

Aggregate Demand, Aggregate Supply and Economic Growth of Vietnam: Theory and evidence on an econometric analysis

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Aggregate Demand, Aggregate Supply and Economic Growth of Vietnam : Theory and evidence on an econometric analysis

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Abstract

This paper examines the determinants of economic growth of Vietnam focusing on an aggregate demand and aggregate supply with an econometric analysis. According to the regression and scenario simulation analysis, we can see that although the Vietnamese economy has achieved the steady growth since Doi Moi, the supply-side is still too weak to meet the demand-side increases, which results in the macro imbalances including trade deficit and inflation as experienced in 2007-08. FDI inflows have played a significant role to strengthen the supply-side economy so that the Vietnamese government needs to improve the environments to attract foreign capital inflows for sustainable growth.

Keywords: aggregate demand, aggregate supply, macro econometric model,
FDI, scenario simulation

JEL Classification Numbers: C53, F21, O11

1. Introduction

Since starting the “Doi Moi” policy in 1986, the Vietnamese economy has achieved a steady growth by strengthening both the demand-side and the supply-side economy. With improvements of social infrastructures by the government, private sector has stimulated capital accumulation and strengthened the supply-side economy. Within this development process, Vietnam has successfully attracted FDI and achieved an export-led growth since the mid-1990s in the vital economic development of Asia and the Pacific.

As a result, the Vietnamese economy has accelerated the growth, and per capita income exceeded one thousand dollar in 2008. However, in the middle of the 2000s the Vietnamese economy was heated, and the economic boom resulted in hyper inflation and large trade deficit in 2007-2008.

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In 2008 the economy experienced large macro imbalances with around twenty percent inflation in terms of general deflator of GDP (GDP deflator) and trade deficit at minus US\$12.8 billion along with the high economic growth and oil price hikes. Although the world financial crisis damaged the world economy in 2008-09, many Asian economies including Vietnam recovered their growth performance in 2010. In the case of Vietnam, it seems the growth performance may heavily depend on the macro supply-side as a driving force since the economy cannot expand beyond the supply capacity in a long-run. In other words, the macro demand-supply imbalance with an inflationary gap may result in inflation, trade deficit, and so on, which prevent the economy from achieving her economic growth.

Accordingly, this paper attempts to analyze the Vietnamese macro economic structure with special attention to the macro demand-side (aggregate demand) and supply-side (aggregate supply) economy, and to examine the determinants of sustainable economic development with an econometric analysis.

Regarding a macro econometric model analysis for Vietnam, some modeling projects have developed an econometric model of Vietnam and analyzed the economic structure, in line with the development of data base, especially SNA. For example, CIEM (Central Institute for Economic Management for Vietnam 2000) developed a macro econometric model of Vietnam and employed it for policy analysis, and Nakamura (2010) examined the macro economic structure and growth performance of Vietnam employing a demand-supply integrated type macro econometric model.

As for the structure of this paper, following this introduction, section 2 discusses a theoretical model for growth employed in this study. Section 3 analyzes the macro economic structure of Vietnam by means of a macro econometric model, with special attention to the demand-side and supply-side economy. Section 4 conducts scenario simulations to analyze the determinants of growth and its performance of the Vietnamese economy. Finally, section 5 summarizes this paper as concluding remarks.

2. Theoretical Model Framework

2.1. Economic development of Vietnam since Doi Moi

Before discussing a model framework employed in this study, let's review

the Vietnamese economy and its growth performance in the transition period since Doi Moi which was held in 1986, in order to clarify the objectives of this research because the model framework heavily depends on the research purposes.

As noted, the Vietnamese economy has achieved fairly high economic growth in the past decades. However, recently, the Vietnamese economy has had macro imbalance problems including inflation and external deficit as well as the other countries experienced in the take-off stage in the past. For example, the economy suffered from hyper inflation exceeding around 22 percent in terms of PGDP and large external deficits of over 15 percent in terms of the ratio of trade of goods and services to nominal GDP in 2008.

However, as shown in Figure 1, the growth performance has been still steady and even after the world financial crisis the economy recovered its high growth as well as the other Asian countries in 2009 onward. If employing Rostow's views (Rostow 1960), many problems are taken place in the take-off stage, which may be the proof of advancing to the next stages.

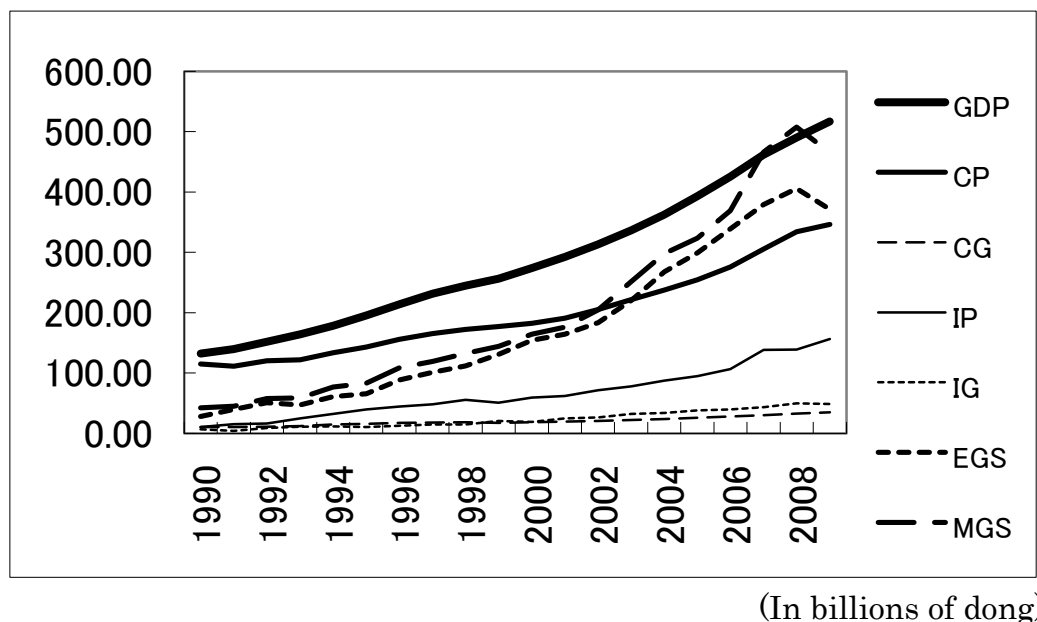


Figure 1 Real GDP and its Components of Vietnam, 1990-2009

As demonstrated in Figure 1, real GDP and its components growth performance have been strong in the past two decades. Particularly, growth

of exports and private investment has been remarkable to lead the economy and government expenditures including government consumption and invest have also recorded steady growth. However, the trade imbalance in terms of goods and services (EGS-MGS) was widened gradually. In particular, after 2007 imports increased sharply in order to meet the sharply increased domestic demand along with the heated economy with a construction boom, which resulted in the large trade imbalance. Therefore, inflation rate also accelerated along with the heated economy and oil price hikes.

Figure 2 shows rate of changes in PGDP, import price and per capita (labor) income in terms of dong in 2000-2009. In the latter half of the 1990, the inflation rate was fairly ceased as compared to that of the 1980s and the first half of the 1990s. However, in line with the high economic growth and per labor income increase, it seems the economy may have large imbalances between aggregate demand and aggregate supply, which resulted in widening the trade imbalance.

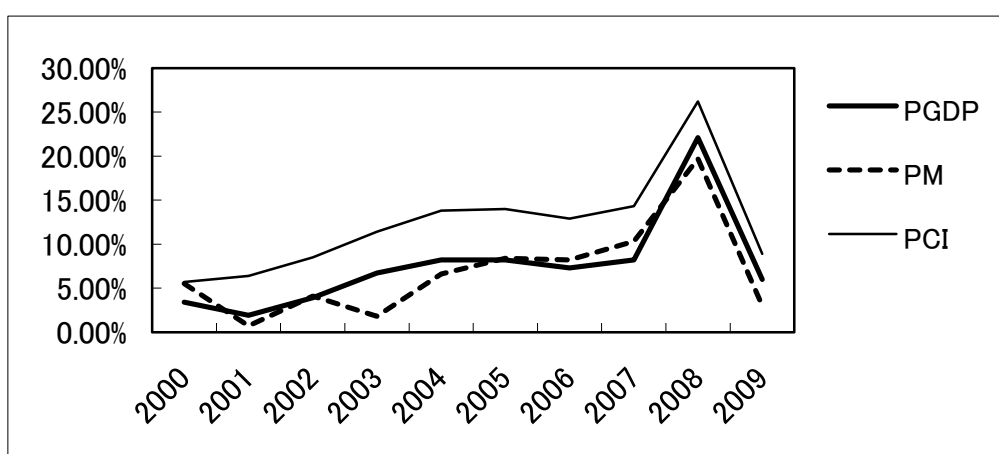


Figure 2 Rate of Changes in PGDP, import prices and Per Labor Income in terms of dong (PCI) in 2000-2009

2.2. Demand-side and supply-side economy in the process of economic development

In the process of economic development we can observe different driving forces for growth in the economy. Figure 3 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 (Y_d), and an aggregate supply which is a macro supply-side GDP (Y_s), 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 capital stock (K), labor (L) and technology (τ), is lower than that of the demand-side GDP which is comprised 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 stronger 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 3)

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 T_1 , there exist a deflationary gap ($Y_d<Y_s$) 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 T_1 since the economic growth depends on the demand-side growth performance as Japan and West Germany experienced in the 1970s (Nakamura 2008).

Generally, the economic structure before T_1 , in which the demand-side GDP is larger than the supply-side, is a “developing country type economic structure” and after T_1 , on the other hand, a “developed country type

economic structure”.

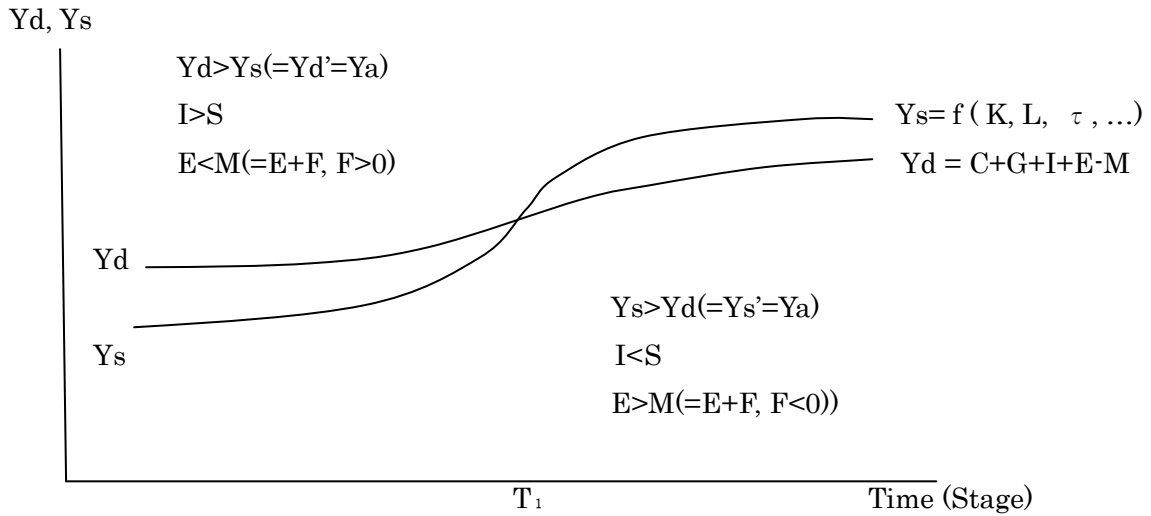


Figure 3 Demand-Side and Supply-Side Economy in the process of Economic Development (source: Nakamura 2008)

2.2. Theoretical model

In the case of Vietnam, the economy is in the stage before T_1 and it seems that the economy has launched into the initial stage of “take-off” since the mid-2000s. In other word, the Vietnamese economy still has an inflationary gap, in which both inflation and trade deficit are deteriorated when the actual economy is stimulated by increases of demand components beyond the supply-side GDP.

Accordingly, this section discusses the theoretical framework of growth model for this analysis. There are several types of growth theories such as the Harrod-Domar model (Harrod 1939, Domar 1947), neoclassical growth theory (Solow 1956, Swan 1956), AK model, new growth theory (Romer 1986, Lucas 1988) and so on, in which these models except for the Harrod-Domar model rely on a supply-side approach for growth. On the other hand, the Harrod-Domar model is a very unique model to analyze equilibrium growth with IS balance, as an extension of Keynes’s static equilibrium analysis, but still the model in a closed economic system.

However, these growth models are too naïve as a theoretical model to be applied to the actual economy. Therefore, we introduce a more realistic model for growth and employ it for empirical studies on the Vietnamese

economy. In this study we introduce a demand-supply integrated type model. Here, we discuss the theoretical framework of the demand-supply integrated growth model, as follows.

<Supply-side model>

$$\Delta Y_s / Y_s = A' + \alpha \Delta K / K + \beta \Delta L / L \quad (\alpha + \beta = 1) \quad (1)$$

$$K = I + (1 - \delta) K(-1) \quad (2)$$

where Y_s , A' , K , L , I and δ mean supply-side GDP, changes in total factor productivity, capital stock, the number of labor, investment and depreciation rate of capital, respectively.

<Demand-side model>

$$Y_d = C + G^* + I + E^* - M \quad (3)$$

$$C = C_d(Y_d) + C^*(p, A, N, \dots) = \gamma Y_d + C^* \quad (4)$$

$$I = I_d(Y_d) + I^*(r, p, K, F, \dots) = \eta Y_d + I^* \quad (5)$$

$$M = M_d(Y_d) + M^*(p, e, \dots) = \theta Y_d + M^* \quad (6)$$

From equation (1) to (6), we obtain a reduced form equation.

$$Y_d = 1 / (1 - \gamma - \eta + \theta) (C^* + G^* + I^* + E^* - M^*) \quad (7)$$

Taking a form of growth rates,

$$\Delta Y_d / Y_d = (1 - \gamma - \eta + \theta)^{-1} W \quad (8)$$

$$(W = (\Delta C^* / C^*)(C^* / Y_d) + (\Delta G^* / G^*)(G^* / Y_d) + (\Delta I^* / I^*)(I^* / Y_d) + (\Delta E^* / E^*)(E^* / Y_d) - (\Delta M^* / M^*)(M^* / Y_d))$$

where Y_d , C , C_d , G , I , I_d , E , M , M_d , p , r , F and e refer to the demand-side GDP, overall consumption, consumption dependent on the demand-side GDP, government expenditure, overall investment, investment dependent on the demand-side GDP, exports, overall imports, imports dependent on the demand-side GDP, prices, interest rate, foreign capital inflows and foreign exchange rates, respectively. And, $*$ means variables independent of Y_d in I-S model, equation (3).

If we consider influences of changes in income distribution between wages and profits on growth, the demand-side growth model is more complicated (Nakamura 2011).

$$\begin{aligned} &<Prices\ block\ to\ integrate\ the\ Supply-side\ with\ Demand-side> \\ &p = p((+) Yd/Ys, (+) pm, (+) w, (-) \tau) \end{aligned} \quad (9)$$

where pm , w and τ mean import price, wage rates and technology, respectively.

As explained, the demand-supply integrated growth model is comprised of three equations, (1), (8) and (9), as a growth model. As well known, equation (1) is the Cobb-Douglas production function and equation (8) is the dynamic analogue of the Keynes-Harrod multiplier model, which consists of a multiplier and rate of changes in autonomous components of Y_d with the ratio of each component to Y_d as a weight. In short, the demand-side economic growth depends on these two factors, a multiplier which is an ‘accelerator’ for growth $((1 - \gamma - \eta + \theta)^{-1})$ and growth rates of autonomous demand-side components which is a ‘generator’ for growth (W).

Equation (9) is a price function which is related to the quantity adjustment process (Marshallian adjustment process), effects of technical progress on the prices and input costs. With price effects which are the price adjustment process (Walrasian adjustment process) in equations (4) - (6), the equation (9) integrates both the demand-side and the supply-side economy in a multi equation structural model system, based on micro foundation of macro analysis.

3. The Macro Demand-Supply Integrated Econometric Model of Vietnam

For analyzing the macro economic structure of Vietnam, we employ an empirical model applicable for an actual economy, as discussed above. Accordingly, we develop the macro demand-supply integrated econometric model of Vietnam, based on the theoretical framework with equation (1) to (9) discussed in the previous section, and examine the macro economic structure of Vietnam with special emphasis on the macro demand-supply balance and growth performance.

3.1. Structure of the macro econometric model of Vietnam

The Vietnamese macro model employed in this paper is comprised of

eight blocks, including (1) the real expenditure block, (2) the nominal expenditure block, (3) the prices and wage block, (4) the production block, (5) population and labor force block, (6) the money and finance block, (7) the government finance block and (8) the international trade and BOP block. As compared to the previous version of the Vietnamese model (Nakamura 2010), the two blocks, the money and finance block and the government finance block are newly integrated within the macro model, employing more reliable data sources. In this new macro model, money supply, M2, and lending rate are endogenized in the money and finance block, and some components of government revenues and expenditures are also modeled as an endogenous variable in the government finance block. The total number of variables in the model exceeds seventy including fifty-two endogenous variables and nineteen exogenous variables.

3.2. Macro economic structure of Vietnam : A regression analysis

Based on the theoretical model framework discussed above, we made a regression analysis. All of the equations, identity and behavioral equations are listed in Appendix A. In this sub-section, we discuss the macro economic structure of Vietnam employing major regression results.

With increases of capital transfer in the economy, the supply-side economy is strengthened and the role of capital accumulation is more important to improve productivities for the economic development of Vietnam. With respect to the supply side economy, the aggregate supply is determined in the conventional Cobb-Douglas production function.

According to the regression result with OLS, the capital share is 0.246 and, hence, the labor share is 0.754 (see equation 4.1 in Appendix A). This result demonstrates that the supply-side economic structure is still labor-intensive with a large share of agriculture sector in GDP. However, time trend (TIME) to explain technical progress is observed significantly. Therefore, it seems the Vietnamese supply-side economy is unceasingly strengthened with technical progress.

As for gross fixed capital formation, in this paper, real gross fixed capital formation is divided into real private investment and real government investment to examine the impacts of private sector investment on both the demand-side and the supply-side economy. Real private investment is estimated by subtracting the government sector investment from overall

gross fixed capital formation, in which the government sector real investment is estimated by the ratio of capital expenditure to overall government expenditure. (Please see Appendix C)

As well known, in the process of economic development since Doi Moi, the private sector investment has stimulated the supply-side economy with FDI. Therefore, we employ FDI as one of the independent variables, as well as real GDP and real interest rate, in real private investment function. According to the regression result, the coefficient of real FDI is 0.51 and it seems FDI might have large impacts on real capital formation and on the supply-side economy.

On the other hand, as for the demand side economy, the aggregate demand (GDE) is determined in an identity totaling the demand-side components including real private consumption, real government consumption, real private investment, real government investment, real inventory changes, and real exports and imports of goods and services. Basically, in the real expenditure block, the demand-side components depend on income effects and price effects, and some demand-side components are determined simultaneously with GDE. Therefore, a static Keynes multiplier, which explains the demand-side structure in an open-economic system, is calculated, as follows.

$$\text{Static Keynes multiplier} = 1 / (1 - 0.504 - 0.250 + 1.207) = 1 / 1.453 = 0.688$$

In accordance with this calculation, the static Keynes multiplier of Vietnam is 0.688, which depends on the marginal propensity to consume at 0.504 (please see equation 1.2 in Appendix A), the coefficient of induced investment at 0.250 (equation 1.3) and the marginal propensity to import at 1.207 (equation 8.2), without considering the impacts of government consumption and other indirect effects. In any case, in the case of Vietnam, the marginal propensity to import is extremely high since the ratio of imports to GDE is high. Therefore, the static Keynes multiplier of Vietnam is very much lower than 1.0, which implies that the supply-side is still too weak to meet the increases of domestic demands within the current macro economic structure. However, a static multiplier is different from a dynamic multiplier which can be calculated in a dynamic model. The dynamic multiplier of Vietnam will be discussed later on in this section.

Real exports of goods and services, on the other hand, are explained by real world imports as income effects, by export prices as price effects, and by supply-side GDP as supply-side effects, in which the coefficient of the supply-side effects seems to be effective enough to stimulate the real exports at 1.098 in terms of elasticity (Krugman 1989).

Concerning the price effects on the demand-side components, in this macro model, the price effects are taken into account in deciding GDE components including real private consumption, real exports and real imports, as the Walrasian price adjustment process. Furthermore, we realize the changes of labor productivity (GDP/LE), which is derived from the supply-side GDP, affect deflators including implicit deflator of GDP, implicit deflator of exports of goods and services (PEGS) and implicit deflator of private consumption (PCP), as the Marshallian quantity adjustment process (Klein 1983). In these implicit deflator equations, the elasticity of labor productivity changes to changes in deflator is 0.822 in the PGDP equation, 1.15 in the PCP equation and 0.248 in the PEGS equation, which means that the PGDP goes down by 0.822 percent, the PCP goes down by 1.15 percent and the PEGS goes down by 0.248 percent, respectively, when the labor productivity goes up by one percent (please see equation 3.4, 3.5 and 3.9 in Appendix A). This mechanism to link the supply-side to the demand-side economy is indispensable in the demand-supply integrated model.

3.3. Model reliability test

Before conducting scenario simulations, we perform a dynamic reliability test in order to evaluate the performance of the Vietnamese macro model whether or not the model can track the actual economy in the regression sample period. As for the model reliability test for the Vietnamese macro model, we employ the Final Test within Goldberger Test (partial, total and final tests) which can explain a dynamic reliability of the model. In dynamic simulation tests, we employ the Gauss-Seidel method with 0.1% convergent criteria within the Fortran System, SIMSYS (Sato and Nakamura 1996).

As for the method of solving the multi-equation structural model, we employ a step wise solving procedure, in which there are two types of regression results in the real expenditure block, OLS and 2SLS results. For the simulation tests and scenario simulations, we employ OLS results since

2SLS results are still unstable for the long-term simulations.

Table 1 Final Test Result with MAPE for Major Variables, 1991-2009 (%)

GDE	CP	CG	IP	IG	EGS	MGS	PGDP
1.93	2.49	2.51	3.59	2.71	2.83	3.08	417
GDEN	GDP	KP	NL	NLE	WN	M2	PCI
5.83	1.41	0.96	0.64	0.77	5.78	6.25	5.83

MAPE = $(\sum (| \text{Estimated} - \text{Actual} |) / \text{Actual}) / N * 100$ (please see variable list in Appendix B)

Table 1 shows the final test results for major endogenous variables in 1991-2009 with MAPE (Mean Absolute Percentage Errors). According to the final test, the Vietnamese macro model is able to track the actual economy within a 1.93% error range for real GDE which contains a 2.49% error range for real private consumption (CP), a 2.51% error range for real government consumption (CG), a 3.59% error range for real private investment (IP), a 2.83% error range for real exports of goods and services (EGS) and a 3.08% error range for real imports of goods and services (MGS), and to track the supply-side GDP within a 1.41% error range and PGDP within a 4.17 % error range. In other words, it seems that the model performance is quite well and the model is able to forecast the Vietnamese demand-side economy (GDE) with 98.07% accuracy. (Please see the dynamic path of the estimated GDE in Appendix D)

3.4. Dynamic multiplier test

As noted, the dynamic multiplier explains the macro economic structure, especially the demand-side economic structure. In this test, we assume that the real government investment (IG) increases by one trillion dong during ten years.

Table 2 shows the path of the dynamic multiplier. According to the dynamic multiplier test result, we can see that the multiplier is very much lower than unity, in which the multiplier is 0.839 in the first year and declining to 0.572 in the second year since there are one-year lagged effects in imports function (see equation 8.2 in Appendix A) and price effects on real

GDE components. In the sixth year the multiplier has the second peak at 0.617, but still very small. The small multiplier mainly results from the large propensity to import, which means that the domestic demand increases stimulated by the government investment are largely covered by imports and leaked out to the rest of the world through imports.

Table 2 Path of the Dynamic IG Multiplier ($\Delta \text{GDE} / \Delta \text{IG}$)

Year	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th
GDE	.839	.572	.552	.53	.571	.617	.590	.579	.586	.596
CP	.709	.330	.334	.341	.359	.364	.350	.373	.374	.380
CG	.009	.041	.044	.040	.041	.042	.037	.042	.043	.043
IP	.207	.102	.127	.117	.133	.145	.129	.136	.138	.141
IG	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EGS	.039	.055	.068	.089	.099	.109	.121	.132	.149	.170
MGS	1.125	.946	1.021	1.054	1.061	1.043	1.047	1.104	1.118	1.138

$$\Delta \text{GDE} / \Delta \text{IG} = (\Delta \text{CP} + \Delta \text{CG} + \Delta \text{IP} + \Delta \text{IG} + \Delta \text{J} + \Delta \text{EGS} - \Delta \text{MGS}) / \Delta \text{IG}$$

4. Scenario Simulation

Since starting the Doi Moi policy the Vietnamese economy has successfully achieved an unceasing development. In this period, government investments have played a significant role to improve social infrastructures with ODA, and to stimulate FDI and capital accumulation (Shishido et al 2003). At the same time, the Vietnamese economy has had a windfall to expand her exports within the world trade expansion, particularly in Asia and the Pacific. In other words, there exist some favorable factors to achieve the strong growth of the economy in the transition period. The Vietnamese economy, however, experienced the higher inflation and large trade deficit in the year 2007-2008 just before the world financial crisis. In short, it seems that the macro imbalances, within the larger demand-side economy than the supply-side economy, might result in the inflation and large trade deficit, and distort the economy in the transition period.

Accordingly, in this section, we conduct some scenario simulations to analyze the causes of the macro imbalances and to examine the impacts of some variable changes on the Vietnamese economy utilizing the macro econometric model. In order to examine the role of the major determinants

for growth in the past decades, we assume three scenarios, including 1) a government investment increase scenario with ODA, 2) a world trade expansion scenario, and 3) a private investment increase scenario with FDI, and analyze the impacts on the economy comparing them, among these three scenario simulations, with the baseline scenario which is the final test simulation conducted in the previous section since we conduct these scenario simulations in 1991-2009.

In these scenario simulations, we exogenously control three variables, including the real government investment (IG), the real exports (EGS) and real private investment (IP) and examine the impacts of increases of IG (SIM1), EGS (SIM2) and IP (SIM3) on the economy. In order to make these three scenario simulations comparable, a 5% of estimated real GDE in the final test is added to these three variables, IG, EGS and IP estimated in the final test, exogenously, for each simulation. Indeed, these three variables are heavily relied on ODA, world trade and FDI, respectively, which are exogenous variables in the model. Therefore, these scenarios are realistic as an ODA expansion scenario, a world trade expansion scenario and a FDI expansion scenario, respectively.

Table 3 shows the impacts of changes of IG, EGS and IP on the major endogenous variables by simulation. In each simulation, the exogenized control variable such as IG for SIM1, EGS for SIM2 and IP for SIM3, has the same deviation as compared to the baseline with the 5% of GDE of the final test which is the baseline scenario, as discussed above. In these scenario simulations, we get very interesting results, as follows.

In the first simulation (SIM1), this is similar to the dynamic Keynes multiplier simulation test conducted in the previous section. Therefore, the impacts on the demand-side GDE are limited at 4.2% in 1991, at 2.5% in 1992, at 2.8% in 2000 and at 2.7% in 2009, in % deviation, as compared to the baseline, in spite of the large increases in the government investment. These limited effects on GDE mainly rely on the large propensity to import and the price effects, as noted.

As shown in the Table 3, real imports (MGS) are increasing by 15.1% in 1991, by 8.9% in 2000, and by 5.7% in 2009, in % deviation, as compared to the baseline. Although the supply-side economy (GDP) has positive effects through private investment increases, the impacts on the supply-side GDP is limited and much smaller than that on the demand-side economy (GDE). As

a result, the macro balances are deteriorating, which results in rises in deflators and larger trade deficit.

Concerning the impacts on deflators, with the stimulated demand-side economy, PGDE rises by 0.3% in 1991, by 3.2% in 2000 and by 3.1% in 2009, in % deviation, as compared to the baseline, which may result in depressing the increases in the GDE components through price effects. As for trade balance in US\$, due to the increased real imports, trade balance in terms of balance on goods and services deteriorates by \$439 million in 1991, by \$1,495 million in 2000 and by \$3,963 million in 2009, as compared to the baseline. The deterioration of these macro imbalances mainly relies on changes in the macro demand-side and supply-side imbalance. Indeed, the inflationary gap between GDE and GDP (IGAP) is widened by 4,724 billion dong in 1991, by 4,822 billion dong and by 9,035 billion dong in 2009, in comparison with the baseline.

In the case of the second simulation (SIM2), real exports are controlled by the 5% increase of the real GDE calculated in the baseline, exogenously as well as in SIM1, so that the impacts on the economy are quite similar to the first scenario, SIM1. However, trade balance does not deteriorate since real exports are exogenously increasing in this scenario. Therefore, trade balance in terms of balance on goods and services (TBGS\$) is improved, as compared to SIM1, in spite of large increases of real imports. With the demand-side economic expansion by exports increase, trade balance is slightly improved by \$47 million in 2000, by \$325 million in 2009, as compared to the baseline.

Finally, in the case of the third scenario simulation (SIM3), with the increased private investment exogenously by the same amounts of IG increase in SIM1 and of EGS increase in SIM2, the impacts on both the demand-side economy (GDE) and the supply-side economy (GDP) are to be larger with dual effects of investment. The initial direct effects by increases in private investment are similar as compared to the other scenarios, SIM1 and SIM2. However, this scenario has great positive effects on the economy through direct and indirect effects. With the strengthened supply-side and labor productivity, the macro imbalances are drastically improved.

Concerning the demand-side economy, real GDE increases by 4.0% in 1991, by 4.3% in 2000 and 4.3% in 2009, in % deviation, as compared to the baseline. As for the impacts on the real GDE components, real private consumption (CP), government consumption (CG), real exports (EGS) and

real imports (MGS) have larger impacts, in which real exports have quite larger impacts through the supply-side effects, in comparison with the other scenario simulations, SIM1 and SIM2.

With respect to the impacts on the supply-side economy, the real supply-side GDP consistently increases, in the tested period, by 2.4% in 1991, by 7.3% in 2000 and by 6.3% in 2009. As a result, the macro demand-supply balance (IGAP) is improved, from the year 1992, by 6,022 billion dong in 1995, by 8,428 billion dong in 2000 and by 10,854 billion dong in 2009 in terms of deviation, as compared to the baseline. Furthermore, the inflation rates are also limited by improved labor productivity in spite of the large increases in the demand-side economy, so that the general deflator (PGDE) rises by 1.0 % in 1991, by 2.3% in 2000 and by 2.0% in 2009, as compared to the baseline, which are, however, much smaller than that of SIM1 and SIM2 because the supply-side is directly strengthened by the investment increases in this scenario simulation.

Trade balance is also deteriorated by increases of real imports, but the level of trade deficit is smaller than that of SIM1 in spite of the larger increases of the demand-side economy since real exports are stimulated by the strengthened supply-side economy in this scenario simulation. Therefore, it is important for the Vietnamese economy to improve trade imbalance which is one of the crucial problems for economic development through strengthening the supply-side economy.

In summary, with three alternative scenario simulations with the same amounts of increase in government investment, exports and private investment, it is elucidated that the Vietnamese economy, which has achieved an early stage of take-off, should reinforce the supply-side economy in order to meet the increased demand-side economy for further economic development by utilizing not only the domestic savings but also foreign capital inflows, in particular with FDI. That is the most probable way of achieving the take-off stage improving the macro imbalances in the future, as demonstrated in Figure 4, Figure 5 and Figure 6.

Table 3 Impacts of Changes in IG (SIM1), EGS (SIM2) and IP (SIM3) on
the Economy, 1991-2009, Deviation and % Deviation

(In billions of dong, %)

FY	1991	1995	2000	2005	2009
GDE: real gross domestic expenditure (demand-side GDP)					
SIM1	5,478(4.2)	5,344(2.7)	7,770(2.8)	10,978(2.9)	13,527(2.7)
SIM2	5,471(4.3)	4,941(2.5)	6,801(2.5)	9,306(2.4)	11,952(2.4)
SIM3	5,153(4.0)	7,282(3.6)	12,061(4.3)	18,802(4.9)	22,018(4.3)
CP: real private final consumption expenditure					
SIM1	4,758(4.6)	3,242(2.3)	4,811(2.5)	6,601(2.6)	8,328(2.5)
SIM2	4,318(4.2)	3,053(2.2)	4,206(2.2)	5,623(2.2)	7,332(2.2)
SIM3	3,700(3.6)	4,230(3.0)	7,077(3.7)	10,512(4.1)	12,268(3.7)
IP: real private investment					
SIM1	1,353(8.9)	1,310(3.4)	1,889(3.2)	2,590(2.7)	3,000(2.0)
SIM2	1,355(9.2)	1,209(3.3)	1,657(2.8)	2,217(2.3)	2,666(1.8)
SIM3	6,496(42.6)	9,952(25.3)	13,907(23.4)	19,175(20.2)	25,258(16.1)
IG: real government investment					
SIM1	6,496(167.1)	9,952(96.4)	13,907(73.0)	19,175(50.2)	25,258(52.0)
SIM2	0.0(0.0)	0.0(0.0)	0.0(0.0)	0.0(0.0)	0.0(0.0)
SIM3	0.0(0.0)	0.0(0.0)	0.0(0.0)	0.0(0.0)	0.0(0.0)
EGS: real exports of goods and services					
SIM1	257(0.6)	848(1.2)	1,900(1.2)	3,438(1.2)	3,821(1.0)
SIM2	6,496(16.4)	9,952(15.2)	13,907(9.0)	19,175(6.4)	25,258(6.8)
SIM3	1,197(2.8)	5,850(8.0)	13,264(8.5)	24,108(8.1)	28,083(7.3)
MGS: real imports of goods and services					
SIM1	7,347(15.1)	10,398(12.2)	15,236(8.9)	21,413(6.5)	27,464(5.9)
SIM2	7,339(16.0)	9,594(12.3)	13,438(7.9)	18,211(5.4)	23,865(5.2)
SIM3	6,912(14.3)	13,845(16.1)	23,296(13.6)	3,6245(10.9)	45,186(9.6)
PGDE: implicit deflator of GDE					
SIM1	0.09(0.2)	3.86(3.2)	5.27(3.2)	7.51(3.4)	9.19(3.1)
SIM2	0.26(0.5)	3.07(2.8)	4.38(2.6)	5.59(2.5)	8.01(2.6)
SIM3	0.53(1.0)	3.31(3.0)	3.88(2.3)	5.36(2.5)	6.02(2.0)

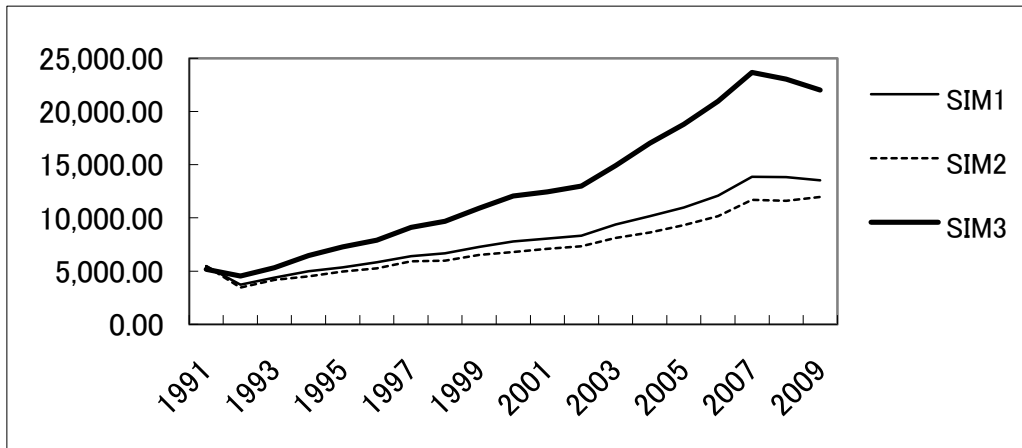
Continued)

Table 3 - Continued

FY	1991	1995	2000	2005	2009
GDP: real gross domestic products (supply-side GDP)					
SIM1	753(0.5)	1,935(1.0)	2,949(1.1)	3,879(1.0)	4,492(0.9)
SIM2	675(0.5)	1,841(1.0)	2,676(1.0)	3,412(0.9)	3,960(0.8)
SIM3	3,484(2.4)	13,304(6.9)	20,489(7.3)	27,073(7.0)	32,876(6.3)
TBGS\$: trade balance of goods and services in US \$					
SIM1	-439(74.5)	-1,016(75.8)	-1,495(119.7)	-2,238(66.5)	-3,983(37.9)
SIM2	-85(15.3)	8(-0.6)	47(-3.7)	86(-2.5)	325(-3.0)
SIM3	-371(64.3)	-975(68.1)	-1,377(108.5)	-2,007(58.7)	-3,530(31.6)
IGAP (= GDE-GDP): inflationary gap					
SIM1	4,724	3,409	4,822	7,099	9,035
SIM2	4,796	3,100	4,124	5,894	7,992
SIM3	1,669	-6,022	-8,428	-8,720	-10,854

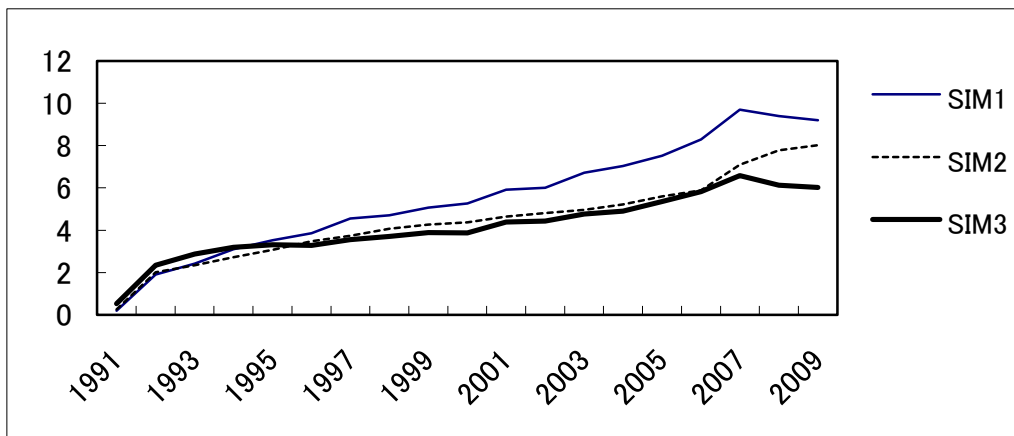
Deviation: SIM – BASE,

% deviation: (SIM-BASE)/BASE*100



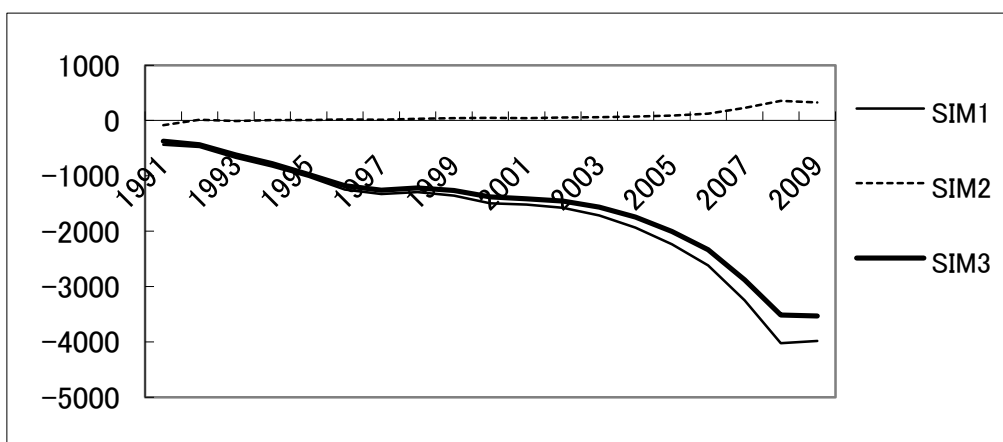
(In millions of dong)

Figure 4 Deviation of real GDE from the Baseline (Final Test) in SIM1, SIM2 and SIM3, 1991-2009



(Index: 1994=100)

Figure 5 Deviation of PGDE from the Baseline (Final Test) in SIM1, SIM2 and SIM3, 1991-2009



(In millions of US\$)

Figure 6 Deviation of Trade Balance of Goods and Services in US\$ from the Baseline (Final Test) in SIM1, SIM2 and SIM3, 1991-2009

5. Concluding Remark

This paper analyzed the macro economic structure focusing on the demand-side and supply-side economy, and examined the major determinants of economic growth. Although Vietnam has achieved the steady economic growth since Doi Moi, there are still several problems including inflation, trade imbalance and so on, under the current macro economic structure. The regression and scenario simulation analysis reveal some critical problems and elucidate the causation of inflation and trade deficit which are the major obstacles for the long-term sustainable development in Vietnam.

However, in the process of economic development, FDI has played a very significant role to strengthen capital accumulation, which results in improving these problems, as one of the major driving forces for development. This mechanism can be seen in the regression and scenario simulation analysis. As discussed, the Vietnamese economy seems to be in the early stage of take-off with inflationary gap. Therefore the central government should implement mid-term and long-term policies to improve social infrastructures for stimulating private business activities and foreign capital inflows. These policies can strengthen the supply-side economy and diversify the economy to more advanced and higher value added industries economy along with the development of conventional industries including agriculture sector and mining sector.

In subsequent research, we will develop a multi-sectoral model of Vietnam and analyze the changes of sectoral economic structures focusing on technical progress (total factor productivity) by sector (Shishido and Nakamura 1992). At present, we can observe the strong economic dynamism of Vietnam in the context of Asia and the Pacific, and therefore we may be able to get a lot of new findings and research evidence from empirical studies.

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Appendices

Appendix A: The Macro Econometric Model of Vietnam

1. Real expenditure block

$$(1.1) \text{ GDE} = \text{CP} + \text{CG} + \text{IP} + \text{IG} + \text{J} + \text{EGS} - \text{MGS} + \text{SD}$$

$$(1.2) \text{ CP} = 150108.5 + .5038 (\text{GDE} - \text{GRT} / \text{PGDP} * 100) - 358.82 \text{ PCP}(-1)$$

$$(3.08) \quad (3.72) \quad (-3.60)$$

$$+ .1266 \text{ M2} / \text{PGDP} * 100 + 24719.7 \text{ D08}$$

$$(4.51) \quad (2.30)$$

$$\text{AR}(1) \quad (1991-2009) \quad \text{R}^2 = .996 \quad \text{SD} = 4,367.59 \quad \text{DW} = 1.505$$

$$(1.3) \text{ IP} = -20371.9 + .249835 \text{ GDE} + .406257 \text{ FDIR} + 4.02501 \text{ M2} / \text{PGDP}$$

$$(-4.00) \quad (9.09) \quad (4.13) \quad (2.28)$$

$$\text{OLS} \quad (1991-2009) \quad \text{R}^2 = .993 \quad \text{SD} = 3,431.25 \quad \text{DW} = 2.040$$

$$(1.4) \text{ CG} = \text{CGN} / \text{PCG} * 100$$

$$(1.5) \text{ IG} = \text{IGN} / \text{PIG} * 100$$

$$(1.6) \text{ EGS} = (\text{EG} + \text{ES})$$

$$(1.7) \text{ MGS} = (\text{MG} + \text{MS})$$

2. Nominal expenditure

$$(2.1) \text{ GDEN} = \text{CPN} + \text{CGN} + \text{IPN} + \text{IGN} + \text{JN} + \text{EGSN} - \text{MGSN} + \text{SDN}$$

$$(2.2) \text{ CPN} = \text{CP} * \text{PCP} / 100$$

$$(2.3) \text{ CGN} = -71813.0 + 2.85055 (\text{WN}) + .058927 (\text{GR}(-1))$$

$$(-2.06) \quad (9.19) \quad (2.79)$$

$$\text{AR}(1) \quad (1991-2009) \quad \text{R}^2 = .997 \quad \text{SD} = 1,263.18 \quad \text{DW} = 1.054$$

$$(2.4) \text{ IPN} = \text{IP} * \text{PIP} / 100$$

$$(2.5) \text{ JN} = \text{J} * \text{PJ} / 100$$

$$(2.6) \text{ EGSN} = \text{EGS} * \text{PEGS} / 100$$

$$(2.7) \text{ MGSN} = \text{MGS} * \text{PMGS} / 100$$

3. Prices and Wage Block

$$(3.1) \text{ EXRI} = \text{EXR} / 10966 * 100$$

$$(3.2) \text{ PMGS} = \text{PMGS\$} * \text{EXRI} / 100$$

$$(3.3) \text{ PGDE} = \text{GDEN} / \text{GDE} * 100$$

$$(3.4) \ln.(PGDP)=7.46545+.212 \ln.(PMGS)+.8222 \ln.(WNI)$$

$$(9.77) \quad (3.04) \quad (12.13)$$

$$-.8853 \ln.(GDP/NLE)$$

$$(-9.93)$$

$$OLS \quad (1990-2009) \quad R^2=0.999 \quad SD= .007848 \quad DW= 1.374$$

$$(3.5) \ln.(PCP)=9.84996+1.0139 \ln.(WNI)-1.14934 \ln.(GDP/NLE)$$

$$(20.43) \quad (47.03) \quad (-17.22)$$

$$OLS \quad (1990-2009) \quad R^2=.999 \quad SD= .015141 \quad DW= 1.401$$

$$(3.6) \ln.(PCG)=-.008667+.32474 \ln.(WN)+.40557 \ln.(PCG(-1))$$

$$(-2.05) \quad (7.19) \quad (6.82)$$

$$OLS \quad (1991-2009) \quad R^2=.994 \quad SD= .035461 \quad DW= 1.17$$

$$(3.7) \ln.(PIP)=1.95626-.11592 \ln.(EXRI)+.42999 \ln.(WN)$$

$$(6.20) \quad (-2.40) \quad (10.71)$$

$$+.2679 \ln.(PIP(-1))$$

$$(6.30)$$

$$OLS \quad (1991-2009) \quad R^2=.998 \quad SD= .020241 \quad DW= 1.224$$

$$(3.8) \text{PIG}=\text{PIP}$$

$$(3.9) \ln.(PEGS)=.5247-.2482 \ln.(GDP/NLE)+1.1157 \ln.(PMGS)$$

$$(2.80) \quad (-2.73) \quad (16.24)$$

$$+.2323 \ln.(EXRI)$$

$$(2.45)$$

$$OLS \quad (1991-2009) \quad R^2=.998 \quad SD= .019883 \quad DW= 1.504$$

$$(3.10) \ln.(WN)=-9.449+.4376 \ln.(PGDE(-1))+1.868 \ln.(GDE/NLE)$$

$$(-11.76) \quad (7.78) \quad (15.64)$$

$$OLS \quad (1991-2009) \quad R^2=.997 \quad SD= .039059 \quad DW= 1.139$$

$$(3.11) \text{PCI}=(\text{GDEN}/\text{NP})/\text{EXR}$$

$$(3.12) \text{IGAP}=\text{GDE}-\text{GDP}$$

4. Production Block

$$(4.1) \ln.(GDP)=4.527+.246 \ln.(KP)+(1-.2456) \ln.(NLE)+.0221 (\text{TIME})$$

$$(33.01) \quad (3.64) \quad (3.52)$$

$$\text{AR}(1) \quad (1991-2009) \quad R^2=.998 \quad SD= .010740 \quad DW= 1.289$$

$$(4.2) \text{KP}=\text{KP}(-1)+\text{IP} - \text{DP}$$

$$(4.3) \text{DP}=\delta \text{KP}(-1) \quad (\delta: 0.13)$$

5. Population and Labor Force Block

$$(5.1) \text{ NL} = 16.2047 + .163993 \text{ NP} + .035591 (\text{GDP}/1000)$$

$$(6.44) \quad (4.09) \quad (17.80)$$

$$\text{OLS} \quad (1991-2009) \quad R^2 = .998 \quad \text{SD} = .218979 \quad \text{DW} = 1.065$$

$$(5.2) \text{ ln.}(\text{UR}) = 113.44 + 23.165 \text{ ln.}(\text{NL}) - 24.157 \text{ ln.}(\text{GDE})$$

$$(24.58) \quad (17.83) \quad (-7.73)$$

$$+ 24.562 \text{ LOG}(\text{WN}/\text{PGDP})$$

$$(3.54)$$

$$\text{OLS} \quad (1990-2009) \quad R^2 = .991 \quad \text{SD} = .045902 \quad \text{DW} = 1.645$$

$$(5.3) \text{ NU} = \text{UR}/100 * \text{NL}$$

$$(5.4) \text{ NLE} = \text{NL} - \text{U}$$

6. Money and Finance Block

$$(6.1) \text{ ln.}(\text{M2}) = -9.903 + 1.0940 \text{ ln.}(\text{GDE}) - .00479 (\text{INTLR} \cdot \text{DOT}(\text{PGDP}))$$

$$(-1.94) \quad (2.00) \quad (-3.49)$$

$$+ .7043 \text{ ln.}(\text{M2}(-1))$$

$$(4.72)$$

$$\text{OLS} \quad (1991-2009) \quad R^2 = .997 \quad \text{SD} = .076064 \quad \text{DW} = 1.788$$

$$(6.2) \text{ INTLR} = 3.828 + .0974 \text{ DOT}(\text{PGDE}) - .0644 \text{ DOT}(\text{M2}) + 0.764 \text{ INTLR}(-1)$$

$$(2.14) \quad (3.36) \quad (-2.22) \quad (8.75)$$

$$\text{OLS} \quad (1991-2009) \quad R^2 = .889 \quad \text{SD} = 1.383 \quad \text{DW} = 2.526$$

7. Government Finance Block

$$(7.1) \text{ GR} = \text{GRCR} + \text{GRGR}$$

$$(7.2) \text{ GRCR} = \text{GRT} + \text{GRNT}$$

$$(7.3) \text{ GRT} = \text{RGRT} * \text{GDEN}$$

$$(7.4) \text{ GRNT} = -2595.49 + .031305 \text{ GDEN} + 25183.7 \text{ D08}$$

$$(-2.52) \quad (17.42) \quad (-9.66)$$

$$\text{OLS} \quad (1990-2009) \quad R^2 = .9490 \quad \text{SD} = 2,244.3 \quad \text{DW} = 1.78$$

$$(7.5) \text{ GE} = \text{GECR} + \text{GECP} + \text{GEOTH}$$

$$(7.6) \text{ GECR} = 3763.39 + .6755 \text{ GR} + 93801.1 \text{ D9}$$

$$(1.92) \quad (39.34) \quad (9.90)$$

$$\text{OLS} \quad (1990-2009) \quad R^2 = .993 \quad \text{SD} = 8177.5 \quad \text{DW} = 1.498$$

$$(7.7) \text{ GECP} = -175.07 + 0.3362 \text{ GR}$$

$$(-1.87) \quad (41.72)$$

$$\text{OLS} \quad (1990-2009) \quad R^2 = .990 \quad \text{SD} = 4327.96 \quad \text{DW} = 1.008$$

8. International Trade and BOP Block

$$(8.1) \ln. EG = 16.11 + 1.484 \ln. TWM - .2304 \ln. PEGS/EXRI/PTW + 1.098 \ln. GDP$$

$$(-12.46) \quad (5.46) \quad (-2.64) \quad (5.49)$$

$$AR(1) \quad (1991-2009) \quad R^2=.996 \quad SD=0.0481 \quad DW=1.563$$

$$(8.2) MG = -107072.1 + 1.2067 GDE - 897.64 PMGS(-1) + .35387 MG(-1)$$

$$(-4.10) \quad (5.60) \quad (-4.46) \quad (2.41)$$

$$OLS \quad (1991-2009) \quad R^2=.985 \quad SD=16,967.0 \quad DW=1.441$$

$$(8.3) ESN\$ = -1691.88 + 66.296 GDEN/EXR + 2033.46 PEGS/EXRI$$

$$(-3.06) \quad (7.44) \quad (2.92)$$

$$OLS \quad (1991-2009) \quad R^2=.984 \quad SD=303.81 \quad DW=1.810$$

$$(8.4) MSN\$ = -41.256 + 53.275 GDEN/EXR + .5870 MSN\$(-1)$$

$$(-2.05) \quad (3.66) \quad (3.45)$$

$$OLS \quad (1991-2009) \quad R^2=.947 \quad SD=616.62 \quad DW=1.710$$

$$(8.5) ESN = ESN\$ * EXR / 1000$$

$$(8.6) MSN = MSN\$ * EXR / 1000$$

$$(8.7) ES = ESN / PEGS * 100$$

$$(8.8) MS = MSN / PMGS * 100$$

$$(8.9) TB\$ = (EG * PEGS / 100 - MG * PMGS / 100) / EXR * 1000$$

$$(8.10) TBGS\$ = (EGS * PEGS / 100 - MGS * PMGS / 100) / EXR * 1000$$

Appendix B: List of variable

Variable (Endogenous(D)/Exogenous(X)): Explanatory Variable

CG (D): real government consumption expenditures (1994 constant prices)
CGN (D): nominal government consumption expenditures
CP (D): real private final consumption expenditures (1994 constant prices)
CPN (D): nominal private final consumption expenditures
DP (D): depreciation of real private capital stock
EG (D): real merchandise export (1994 constant prices)
EGN (D): nominal merchandise export
EGS (D): real exports of goods and services (1994 prices)
EGSN (D): nominal exports of goods and services
ES (D): real service exports (1994 constant prices)
ESN (D): nominal service exports
ESN\$ (D): nominal service exports in terms of US \$
EXR (X): exchange rate (dong/\$)
EXRI (D): exchange rate index (EXRI.1994=100)
FDI\$ (X): foreign direct investment inflow in US\$
FDIR (D): real foreign direct investment inflow in local currency
GDE (D): real gross domestic expenditures (1994 constant prices)
GDEN (D): nominal gross domestic expenditures
GDP (D): real gross domestic products(1994 constant prices)
GDPN (D): nominal gross domestic products
GFCF (D): real gross fixed capital formation(1994 constant prices)
GFCFN (D): nominal gross fixed capital formation
GE (D): total government expenditure
GECP (D): government capital expenditure
GECR (D): government current expenditure
GEOTH (X): other government expenditure
GR (D): total government revenue
GRCR (D): government current revenue
GRNT (D): government non-tax revenue
GRT (D): government tax revenue
GRGR (X): government revenue from grants

INTLR (D): lending rates
 IG (X): real government investment
 IGAP (D): inflationary gap (GDE-GDP)
 IGN (D): nominal government investment
 IP (D): real gross fixed capital formation in private sector
 IPN (D): nominal gross fixed capital formation in private sector
 J (X): real inventory changes (1994 constant prices)
 JN (D): nominal inventory changes
 KP (D): real private capital stock (1994 constant prices)
 MG (D): real merchandise imports (1994 constant prices)
 MGN (D): nominal merchandise imports
 MG\$ (D): real merchandise imports in US\$
 MGN\$ (D): nominal merchandise imports in US\$
 MGS (D) : real imports of goods and services (1994 constant prices)
 MGSN (D): nominal imports of goods and services
 MS (D): real service imports (1994 constant prices)
 MSN (D): nominal service imports
 MSN\$ (D): nominal service imports in terms of US\$
 M2 (D): money supply, M2
 NP (X): number of population
 NLE (D): number of employment
 NL (D): number of labor force
 NU (D): number of unemployment
 PCG (D): implicit deflator of CG
 PCI (D): per-capita income in terms of US\$
 PCP (D): implicit deflator of CP
 PEG (D): implicit deflator of EG
 PEGS (D): implicit deflator of EGS
 PGDE (D): implicit deflator of GDE
 PGDP (D): implicit deflator of GDP
 PIG (D): implicit deflator of IG
 PIP (D): implicit deflator of IP
 PJ (X): implicit deflator of J
 PMG (DD): implicit deflator of MG
 PMGS (D) : implicit deflator of MGS
 PMS (X): import price Index in terms of US\$ (PMS.2000=100)

PTW (X): deflator of TWM in \$

TB\$ (D) :trade balance, merchandise in US\$

TBGS\$ (D): trade balance on goods and services in US\$

TWM (X): real world trade

WN (D): nominal wage per employment

δ (X): rate of depreciation of capital

Appendix C: Estimation for Missing Data

(1) Real private capital stock(KP)

$$KP_{91} = IP_{91} / \Delta GDP_{91} * GDP_{91}$$

From 1992 to 2009,

$$KP(t) = KP(t-1) + IP(t) - \delta * KP(t-1) \quad (\delta : 0.13)$$

(2) Import price in terms of US\$ (PMSHAT) from 1990 to 2009

$$PMS_{<j>} = \sum_i (EN_{<i,j>} / \sum_i (E_{<i,j>})) * 100 \text{ from 1990 to 2009}$$

(j:Vietnam, i:trade partner, $EN_{<i,j>}$:nominal bilateral trade, $E_{<i,j>}$: real bilateral trade)

(3) Deflators and real GDE components missing before 1993

As real GDE components are not available in 1990-93, we estimated deflators of GDE components except exports and imports of goods and services from 1990 to 1993 based on regression results with 1994-2009 data. As for exports deflator, we estimated the exports deflator to regress it on PGDP based on available data in 2000s. With the estimated deflators, real GDE components missing are also calculated dividing each nominal GDE component by its deflator.

(4) Estimation of nominal and real private and government investment

By using the data of government capital expenditure and the ratio to total expenditure, we estimate nominal government investment and private investment. Thereafter, both real private and government investments are estimated by using the deflator of gross fixed capital formation, overall investments.

Appendix D: Estimated GDE and its Error in the Final Test, 1991 - 2009

(In billions of dong, %)

Year	Actual	Estimated	Deviation	% deviation
1991	139,637.0	133,785.5	-5,851.5	-4.19
1992	151,782.0	150,189.7	-1,592.3	-1.05
1993	164,043.0	164,672.9	629.9	0.38
1994	173,534.0	182,530.0	3,996.0	2.24
1995	195,567.0	198,560.1	2,993.1	1.53
1996	213,832.0	215,692.6	1,860.6	0.87
1997	231,264.0	236,485.8	5,221.8	2.26
1998	244,596.0	243,903.8	-692.2	-0.28
1999	256,269.0	263,174.7	6,905.7	2.69
2000	273,666.0	278,456.1	4,790.1	1.75
2001	292,535.0	291,547.7	-987.3	-0.34
2002	313,247.0	303,837.8	-9,409.2	-3.00
2003	336,243.0	331,803.9	-4,439.1	-1.32
2004	362,435.0	356,518.6	-5,916.4	-1.63
2005	393,031.0	383,646.6	-9,384.4	-2.34
2006	425,372.0	418,983.9	-6,388.1	-1.50
2007	461,344.0	481,034.9	19,690.9	4.27
2008	490,459.0	496,388.6	5,929.6	1.21
2009	516,568.0	504,615.3	-11,952.7	-2.31

Deviation: (Estimated – Actual), % deviation: (Estimated – Actual)/ Actual

Notes: Data Sources

International Financial Statistics (IFS), IMF

Direction of Trade (DOT), IMF

Balance of Payments Statistics (BOP), IMF

Key indicators for Asia and the Pacific, ADB