*, 36 Issue: 3 Page: 48(4).
- Otani, I. and Pham, C. (1996). *The Lao People's Democratic Republic System Transformation and Adjustment*, International Monetary Fund.
- Toyoda, T. and Kyophilavong, P. (2005). Macroeconomic management of the Lao economy: An econometric evaluation. *Journal of Economic Sciences*, 9 (1).
- Toyoda, T. and Kyophilavong, P. (2007). Unfavorable truth of currency integration: The case of Laos. *Journal of Economic Sciences*, 11 (1).
- UNDP (United Nations Development Programme). (2007/2008). Fighting climate change: Solidarity in a divided world. In UNDP (Ed.) *Human Development Report 2007/2008*. United Nations Development Programme.
- WB (World Bank). (2007). *Lao PDR economic monitor*. Vientiane: World Bank.
- WB (World Bank). (2008). *Lao PDR economic monitor*. Vientiane: World Bank.
- Woodford. M. (2001). Fiscal requirements for price stability." *Journal of Money, Credit, and Banking*, 33 (3).

Table 1. Main macroeconomic variables for the Lao economy

Macroeconomic indicators	2001-2006	1996-2000	1990-1995
Population (million. person)*	5.46	4.86	4.40
Population growth (%)	2.12	2.06	2.52
GDP (current million US\$) **	2,416	1,618	1,276
GDP growth (%)	6.53	6.18	6.46
GDP per capita (constant 2000 US\$) **	379	307	248
GDP per capita growth (%)	4.04	3.68	3.80
Reserve Money (M2) (million US\$)*	450,981	270,728	148,280
Money supply (M2) (%)*	21.14	65.99	30.92
Inflation -CPI (%)	9.73	57.00	15.27
Trade Deficit (million. US\$)***	-219.91	-263.21	-174.92
Trade Deficit /GDP (%)	-9.24	-16.06	-13.14
Foreign reserve (million. US\$)***	220	127	48
External debt (million US\$) *	2,640	2,410	1,965
External debt /GDP (%)	115	152	161
Budget Deficit (including grants)(million US\$)	-104	-58	-100
Budget Deficit /GDP (%)	-4.42	-3.60	-7.61
Budget Deficit (exclude grants)(million US\$)	-149	-121	-145
Budget Deficit /GDP (%)	-6.29	-7.58	-11.21
Exchange Rate (kip/US\$) Official Rate***	10,163	4,094	727

Sources:

* Asian Development Bank (ADB), *Key Indicators for Asia and the Pacific 2008* www.adb.org/statistics

** World Bank, *World Development Indicators CD-ROM (2005)* and

*** International Monetary Fund, *International Financial Statistics CD-ROM August 2008*

Table 2. Data sources of main variables

variables	Code	Unit	en/ex	Source
Government consumption(real)	CG	Bill.Kip	Endogenous	World Development Indicators CD-ROM 2007
Private consumption(real)	CP	Bill.Kip	Endogenous	World Development Indicators CD-ROM 2007
Export (real)	EX	Bill.Kip	Endogenous	International Financial Statistics CD-ROM 2007
Import (real)	IM	Bill.Kip	Endogenous	International Financial Statistics CD-ROM 2007
General Price	PL	1995=100	Endogenous	Key Indicators Of Developing Asian And Pacific Countries 2007
Non-tax revenue(real)	NOTAX	Bill.Kip	Exogenous	Bank of The Lao PDR, Annual Report, Various Issues
Exchange rate (Kip/Dollar)	RATEU	Kip/Dollar	Exogenous	Key Indicators Of Developing Asian And Pacific Countries 2007
Government revenue(real)	REV	Bill.Kip	Endogenous	Bank of The Lao PDR, Annual Report, Various Issues
Lending rate(nominal)	RISI	Percent	Exogenous	Bank of The Lao PDR, Annual Report, Various Issues
Direct tax(real)	DTAX	Bill.Kip	Endogenous	IMF Staff Country Report Various Issues
Indirect tax(real)	ITAX	Bill.Kip	Endogenous	IMF Staff Country Report Various Issues
Foreign direct investment(real)	FDI	Bill.Kip	Exogenous	Key Indicators Of Developing Asian And Pacific Countries 2007
Gross domestic product	GDP	Bill.Kip	Endogenous	Key Indicators Of Developing Asian And Pacific Countries 2007
Potential non-agriculture GDP(real)	GDPNS	Bill.Kip	Endogenous	Key Indicators Of Developing Asian And Pacific Countries 2007
Potential agriculture GDP(real)	GDPAS	Bill.Kip	Endogenous	Key Indicators Of Developing Asian And Pacific Countries 2007
Government investment(real)	IG	Bill.Kip	Exogenous	Key Indicators Of Developing Asian And Pacific Countries 2007
Import price	IP	1995=100	Exogenous	Key Indicators Of Developing Asian And Pacific Countries 2007
Agriculture population	LA	1000 persons	Exogenous	Key Indicators Of Developing Asian And Pacific Countries 2007
Non-agriculture population	LN	1000 persons	Endogenous	Key Indicators Of Developing Asian And Pacific Countries 2007
Money supply(nominal)	MONP	Bill.Kip	Exogenous	Key Indicators Of Developing Asian And Pacific Countries 2007
Total population	NP	1000 persons	Endogenous	Key Indicators Of Developing Asian And Pacific Countries 2007
Agriculture area	HPA	1000 Hector	Exogenous	National Statistic Center
Capital stock(real)	K	Bill.Kip	Endogenous	Calculation
Domestic investment(real)	DI	Bill.Kip	Exogenous	National Statistic Center

Source: the author

Table 3. Results of the final test

Variables	RMSPE (%)
CP	18.04
DI	25.00
EX	12.75
GDP	17.72
I	30.56
IM	20.18
K	5.66
LN	4.68
NP	0.80
PL	9.59
TAX	11.70
WAGE	15.89

Source: authors estimation from model.

Note: RMSPE: Root-Mean-Squared Percent Error

Table 4: Assumptions for simulation

Policy		Assumptions	
IGP	Fiscal policy	Government investment	+/- 100 bil.kip
MONEP	Monetary policy	Money supply	+/- 100 bil.kip
RATEU	Exchange rate policy	Exchange rate (Kip/US)	+/- 5%

Source: the author.

Table 5: Policy simulation scenarios

Scenarios		Policies
Scenario1	IGP(+) MONEP(+) RATEU(+)	1. Increased government investment by 100 billion kip 2. Increased money supply by 100 billion kip 3. Exchange rate (Kip/US) appreciation by 5%
Scenario2	IGP(+) MONEP(+) RATEU(-)	1. Increased government investment by 100 billion kip 2. Increased money supply by 100 billion kip 3. Exchange rate (Kip/US) depreciation by 5%
Scenario3	IGP(-) MONEP(-) RATEU(-)	1. Decreased government investment by 100 billion kip 2. Decreased money supply by 100 billion kip 3. Exchange rate (Kip/US) depreciation by 5%
Scenario4	IGP(-) MONEP(-) RATEU(+)	1. Decreased government investment by 100 billion kip 2. Decreased money supply by 100 billion kip 3. Exchange rate (Kip/US) appreciation by 5%
Scenario5	IGP(-) MONEP(+) RATEU(+)	1. Decreased government investment by 100 billion kip 2. Increased money supply by 100 billion kip 3. Exchange rate (Kip/US) depreciation by 5%
Scenario6	IGP(-) MONEP(+) RATEU(-)	1. Decreased government investment by 100 billion kip 2. Increased money supply by 100 billion kip 3. Exchange rate (Kip/US) depreciation by 5%
Scenario7	IGP(+) MONEP(-) RATEU(-)	1. Increased government investment by 100 billion kip 2. Decreased money supply by 100 billion kip 3. Exchange rate (Kip/US) appreciation by 5%
Scenario8	IGP(+) MONEP(-) RATEU(+)	1. Increased government investment by 100 billion kip 2. Decreased money supply by 100 billion kip 3. Exchange rate (Kip/US) appreciation by 5%

Source: the author

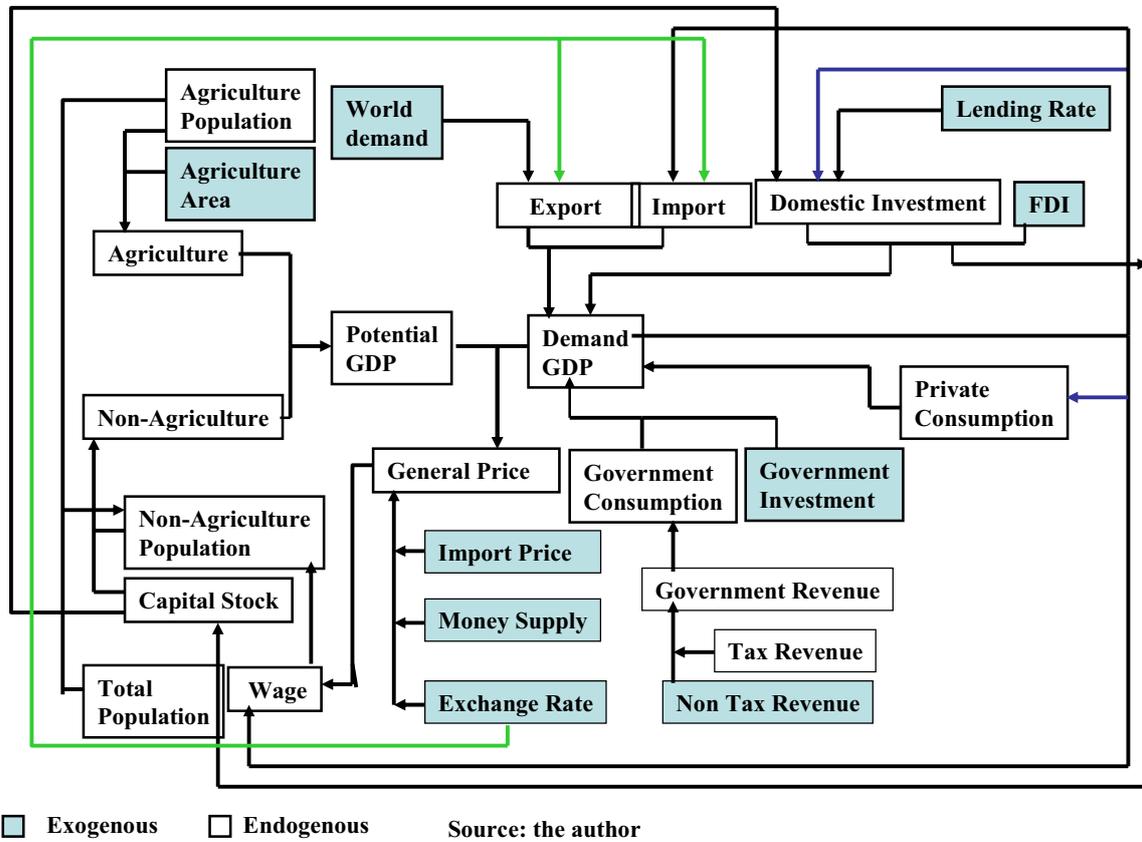
Table 6. Simulation results

(%)

Scenarios	Variables	Year 1	Year 2	Year 3	Average
Scenario1	GDP	0.50	0.45	0.34	0.43
	PL	31.60	25.61	18.14	25.12
Scenario2	GDP	0.87	0.96	0.97	0.93
	PL	28.64	22.47	15.09	22.07
Scenario3	GDP	-0.59	-0.77	-0.75	-0.70
	PL	-32.32	-25.27	-17.11	-24.90
Scenario4	GDP	-1.10	-1.38	-1.44	-1.31
	PL	-30.28	-22.96	-14.69	-22.64
Scenario5	GDP	-7.63	-7.86	-7.71	-7.73
	PL	-5.08	-0.02	3.39	-0.57
Scenario6	GDP	-7.26	-7.40	-7.16	-7.28
	PL	-8.11	-3.22	0.32	-3.67
Scenario7	GDP	6.78	7.28	7.35	7.14
	PL	5.39	1.54	-1.57	1.79
Scenario8	GDP	6.32	6.67	6.61	6.53
	PL	7.67	4.01	0.94	4.20

Source: the author

Figure 1. Model Flowchart



Appendix 1: Behavior equations and identity

In this model, there are behavior equations, identities and statistic equations³¹ as follows:

Gross domestic product (GDP)

$$\text{GDP} = \text{CP} + \text{I} + \text{G} + \text{EX} - \text{IM} \quad (1)$$

CP = Private investment EX = Export

I = Total investment IM = Import

G = Government expenditure

Nominal GDP (GDPP)

$$\text{GDPP} = \text{GDP} * \text{PL} / 100 \quad (2)$$

GDP = Gross domestic product PL = General prices

Gross national product (GNP)

$$\text{GNP} = \text{GDP} + \text{IFA} \quad (3)$$

GDP = Gross domestic product IFA = Net income from abroad

National income³² (NI)

$$\text{NI} = \text{GDP} - \text{ITAX} \quad (4)$$

GDP = Gross domestic product NI ITAX = Indirect tax

Potential production function³³ (GDPS)

$$\text{GDPS} = \text{GDPAS} + \text{GDPNS} \quad (5)$$

GDPAS = Potential agriculture production

GDPNS = Potential non-agriculture production

Potential agriculture production³⁴ (GDPAS)

³¹ It is important to note that most of variables is real value except price, agriculture area, interest rate and exchange rate.

³² There are no time series depreciation data for Laos. To make it simpler, the author assumed no depreciation. Therefore, real net national income is equal to real gross national product (GNP).

³³ The author assumed that potential production (GDPS) has the estimated value of real GDP, which is determined by capital stock lag one year and labor. In developing countries, it is common to divide potential production function into agricultural and non-agricultural sectors. In Laos, the agricultural sector is an important one. Therefore, the author divided potential production function into agricultural and non-agricultural sectors.

$$\text{Ln}(\text{GDPAS}/\text{LA}) = f ((+)\text{Ln}(\text{HPA}/\text{LA})) \quad (6)$$

LA= Agricultural labor HPA= Agricultural area

Potential non-agriculture production³⁵ (GDPNS)

$$\text{Ln}(\text{GDPNS}/\text{LN}) = f ((+) \text{Ln} (\text{Kn}(-1) / \text{LN})) \quad (7)$$

LN = Non-agriculture population

Kn(-1) = Non-agriculture capital stock lag one year

Demand pressure definition (DS)

$$\text{DS} = (\text{GDP}/\text{GDPS}) * 100 \quad (8)$$

GDPS= Potential GDP GDP = Gross domestic product

Private consumption function³⁶ (CP)

$$\text{CP} = f ((+) \text{NI} , (+) \text{CP}(-1)) \quad (9)$$

CPI (-1) = Private consumption lag one year

NI = National income

Domestic investment function (DI)

$$\text{DI} = f ((+) (\text{GDP} - \text{GDP}(-1)) , (-) \text{K}(-1) , (+) \text{RISI}) \quad (10)$$

GDP= Gross domestic product GDP(-1)= Gross domestic product lag one year

K(-1) = Capital stock lag one year RISI = Nominal lending rate

Total investment (I)

$$\text{I} = \text{DI} + \text{FDI} + \text{IG} \quad (11)$$

DI= Domestic investment

FDI= Foreign direct investment

IG= Government investment

³⁴ GDPAS is determined from agricultural area (HPA) and agricultural population (LA). GDPAS is assumed as the homogeneous Cobb-Douglas production function.

³⁵ In addition, GDPNS is determined from non-agricultural capital stock lag one year K(-1) and non-agriculture population (LN). GDPNS is also assumed as the homogeneous Cobb-Douglas production function.

³⁶ To make it simple, the author followed Keynes's theory in which consumption is determined only by income. In general, private consumption is determined by personal disposable income. But income tax is a small percentage of tax revenue. Therefore, the author assumed that only real national income is determined by real private consumption.

Capital stock (K)

$$K = K(-1) + I \quad (12)$$

K = Total capital stock K(-1) = Total capital stock lag one year

I = Total investment

Wage function³⁷ (WAGE)

$$WAGE = f((+) GDP, (+) PL, (+) WAGE(-1)) \quad (13)$$

GDP = Gross domestic product PL = General prices

WAGE(-1) = Wage lag one year

Direct tax function (DTAX)

$$DTAX = f((+) NI, (+) DTAX(-1)) \quad (14)$$

NI = National income DTAX(-1) = Direct tax lag one year

DTAX = Direct tax

Indirect tax function (ITAX)

$$ITAX = f((+) NI, (+) ITAX(-1)) \quad (15)$$

NI = National income

ITAX(-1) = Indirect tax lag one year

Total tax function (TAX)

$$TAX = ITAX + DTAX \quad (16)$$

DTAX = Direct tax

ITAX = Indirect tax

³⁷ In general, wage can be explained by the unemployment rate and general price. Due to an incomplete labor market in Laos, the author assumed that unemployment does not strongly affect wage. In addition, there are no time series wage data in Laos. Therefore, the author assumed that real wage is determined from real GDP, general price, and lag one year of itself.

Government expenditure (G)

$$G = IG + CG \quad (17)$$

CG= Government consumption

IG= Government investment

Total government revenue (REV)

$$REV = TAX + NOTAX \quad (18)$$

TAX = Tax revenue

NOTAX= Non-tax revenue

Government consumption function (CG)

$$CG = f((+) REV, (+) CG(-1)) \quad (19)$$

REV = Government revenue

CG(-1)= Government consumption lag one year

Export function (EX)

$$EX = f((+) TV, (+) RATEU) \quad (20)$$

TV= GDP of Thailand and Vietnam

RATEU= Nominal exchange rate (Kip/US\$)

Import function (IM)

$$IM = f((+) GDP, (+) RATEU) \quad (21)$$

GDP= Gross domestic product

RATEU= Nominal exchange rate (Kip/ US\$)

Agricultural population (LA)

$$LA = NP - LN \quad (22)$$

NP= Total population

LN= Non-agriculture population

Non-agriculture population function (LN)

$$LN = f((+) WAGE, (+) LN(-1)) \quad (23)$$

WAGE= Wage

LN(-1)= Non-agriculture population lag one year

General prices function³⁸ (PL)

$$PL = f((+) DS, (+) MONP/GDP, (+) RATEU) \quad (25)$$

DS= Demand pressure

MONP=Money supply

GDP= Gross domestic product

RATEU= Exchange rate (kip/ US\$)

³⁸ High inflation is not a serious problem in developed countries as it is in developing countries. Because in Laos the monetary sector is incomplete, the circle of wage and price cycle cannot explain inflation. Drawing on previous studies of macroeconomic models in developing countries, the author used the quantity theory of money to explain inflation.

Appendix 2: Estimated equations

Behavior equation

1. Private Consumption Function

$$CP = -217.67 + 0.46*NI + 0.67*CP(-1)$$

(-2.62) (2.46) (3.45)

$$R-SQ = 0.91 \quad F = 40.98$$

2. Domestic Investment Function

$$DI = 323.29 + 0.59*(GDP - GDP(-1)) - 0.04*K(-1) - 1.01*RISI$$

(2.84) (2.84) (-3.96) (-0.20)

$$R-SQ = 0.88 \quad F = 25.51$$

3. Wage Function

$$WAGE = 130.02 + 0.81*GDP + 0.05*PL - 0.02*WAGE(-1) + 43.14*DD1$$

(5.77) (12.63) (2.85) (-0.29) (5.63)

$$R-SQ = 0.99 \quad F = 1637.45$$

4. Direct Tax Function

$$DTAX = -33.71 + 0.05*NI - 0.12*DTAX(-1) + 5.95*DD1$$

(-2.12) (2.75) (-0.37) (1.39)

$$R-SQ = 0.85 \quad F = 22.41$$

5. Indirect Tax Function

$$ITAX = -76.57 + 0.10*NI + 0.49*ITAX(-1) - 56.53*DD1$$

(-3.5) (6.63) (3.19) (-5.98)

$$R-SQ = 0.84 \quad F = 48.52$$

6. Government Consumption Function

$$CG = 16.13 + 0.16*REV + 0.72*CG(-1) - 32.02*DD1$$

(0.72) (1.68) (4.84) (-0.55)

$$R-SQ = 0.75 \quad F = 12.51$$

7. Export Function

$$EX = -230.59 + 2.43*TV + 0.03*RATEU + 90.85*DD1$$

(-1.40) (2.49) (3.93) (2.15)

$$R-SQ = 0.73 \quad F = 10.43$$

8. Import Function

$$IM = -586.12 + 0.77*GDP - 0.02*RATEU$$

(-5.69) (9.26) (-2.12)

$$R-SQ = 0.93 \quad F = 72.23$$

9. Non-agriculture Population

$$LN = 10.62 + 0.02*WAGE + 1.02*LN(-1)$$

(1.56) (0.37) (16.34)

R-SQ = 0.91 F = 40.98

10. General Price Function

$$PL = -17.84 + 0.12 * GDP/GDPS + 324.56 * MONP/GDP + 0.04 * RATEU$$

(-0.38) (0.70) (10.68) (6.00)

R-SQ=0.98 F=196.28

Statistic Equation

11. Potential Agriculture Production Function

$$\ln(GDPAS/LA) = -0.44 + 0.13 * \ln(HPA/LA) - 0.07 * DDI$$

12. Potential Non-agriculture Production Function

$$\ln(GDPNS/LN) = -0.62 + 0.71 * \ln(k(-1)/LN) - 0.005 * DDI$$