

*Perspective for the Vietnamese Economy in the Context of Asia and the Pacific: An econometric analysis with a global macro econometric model*

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# Perspectives for the Vietnamese Economy in the Context of Asia and the Pacific: An econometric analysis with a global macro econometric model

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## *Abstract*

*In the context of the transition period to a market oriented economy, Vietnam attracts foreign capital to strengthen the supply-side economy. FDI plays a very important role in achieving export-led growth and contributes to the steady economic growth rate of 6-8% per annum. According to scenario forecasts employing the global macro model system(IUJ GM25), it is expected that the Vietnamese economy is likely to experience high growth, achieving a take-off stage with an export-led growth against the background of strong economic growth in Asia. It is noteworthy that the Vietnamese macro imbalances, including I-S and trade imbalance, and so on, are also expected to be improved if FDI will be increasing.*

*Keywords: FDI, take-off stage, macro-econometric model, scenario forecast*

JEL Classification Numbers: C53, E17, F47

## 1. Introduction

Since the middle of the 1990s economic dynamism in the southeastern peninsula of Asia has been remarkable. In particular, the performance of the Vietnamese economy has been strong, achieving a steady progress in economic development with a 6-8 percent growth per annum and increasing exports to the rest of the world. Since starting the “Doi Moi” policy in the year 1986, Vietnam has attracted FDI and increased high value-added products within a virtuous circle of export-led growth in the transition economy from a centrally planned to a market oriented economy. It seems that the Vietnamese economy has achieved an early stage of “take-off” since the mid-2000s. Indeed, per-capita income of Vietnam exceeded one thousand US dollars in 2008, as China did in 2002.

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The export-led FDI has played a significant role in Vietnam's economic development. Indeed, it might be viewed as one of the major driving forces in the country's economic growth. At the same time, economic dynamism can be seen in the other new ASEAN member countries including Myanmar, Cambodia and Lao PDR, which results in favorable influences to the Vietnamese economy, as a neighboring country. It is therefore expected that the Vietnamese economy will experience still higher economic growth and that Vietnam will be one of the leading countries in this region in the near future.

Accordingly, this study attempts to analyze the macro economic structure and growth performance of Vietnam in the context of Asia and the Pacific, through econometric modeling and forecasting within a global macro econometric model system.

A global modeling project is frequently employed in analyzing the economic performance of a country in the world economy. There currently exist several global modeling projects. Project LINK is well known integrating country and regional models which cover the world economy, through international trade, capital transfer, ODA and so on, within a global system (Klein 1976, Klein and Peeterseen 1973). NIRA-LINK Project is also famous as a multi-sectoral global model (Adams and Shishido 1990). INTERLINK MODEL is well known as a long-term forecasting model (OECD 1997). This paper also employs a global macro model for analyzing the economic performance of a country in the context of the world economy.

As for a macro econometric model of Vietnam, in spite of the limitations of data, there exist some Vietnamese model projects. CIEM(Central Institute of Economic Management 2000) developed a Vietnamese macro model in 2000 based on the newly developed SNA. Nakamura (2010) examined the macro economic structure of Vietnam and the country's growth performance by means of a macro demand-supply integrated model. In the present study the Vietnamese macro model (Nakamura 2010) is renewed and integrated within the global model, IUJ-GM25 (Nakamura 2007).

Following this introduction, section 2 of this paper, discusses the global macro econometric model and the macro-econometric model of Vietnam employed in the present study, and analyzes the macro economic structure of Vietnam based on regression results. Section 3 discusses the results of dynamic simulation tests and section 4 conducts scenario simulations to

analyze the growth performance of Vietnam in the context of the global economy utilizing the global model system. Section 5 concludes this study.

## 2. The Model System

### 2.1. Global Macro Econometric Model

The global macro econometric model, IUJ-GM25, employed in this study consists of twenty-five country/regional macro econometric models, which cover the entire world economy. The Vietnamese macro econometric model is newly developed and integrated within the global macro model for this study, as a country model (see Table 1).

The global macro-econometric model is designed to study not only macro economic structures of each country / region but also global economic perspectives, as a whole, including world trade, world energy demands and so on. At the same time, the model is able to study the impacts of policy changes in one particular nation and of changes in energy prices on each national economy and on the world economy.

Table 1 Country and Regional Classification in the Global Macro Model

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Asia and Oceania (14) :	Australia, New Zealand, China(Mainland), Hong Kong, Japan, South Korea, Taiwan, Indonesia, Malaysia, the Philippines, Singapore, Thailand, Vietnam, other Asian countries
North America (2) :	Canada, the U.S.
Middle and South America (1)	
Europe and EU (5) :	Germany, France, Italy, the U.K., other European countries
Russia and Central Asia (1)	
Middle East (1)	
Africa (1)	

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Each country / regional macro model is comprised of nine blocks as a general specification, including (1) the real expenditure block, (2) the nominal expenditure block, (3) the prices and wage rates block, (4) the production block, (5) the population and labor force block, (6) the income distribution block, (7) the money and finance block, (8) the public finance block, and (9) the international trade and BOP block. Furthermore, the

country/regional model has a similar structure and causation based on economic theories, relying on the general specification of the model in order to make a comparative study in a regression and scenario simulation analysis.

The country / regional macro model is basically a demand-side oriented type model (Keynesian type model) for all economies including advanced market economies, developing market economies and centrally planned economies, since a demand-side model is a more realistic and powerful tool to explain an economic performance in an open economic system (Thirlwall 2002). Furthermore, the major country models involve interactions between the supply-side and the demand-side economy through changes in productivity and in prices in the economy, so that these models are called demand-supply integrated type models.

Concerning the linkages of country/regional models, each macro model is linked to the other country models through bilateral trade flows by means of a bilateral trade model between major economies and a constant real share approach between the other country/regional economies. Therefore, six hundred bilateral trade flows ( $25 \cdot 25 - 25$ ) are calculated in the global model and link twenty-five countries/regions.

The number of macro economic variables is around ninety to one-hundred in the advanced country models and fifty to sixty in the developing economy models. On the other hand, the structure of the regional models is very simple because of data constraints. The total number of variables in the global macro model exceeds two thousand including bilateral trade flows. A software system for solving the global model is developed. By employing this software system, SIMSYS (Sato and Nakamura 1995), a large scale econometric model, including a multi-equation structural model, trade model and inverse matrix in I-O model, is solved.

## 2.2. Macro-econometric Model of Vietnam

As mentioned above, the Vietnamese macro model is integrated within the global macro model system in this study. Basically, the structure of the macro model of Vietnam relies on the general specification discussed in the previous sub-section. However, the Vietnamese macro model is comprised of six blocks, including the real expenditure block, the nominal expenditure block, the prices and wage rates block, the production block, the population

and labor force block, and the international trade and BOP block. The other three blocks, the income distribution block, the money and finance block and the public finance block, are not modeled because of data limitations at present.

Nevertheless, the Vietnamese macro model with six blocks performs well as a country model, as well as the other national models in the global macro model system (Model performance tests are conducted in Section 3). Further more, the Vietnamese model, as well as the other major country models, has a feed-back system between the demand-side and supply-side economy.

The Vietnamese macro model is linked to the other country/regional models utilizing a bilateral trade model with major ten country-models including Indonesia, Malaysia, the Philippines, Singapore, Thailand, China, Korea, Australia, Japan and the U.S. and employing a constant real share approach with the other country/regional models. The total number of equations in the Vietnamese macro model exceeds eighty including bilateral real and nominal trade flows (please see Appendix A : Macro Econometric model of Vietnam).

### 2.3. Macro Economic Structure of Vietnam : A Regression Analysis

With increases of capital transfers, especially FDI, in the economy, the role of capital accumulation has been very important in strengthening the supply-side and in improving productivity in Vietnam. In the macro model of Vietnam both the supply-side and demand-side economies are determined separately.

With respect to the supply side economy, the aggregate supply is determined in a Cobb-Douglas type function employing a vintage model. According to the regression result with OLS, the capital share is 0.389 and, hence, the labor share 0.611 (see equation (eq.4.1 in Appendix A). This result demonstrates that the supply-side economic structure is still labor-intensive, but it seems that the labor share, 0.611, may be small in spite of the large share of the primary industry in GDP. In other words, strengthened capital accumulation contributes to steady economic growth in the move towards economic development.

For capital accumulation, real FDI is one of the important independent variables in GFCF behavioral equation, in which the coefficient of real FDI

at 0.788 might have large effects on capital formation and on the supply-side economy, as well as on the demand-side economy through the dual effects of investment.

On the other hand, as for the demand side economy, the aggregate demand (demand-side GDP) is determined in an identity totaling real GDE components, including real private consumption, real government consumption, real gross fixed capital formation, real inventory changes, and real exports and imports of goods and services(see eq.1.1). Basically, in the real expenditure block, each demand-side component depends on income effects and price effects. Some components are determined simultaneously with GDE so that a static Keynes multiplier in an open-economic system is calculated, as follows.

$$\text{Static Keynes multiplier} = 1 / (1 - 0.589 - 0.304 + 1.264) = 1/1.371 = 0.729$$

The static Keynes multiplier of Vietnam is 0.729, which depends on the marginal propensity to consume (0.589 in eq.1.2), the coefficient of induced investment (0.304 in eq.1.3) and the marginal propensity to import (1.264 in Appendix E), theoretically, without considering the impacts of government consumption. In any case, in the case of Vietnam, the marginal propensity to import is extremely high since the ratio of imports to GDE is very high (0.94 in 2007). 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 in the current macro economic structure. In other words, the effective demand stimulated by government expenditure leaks out to the rest of the world through imports. 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 section 3.

Concerning the price effects on demand components, in this macro model, we realize a Walrasian price adjustment process in private consumption and bilateral trade function. In addition to that, the process whereby changes of labor productivity (GDP/LE), derived from the supply-side GDP, affect deflators including PGDP (therefore export price) and the implicit deflator of private consumption, is explicitly introduced as a Marshallian quantity adjustment process(Klein 1983). In each equation for deflators, elasticity of

labor productivity changes to changes in deflators is around 0.9 (0.935 in PCP and 0.880 in PGDP equation), which means that these deflators go down by around 0.9 percent, when labor productivity goes up by one percent (see eq.3.4 and eq.3.6 in Appendix A). This mechanism to link the supply-side to demand-side economy is indispensable in the demand-supply integrated type model, which is involved in the Vietnamese macro model as well as in the other country macro models.

Furthermore, labor productivity affects nominal wages rates and thereafter some demand components in the model. This is a very important channel to link the supply-side to the demand-side economy, as well (see eq.3.7 in Appendix A).

#### 2.4. Bilateral Trade Structure with major Ten Countries and the R.O.W

As discussed above, the Vietnamese macro model has bilateral trade flow equations with major ten countries models and the rest of the world. Table 2 shows income and price elasticity in regression results of bilateral trade flows with major countries and the rest of the world. In the case of Vietnam, we employ four independent variables, GDP of the importing country ( $GDP_{<j>}$ ) as income effects, relative prices of export price in the exporting country to PGDP in the importing country in terms of the same currency unit ( $PES_{<i>*EXRI_{<j>}/PGDP_{<j>}$ ), supply-side GDP as supply-side effects ( $GDP_{<i>}$ ) and a one-year lagged bilateral flow ( $E_{<i,j>(-1)}$ ) in the bilateral trade equation.

With respect to the exports side ( $E_{<i,j>}$ ,  $i$ :Vietnam), income elasticity with the major ten countries is fairly high, in which the long-term income elasticity of Indonesia, the Philippines and Thailand is becoming higher at 5.9, 1.3 and 6.7, respectively, than the listed value in Table 2 if we consider the coefficient of one-year lagged trade flow ( $E_{<i,j>(-1)}$ ). With the large income elasticity, we can see that the Vietnamese exports to these countries are increasing sharply in line with high economic growth rates of these countries in the past two decades, except for Japan.

On the other hand, price elasticity is consistent at 1.0 - 2.0 among these countries. In addition, the supply-side effects can be seen in the bilateral exports with the US, Japan and the rest of the world, which means that the exports to Japan, the U.S. and the rest of the world increase in line with the supply-side economic growth (Krugman 1989).



As for the imports side ( $E_{i,j}$ ,  $j$ :Vietnam), both income elasticity and price elasticity are consistent among these countries except for price elasticity with the U.S., in which small differences of elasticity might be dependent on the extent of economic linkage and on the basket of traded goods between countries. Due to the space limitation, we will discuss these issues on another occasion.

Table 2 Income and Price Elasticity in Bilateral Trade Function of Vietnam

		IN	MA	PH	SI	TH	CN	KR	AU	US	JP	ROW
$E_{i,j}$	income	1.8	5.4	0.8	2.6	0.7	6.2	2.5	6.2	3.7	5.1	0.9
( $i$ :VN)	price	-	2.0	-	2.0	1.2	-	-	-	1.9	1.0	1.2**
$E_{i,j}$	income	1.9	3.6	2.5	2.3	2.2	1.6	12.1*	2.5	1.8	1.3	1.8
( $j$ :VN)	price	1.5	3.9	-	0.9	1.8	0.8	2.5	0.2	6.5	1.9	0.9

\* GDE/GDE(-1), \*\* PES/PES(-1) (Please see eq.6.8 – 6.29 in Appendix A)

### 3. Dynamic Simulation Tests

Before conducting scenario forecasts, we make two dynamic simulation tests including (1) a dynamic reliability test and (2) a dynamic multiplier test in this section. In order to evaluate the performances of the Vietnamese macro model, we conduct both tests without linking the Vietnamese model to the other country/regional models.

#### 3.1. Model Reliability Test

As for the reliability test for the Vietnamese macro model, we employ the Final Test within Goldberger Tests (partial, total and final tests) which can explain the dynamic reliabilities of a model. For solving the macro model of Vietnam, we employ Gauss-method with 0.1% convergent criteria. There are two types of regression results in the real expenditure block, OLS and 2SLS results. For these simulation tests we employ OLS results since 2SLS results are still unstable in a long-run simulation.

Table 3 shows the final test results for major variables in 1991-2007, with MAPE (Mean Absolute Percentage Errors). According to the final test results, the Vietnamese macro model is able to track the actual economy within a 2.33% error range for the demand-side economy(GDE) which contains a 2.35% error range for real private consumption(CP), a 4.84% error range for real government consumption(CG), a 6.69% error range for real

gross fixed capital formation(GFCF), a 4.72% error range for real exports of goods and services(EGS) and a 4.22% error range for real imports of goods and services(MGS), and to track the supply-side GDP within a 1.54 % error range and PGDP within a 2.99 % 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 with 97.67% accuracy.

Table 3 Final Test Results with MAPE for Major Variables, 1991-2007 (%)

GDE	CP	CG	GFCF	EGS	MGS	PGDP	GDP
2.33	2.35	4.84	6.69	4.72	4.22	2.99	1.53

$$\text{MAPE} = (\sum (| \text{Estimated} - \text{Actual} |) / \text{Actual}) / N * 100$$

### 3.2. Dynamic Multiplier Test

In this section, we conduct a dynamic multiplier test. In the data base, real gross fixed capital formation(GFCF) consists of both private and government investment so that we consider another autonomous expenditure in the GDE identity for this test. We thereafter assume two scenarios, a baseline scenario without increases in government expenditure and an increased government expenditure scenario with an additional one trillion dong (1994 constant) during the tested period.

Table 4 shows the results of the dynamic multiplier test for GDE and the components of real GDE. According to the results of this test, the dynamic Keynes multiplier is a little bit higher than the static multiplier calculated in previous section. The dynamic multiplier is 0.825 in the first year, decreasing slightly to 0.809 in the second year and increasing from 0.820 in the third to 0.844 in the seventh year. In any case, the multiplier itself is very small, as is the static one, which is heavily dependent on the large increases of imports of goods and services stimulated by domestic demand increases in the increased government expenditure scenario.

The dynamic multiplier test information is very important for understanding the demand-side macro economic structure and the relations between the supply-side and demand-side economy. According to the test results, we can see that the domestic demand increases are heavily dependent on the increases in the supply from the rest of the world through imports since the domestic supply-side is still too weak to meet the increases of domestic demand, as mentioned above.

Table 4 Dynamic Multiplier test ( Dynamic Keynes multiplier)

Year :	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	7 <sup>th</sup>
<b>GDE</b>	<b>0.815</b>	<b>0.809</b>	<b>0.820</b>	<b>0.827</b>	<b>0.834</b>	<b>0.839</b>	<b>0.844</b>
CP	0.422	0.416	0.424	0.426	0.432	0.435	0.438
CG	0.029	0.002	0.003	0.009	0.013	0.016	0.021
GFCF	0.216	0.216	0.218	0.220	0.221	0.222	0.224
EGS	0.076	0.094	0.109	0.118	0.123	0.128	0.137
MGS	0.928	0.919	0.934	0.946	0.955	0.962	0.976

Multiplier : changes in GDE / changes in Government expenditure between the baseline and the increased government investment scenario

#### 4. Future Forecasts with Scenario Simulation

This section conducts future forecasts for the Vietnamese economy and the world economy up to the year 2015, linking the Vietnamese model to the other country/regional models within the framework of the global model, IUJ-GM25. For the future forecasts, we assume two scenarios, 1) a baseline scenario and 2) a FDI expansion scenario.

##### 4.1. Baseline scenario: a most-likely scenario

In the baseline scenario, we assume that most of the exogenous variables in the model will depend on the current trends up to the year 2015 (please see Appendix C for Vietnam).

Table 5 shows the future economic forecasts of the major countries in Asia and the Pacific, including Vietnam, in terms of annual growth rates of real GDE in the baseline scenario. According to the baseline scenario forecast, although the performance of these economies was declining in 2008 and 2009, just after the world financial crisis, most of the economies are expected to recover from 2010 onwards, except for Canada, the U.S. and Japan. The Chinese economy, especially, is likely to continue high economic growth at around 9 percent per annum up to the year 2015. At the same time, Asian NIES and ASEAN-five countries are also expected to realize high growth rates up to the year 2015, as they did in the period before the world financial crisis.

Table 5 Forecasts of Major Asian and the Pacific Countries

: Baseline Forecasts, Real GDP Growth Rates, 2008-2015								(%)
	2008	2009	2010	2011	2012	2013	2014	2015
Indonesia	6.0	4.5	6.1	6.0	5.8	6.0	6.2	6.1
Malaysia	4.6	-1.7	4.8	4.5	4.6	4.7	5.0	4.9
Philippines	3.8	0.9	4.2	3.7	3.9	4.0	3.9	3.8
Singapore	1.4	-1.3	9.1	5.1	5.7	5.8	5.5	5.4
Thailand	2.5	-2.2	7.2	6.5	6.7	6.5	6.6	6.5
<b>Vietnam</b>	<b>6.1</b>	<b>5.3</b>	<b>7.2</b>	<b>7.1</b>	<b>7.1</b>	<b>7.1</b>	<b>7.0</b>	<b>7.0</b>
China	9.6	9.1	9.8	9.5	9.2	9.3	9.0	8.9
Hong Kong	2.2	-2.8	5.1	4.3	4.1	4.2	4.5	4.4
Korea	2.2	0.2	4.5	4.6	4.1	4.0	3.9	3.8
Taiwan	0.7	-1.9	3.7	3.9	3.8	3.9	4.0	3.9
Japan	-1.2	-5.2	1.9	1.4	1.5	1.5	1.3	1.2
Australia	2.2	1.4	2.3	2.2	2.4	2.5	2.5	2.4
The U.S.	0.4	-2.4	1.3	1.7	1.6	1.7	1.8	1.7
Canada	0.4	-2.6	1.5	1.4	1.7	2.1	2.2	2.1

Regarding the Vietnamese economy, annual growth rates of real GDE slowed down slightly, dropping to 5.3 percent in 2009. However, the growth rates subsequently recovered, reaching 7.2 percent in 2010 and growth rates of around 7 percent per annum are likely to continue up to the year 2015 in the baseline. The major factor underpinning for the recovery will be the strong exports, in line with the economic recovery of the other Asian economies (see Table 6).

With the high growth up to the year 2015, per-capita income is expected to exceed US\$1,190 in 2010 and to reach US\$1,695 in 2015. On the other hand, the trade balance(TB\$) is expected to worsen from (-)8,302 million dollars in 2009 to (-)12,740 million dollars in 2015. In terms of the ratio of trade deficit to GDE, the ratio is expected to worsen slightly from minus 0.088 in 2009 to minus 0.089 in 2015 along with the high economic growth up to the year 2015.

As for domestic inflation, the inflation rate in terms of the general deflator (PGDP) is expected to be around 3-4 percent per annum during the latter half of the 2010s. We can see that the improvements of labor productivity(GDP/LE) at around 4 per cent per annum will contribute to avoiding higher inflation as experienced in 2007 and 2008 in the baseline

scenario (please see GDP and LE rates of increase in Table 6).

Table 6 Baseline Scenario Forecasts for the Vietnamese Economy, 2009–2015  
: Major economic indicators (In billions of dong)

	- Estimated -		Forecasts				
	2009	2010	2011	2012	2013	2014	2015
GDE	515793	552825	592244	634268	679092	726939	778069
(%)	(5.3)	(7.2)	(7.1)	(7.1)	(7.1)	(7.0)	(7.0)
CP	342951	364498	387472	411996	438181	466158	496080
(%)	(4.6)	(6.3)	(6.3)	(6.3)	(6.4)	(6.4)	(6.4)
CG	31495	32334	33126	33885	34622	35338	36037
(%)	(3.0)	(2.7)	(2.4)	(2.3)	(2.2)	(2.1)	(2.0)
GFCF	197558	215704	234608	254368	275030	296650	319303
(%)	(4.7)	(9.2)	(8.8)	(8.4)	(8.1)	(7.9)	(7.6)
EGS	394625	438833	486449	537708	592897	652349	716448
(%)	(9.8)	(11.2)	(10.9)	(10.5)	(10.3)	(10.0)	(9.8)
MGS	523013	570754	621620	675877	733814	795724	861957
(%)	(6.9)	(9.1)	(8.9)	(8.7)	(8.6)	(8.4)	(8.3)
PGDP	312.2	323.1	333.7	344.1	354.5	364.8	375.0
(%)	(3.6)	(3.5)	(3.3)	(3.1)	(3.0)	(2.9)	(2.8)
GDP	520897	556630	594042	633825	680521	726055	774214
(%)	(5.2)	(6.9)	(6.7)	(6.7)	(6.6)	(6.7)	(6.6)
TB\$	-8302	-8102	-8185	-8612	-9452	-10792	-12740
LE	46181	47372	48607	49898	51247	52660	54140
(%)	(2.3)	(2.2)	(2.6)	(2.6)	(2.7)	(2.7)	(2.8)
PCI(\$)	1093.0	1193.0	1292.9	1393.2	1493.4	1593.2	1692.0
(%)	(8.3)	(9.1)	(8.4)	(7.8)	(7.2)	(6.7)	(6.2)
RTB\$	-.0879	-.0797	-.0749	-.0736	-.0755	-.0806	-.0892

TB\$(millions of US\$), LE(1000 persons), RTB\$(ratio of trade balance to GDEN\$)

#### 4.2. FDI expansion scenario

In the baseline scenario, we assume that Vietnam will keep the level of FDI inflows at 6,900 million dollars up to the year 2015. Indeed, FDI inflows increased in the 2000s, and jumped from 2,300 million in 2006 to 6,500 million in 2007 and to 9,200 million US dollars in 2008. However, the world

financial crisis profoundly affected FDI behavior so that FDI inflows into Vietnam declined to 6,900 million dollars in 2009. As an alternative scenario, therefore, we assume that FDI inflows into Vietnam will grow at 10 percent annually from 2011 to 2015 and we analyze the impacts of FDI increases on the economy.

Table 7 shows the impacts of FDI inflow expansion on the Vietnamese economy. In this scenario simulation, FDI increases affect gross fixed capital formation and the supply-side economy (GDP) through capital accumulation, and influence the demand-side economy (GDE) and the other endogenous variables.

As for the demand-side economy, it is expected that the annual growth rates of real GDE will be 9.4-9.8 percent from 2011 to 2015 and the level of real GDE will reach to 879,588 billion dong in 2015. The impacts on real GDE are fairly large and real GDE is expected to increase by 101,519 billion dong and by 13.0 percent in 2015 in % deviation, as compared to the baseline forecast, in which the impacts mainly result from increases of real gross fixed capital formation, and from increases of real exports stimulated by the supply-side GDP increases. At the same time, the other GDE components, which are simultaneously determined, including real private consumption expenditures and real imports of goods and services, also have large and favorable impacts in this scenario forecast.

Concerning the effects on the supply-side economy, the supply side economy (GDP) is expected to experience large impacts through capital accumulation, with a 90,887 billion dong increase, which is 12.7 percent increase, in % deviation, in 2015, as compared to the baseline forecast. As a result, labor productivity (GDP/LE) will increase by 9.2 percent, since the number of employed (LE) will increase by 3.5 percent in 2015 in comparison with the baseline forecast.

Regarding the impacts on deflators and inflation, the improvement of labor productivity might have favorable impacts on the level of deflators and inflation. In spite of large impacts on the demand-side economy (GDE), PGDP is likely to increase slightly by only 1.9 percent, in % deviation, in 2015, as compared to the baseline forecast. This means FDI expansion has large positive impacts on GDE components through not only income effects but also price effects, especially on the domestic investment (real gross fixed capital formation) and exports.

As a result, trade balance(TB\$) is likely to be improved by 3,690 million dollars in 2015, and the ratio to GDE\$(RTB\$) will be improved by 0.0309 in 2015, from minus 0.0892 to minus 0.0583, as compared to the baseline forecast. Furthermore, per-capita income(PCI\$) is also expected to increase by 303 dollars, which is a 17.9 percent increase in % deviation in 2015, in comparison with the baseline, and per-capita income itself will reach 1,995 dollars in 2015, in the FDI expansion scenario.

Table 7 The Impacts of Increased FDI on the Economy, Deviation and % deviation as compared to the Baseline, 2011-2015 (In billions of dong)

	2010	2011	2012	2013	2014	2015
GDE	-	12674	29390	49881	73786	101519
(%)		(2.1)	(4.6)	(7.3)	(10.2)	(13.0)
CP	-	7462	17284	29313	43352	59643
(%)		(1.9)	(4.2)	(6.7)	(9.3)	(12.0)
CG	-	43	133	262	415	587
(%)		(0.1)	(0.4)	(0.8)	(1.2)	(1.6)
GFCF	-	6544	14472	23624	33943	45617
(%)		(2.8)	(5.7)	(8.6)	(11.4)	(14.3)
EGS	-	3783	11336	21984	34661	49608
(%)		(0.8)	(2.1)	(3.7)	(5.3)	(6.9)
MGS	-	5173	13839	25245	38534	53890
(%)		(0.8)	(2.0)	(3.4)	(4.8)	(6.3)
PGDP	-	0.12	1.17	2.91	4.91	7.13
(%)		(0.0)	(0.3)	(0.8)	(1.3)	(1.9)
GDP	-	13196	29690	45965	69810	98087
(%)		(2.2)	(4.7)	(6.8)	(9.6)	(12.7)
TB\$	-	9	455	1322	2391	3690
(%)		-	-	-	-	-
LE	-	235	545	925	1368	1882
(%)		(0.5)	(1.1)	(1.8)	(2.6)	(3.5)
PCI(\$)	-	29	76	140	215	303
(%)		(2.2)	(5.4)	(9.4)	(13.5)	(17.5)
RTB\$		.0008	.0055	.0135	.0218	.0309
(%)		-	-	-	-	-

## 5. Concluding Remarks

With the strong export demands and the supply-side economy improved by foreign capital inflows, especially by FDI, the Vietnamese economy has realized strong economic growth based on export-led growth in the transition economy. In this study, we analyzed the macro economic structure and economic performance of Vietnam with an econometric analysis. We can summarize our analysis, as follows.

Based on the regression analysis and dynamic multiplier test,

- (1) In the transition period since “Doi Moi” the supply-side economy has been strengthened through capital accumulation, in which FDI has played a very significant role. The coefficient of real FDI in gross fixed capital formation equation is around 0.78, which shows that FDI has fairly large impacts on capital accumulation and the supply-side economy.
- (2) The demand-side economy has been stimulated by FDI, as well. In particular, exports have been reinforced by the strengthened supply-side economy. We can see this mechanism in both the macro and bilateral exports regression results.
- (3) The price effects can be seen in demand components, in which labor productivity changes have played a very important role to stimulate real demand components through supply-side effects to depress the increases in prices or deflators.
- (4) However, the marginal propensity to import is fairly large, which results in small multiplier effects. In the dynamic multiplier test, this is proven and the test explains that the supply-side economy is still weak and cannot meet the demand-side increases, especially in the case of government expenditure increases. In short, without strengthening capital accumulation and technology, demand increases result in accelerating trade imbalances and inflation as experienced in 2007 and 2008.

Looking at both scenario forecasts,

- (5) If FDI inflows continue at 6,900 US\$ level, the annual growth rates of real GDE will be around 7 per cent up to the year 2015. However, the macro imbalances, including the macro demand-supply imbalance and trade imbalance, will be deteriorating in the baseline forecast.
- (6) On the other hand, in the FDI expansion scenario forecast, the Vietnamese economy is likely to achieve a high growth at around 9.4-9.8



per cent per annum if FDI inflows grow at 10 percent per annum from 2011 to 2015. Furthermore, it can be seen that the macro imbalances including the macro demand-supply imbalance and trade imbalance could be improved through strengthening the supply-side economy

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

In subsequent research, we will make a sectoral analysis for the Vietnamese economy by means of a multi-sectoral model with an Input-Output analysis, which can analyze more specific issues focusing on sectoral economies including sectoral output, investment, exports, imports and so on (Shishido et al 2003).

In the near future Vietnam will experience a high economic growth, in the Chinese pattern.

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## Appendices

### Appendix A:Macro Econometric Model of Vietnam

#### (1) Real expenditure block

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

$$(1.2) \text{ CP} = 60,286.1 + 0.5892 \text{ GDE} - 7,075.9 \ln(\text{PCP})$$

$$(4.97) \quad (31.46) \quad (-2.13)$$

$$\text{OLS Sample:1990-2007 } R^2=0.996 \quad \text{SD}=3,308.6 \quad \text{DW}=1.114$$

$$(1.3) \text{ CG} = \text{CGN/PCG} * 100$$

$$(1.4) \text{ GFCF} = -263,374.2 + 0.3043 \text{ GDE} + 0.788 \text{ FDIR}$$

$$(-1.79) \quad (3.50) \quad (2.75)$$

$$-293.04 (\text{INTLR-DOT}(\text{PGFCF}))$$

$$(-2.05)$$

$$\text{OLS Sample:1990-2007 } R^2=0.993 \quad \text{SD}=3,698.8 \quad \text{DW}=1.327$$

$$(1.5) \text{ EGS} = (\text{EG\$} + \text{ES\$}) * \text{EXR}$$

$$(1.6) \text{ MGS} = (\text{MG\$} + \text{MS\$}) * \text{EXR}$$

$$(1.7) \text{ FDIR} = \text{FDI\$} * \text{EXR} / \text{PGFCF} * 100$$

(2) Nominal expenditure block

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

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

$$(2.3) \ln.\text{CGN} = 4.657 + 0.464 \ln.\text{WN} + 0.4974 \ln.\text{CGN}$$

$$(4.71) \quad (3.01) \quad (4.48)$$

$$\text{OLS Sample:1990-2007 } R^2=0.997 \quad \text{SD}=0.0456 \quad \text{DW}=1.663$$

$$(2.4) \text{GFCFN} = \text{GFCF} * \text{PGFCF} / 100$$

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

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

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

$$(2.8) \text{PCI} = (\text{GDEN} / \text{EXR}) / \text{NP}$$

(3) Prices and wage rates block

$$(3.1) \ln.\text{PCP} = -2.005 + 1.0616 \ln.\text{WN} - 0.9350 \ln.\text{GDP/LE}$$

$$(-28.36) \quad (51.61) \quad (-16.81)$$

$$\text{OLS Sample:1990-2007 } R^2=0.999 \quad \text{SD}=0.015 \quad \text{DW}=1.698$$

$$(3.2) \ln.\text{PCG} = 0.4366 + 0.2342 \ln.\text{WN} + 0.5134 \ln.\text{PCG}(-1)$$

$$(2.34) \quad (4.49) \quad (8.61)$$

$$\text{OLS Sample:1990-2007 } R^2=0.994 \quad \text{SD}=0.0307 \quad \text{DW}=1.176$$

$$(3.3) \ln.(\text{PGFCF}) = -0.30468 + 0.2596 \ln.\text{PMG}(-1) + 0.46706 \ln.\text{WN}$$

$$(-2.92) \quad (4.24) \quad (13.71)$$

$$\text{OLS Sample:1994-2007 } R^2=0.996 \quad \text{SD}=0.0140 \quad \text{DW}=1.374$$

$$(3.4) \ln.\text{PJP} = 2.160 + 0.2422 \ln.\text{PGDP} + 0.3471 \ln.\text{PJP}(-1)$$

$$(2.47) \quad (3.24) \quad (3.33)$$

$$\text{OLS Sample:1990-2007 } R^2=0.981 \quad \text{SD}=0.0117 \quad \text{DW}=2.182$$

$$(3.5) \text{PEGS} = \text{PGDP}$$

$$(3.6) \text{PMGS} = \text{PMG} / \text{PMG}.94 * 100$$

$$(3.7) \ln.\text{WN} = 2.170 + 0.6270 \ln.\text{PCP} + 0.9435 \ln.\text{GDP/LE}$$

$$(30.07) \quad (5.88) \quad (19.61)$$

$$+ 0.1829 \ln.\text{WN}(-1)$$

$$(3.17)$$

$$\text{OLS Sample:1990-2007 } R^2=0.999 \quad \text{SD}=0.0112 \quad \text{DW}=2.182$$

$$(3.8) \ln.\text{PGDP} = -1.849 + 0.10798 \ln.\text{PMGS} + 0.9213 \ln.\text{WN}$$

$$(-4.30) \quad (2.74) \quad (10.20)$$

$$- 0.87978 \ln.\text{GDP/LE}$$

$$(-4.88)$$

OLS Sample 1990 – 2007  $R^2=0.999$   $SD=0.0145$   $DW=1.221$   
(3.9)  $PMG=(PMS*EXRI)/(PMS.94/EXRI.94)*100$   
(3.10)  $PMS_{<j>} = \Sigma i(EN_{<i,j>}) / \Sigma i(E_{<i,j>}) * 100$   
(3.11)  $PES=(PGDP/PGDP.2000*100)/EXRI*100$

(4) Production block

(4.1)  $\ln.GDP=0.0563+0.389 \ln.K+0.611 \ln.LE$   
(6.13) (19.6) (15.3)  
 $+ 0.7916 (GFCF+GFCF(-1)+GFCF(-2))/K$   
(5.09)

OLS Sample:1993-2007  $R^2=0.995$   $SD=0.0110$   $DW=1.347$   
(4.2)  $K=K(-1)+GFCF \cdot D$   
(4.3)  $D= \delta K(-1) (\delta =0.08)$

(5) Population and labor force block

(5.1)  $NL=2,045.99+402.554 NP+0.01818 GDE-425.47 D2000$   
(1.84) (9.93) (6.38) (-2.60)  
OLS Sample:1990-2007  $R^2=0.998$   $SD=173.730$   $DW=2.342$   
(5.2)  $NE=1,090.02+401.509 NP+0.01854 GDE-439.249 D2000$   
(1.46) (10.22) (6.70) (-2.77)  
OLS Sample:1990-2007  $R^2=0.998$   $SD=168.506$   $DW=2.223$   
(5.3)  $NU=NL-NE$   
(5.4)  $UR=NU/NL*100$

(6) International trade BOP block

(6.1)  $EG_{<j>} = \Sigma j(E_{<i,j>})$   
(6.2)  $EGN_{<j>} = \Sigma j(EN_{<i,j>})$   
(6.3)  $EG=EG_{<j>}*EXRI/100$   
(6.4)  $EGN=EGN_{<j>}*EXRI/100$   
(6.5)  $EN_{<i,j>}=E_{<i,j>}*PE_{<i>}/100$   
(6.6)  $MG_{<j>} = \Sigma i(E_{<i,j>})$   
(6.7)  $MGN_{<j>} = \Sigma i(EN_{<i,j>})$   
(6.8)  $MG=MG_{<j>}*EXRI/100$

<Real merchandize exports to major ten countries, Japan(J), China(C), Australia(A), the U.S.(U), South Korea(K), Indonesia(I), Malaysia(M), the

Philippines(P), Singapore(S), and Thailand(T) >

$$(6.8) \ln.E<V,J> = -80.159 + 5.071 \ln.GDEI.J - 1.011 \ln.PES.V * EXRI.J / PGDP.J$$

$$(-3.04) \quad (2.37) \quad (-2.90)$$

$$+ 1.0977 \ln.GDP.V$$

$$(2.45)$$

OLS Sample 1990-2007  $R^2=0.914$   $SD=0.1259$   $DW=1.647$

$$(6.9) \ln.E<V,C> = -2.058 + 6.178 \ln.GDEI.C + 0.4750 \ln.GDP<V>$$

$$(-1.59) \quad (2.48) \quad (2.97)$$

$$+ 0.44953 \ln.E<V,C>(-1)$$

$$(2.39)$$

OLS Sample 1991-2007  $R^2=0.938$   $SD=0.2938$   $DW=2.247$

$$(6.10) \ln.E<V,A> = -24.4076 + 6.1777 \ln.GDEI.A + 0.34773 \ln.E<V,A>(-1)$$

$$(-2.28) \quad (2.95) \quad (2.74)$$

OLS Sample 1991-2007  $R^2=0.926$   $SD=0.4506$   $DW=1.388$

$$(6.11) \ln.E<V,U> = -23.028 + 3.70 \ln.GDEI.U - 1.923 \ln.PES.V(-1) / PGDP.U(-1)$$

$$(-1.48) \quad (2.30) \quad (-2.19)$$

$$+ 0.8201 \ln.GDP<V> + 0.6796 \ln.E<V,U>(-1)$$

$$(3.10) \quad (2.98)$$

OLS Sample 1995-2007  $R^2=0.971$   $SD=0.2228$   $DW=1.844$

$$(6.12) \ln.E<V,K> = -5.9411 + 2.4696 \ln.GDEI.K - 0.4987 D94 + 0.7630 D96$$

$$(-7.05) \quad (13.24) \quad (-2.75) \quad (4.28)$$

OLS Sample 1990-2007  $R^2=0.941$   $SD=0.1723$   $DW=1.650$

$$(6.13) \ln.E<V,I> = -6.882 + 1.827 \ln.GDEI.I + 0.6928 \ln.E<V,I>(-1)$$

$$(-1.23) \quad (1.39) \quad (3.33)$$

OLS Sample 1991-2007  $R^2=0.712$   $SD=0.6107$   $DW=2.227$

$$(6.14) \ln.E<V,M> = -9.244 + 5.3802 \ln.GDEI.M - 2.0298 \ln.PES.V$$

$$(-5.03) \quad (5.46) \quad (-2.03)$$

OLS Sample 1991-2007  $R^2=0.866$   $SD=0.3632$   $DW=1.801$

$$(6.15) \ln.E<V,P> = -0.1907 + 0.773 \ln.GDEI.P + 0.41410 \ln.E<V,P>(-1)$$

$$(-1.02) \quad (2.30) \quad (3.46)$$

OLS Sample 1991-2007  $R^2=0.948$   $SD=0.44323$   $DW=2.374$

$$(6.16) \ln.E<V,S> = 5.8324 + 2.587 \ln.GDEI.S - 1.9999 \ln.PES.V * EXR.S$$

$$(4.23) \quad (3.44) \quad (-2.47)$$

OLS Sample 1991-2007  $R^2=0.964$   $SD=0.1789$   $DW=1.734$

$$(6.17) \ln.E<V,T> = 7.7025 + 0.6771 \ln.GDEI.T - 1.1609 \ln.PES.V * EXR.T$$

$$(3.11) \quad (1.89) \quad (-2.36)$$

$$+0.8995 \ln.E<V,T>(-1)$$

(5.12)

OLS Sample 1995-2007  $R^2=0.901$   $SD=0.10135$   $DW=2.097$

<Real merchandize imports from major ten countries>

$$(6.18) \ln.E<J,V>=0.556+1.32 \ln.GDEI.V-1.921 \ln.PES.J*EXRI.V/PGDP.V$$

(2.57) (5.62)

(-7.75)

OLS Sample 1990-2007  $R^2=0.991$   $SD=0.10589$   $DW=1.748$

$$(6.19) \ln.E<C,V>=0.705+1.645 \ln.GDEI.V-0.798 \ln.PES.C*EXRI.V/PGDP.V$$

(-1.20) (2.21)

(-2.87)

$$+0.6620 \ln.E<C,V>(-1)$$

(4.91)

OLS Sample 1991-2007  $R^2=0.9901$   $SD=0.1845$   $DW=2.391$

$$(6.20) \ln.E<A,V>=2.587+2.453 \ln.GDEI.V$$

(1.24) (11.16)

$$-0.2013 \ln.PES.A*EXRI.V/PGDP.V$$

(-6.56)

OLS Sample 1991-2007  $R^2=0.963$   $SD=0.2349$   $DW=1.27$

$$(6.21) \ln.E<U,V>=24.164 + 1.847 \ln.GDEI.V$$

(3.03) (2.26)

$$-6.5055 \ln.PES.U*EXRI.V/PGDP.$$

(-6.07)

OLS Sample 1990-2007  $R^2=0.950$   $SD=0.5568$   $DW=1.179$

$$(6.22) \ln.E<K,V>=196.7+12.127 \ln.GDEI.V/GDPI.V(-1)$$

(4.37) (3.98)

$$-2.4973 \ln.PES.K*EXRI.V/PGDP.V$$

(-30.85)

OLS Sample 1991-2007  $R^2=0.984$   $SD=0.1440$   $DW=1.82$

$$(6.23) \ln.E<I,V>=2.8563+1.948 \ln.GDEI.V-1.484 \ln.PES.I*EXRI.V/PGDP.V$$

(0.91) (5.37)

(-3.72)

OLS Sample 1990-2007  $R^2=0.935$   $SD=0.3036$   $DW=2.284$

$$(6.24) \ln.E<M,V>=6.553+3.5915 \ln.GDEI.V$$

(1.46) (9.56)

$$-3.8987 \ln.PGDP.M*EXRI.V/PGDP.V$$

(-5.23)

OLS Sample 1990-2007  $R^2=0.935$   $SD=0.4702$   $DW=1.629$

$$(6.25) \ln.E<P,V>=-1.1580+2.474 \ln.GDEI.V$$

$$\begin{aligned}
& (0.17) \quad (2.93) \\
& -1.4645 \ln.PES.P*EXRI.V/PGDP.V \\
& (-2.03) \\
& OLS \quad \text{Sample 1994-2007} \quad R^2=0.971 \quad SD=0.1947 \quad DW=2.146 \\
(6.26) \quad & \ln.E<S,V>=1.0979+2.3396 \ln.GDEI.V-0.8960 EXRI.V \\
& (1.22) \quad (13.12) \quad (-2.47) \\
& OLS \quad \text{Sample 1991-2007} \quad R^2=0.989 \quad SD=0.07053 \quad DW=1.824 \\
(6.27) \quad & \ln.E<T,V>=4.0829+2.1923 \ln.GDEI.V \\
& (1.75) \quad (5.78) \\
& -1.7946 \ln.PES.T*EXR.V/PGDP.V \\
& (-1.93) \\
& OLS \quad \text{Sample 1991-2007} \quad R^2=0.999 \quad SD=0.12635 \quad DW=1.134 \\
<Real merchandize exports and imports with the R.O.W.> \\
(6.28) \quad & \ln.E<V,ROW>=-3.0784+0.8828 \ln. GDEI.ROW+0.8320 \ln.GDPI.V \\
& (-2.28) \quad (3.56) \quad (4.56) \\
& -1.156 PES.V/PES.V(-1) \\
& (-7.87) \\
& AR(1) \quad \text{Sample 1994-2007} \quad R^2=0.993 \quad SD=0.035 \quad DW=2.291 \\
(6.29) \quad & \ln.E<ROW,V>=4.18+1.80 \ln.GDEI.V \\
& (5.35) \quad (24.98) \\
& -0.864 \ln.PES.ROW*EXRI.V/PGDP.V-0.2855 D95 \\
& (-5.55) \quad (-2.57) \\
& OLS \quad \text{Sample 1990-2007} \quad R^2=0.978 \quad SD=0.1041 \quad DW=1.630 \\
(6.30) \quad & E<i,j>= \alpha_{i,j} M<j> \quad ( \alpha_{ij}= E<i,j>/M<j> : \text{constant real share approach} ) \\
(6.31) \quad & ES\$=-18469.3+2.7626 EXR+0.04166 D9596 \\
& (-2.80) \quad (4.32) \quad (2.33) \\
& OLS \quad \text{Sample 1990-2007} \quad R^2=0.884 \quad SD=3907 \quad DW=1.410 \\
(6.32) \quad & MS\$=613.9+0.0448 GDE/1000+1942.5 D9596 \\
& (1.64) \quad (2.33) \quad (5.49) \\
& OLS \quad \text{Sample 1990-2007} \quad R^2=0.893 \quad SD=429.9 \quad DW=1.557 \\
(6.33) \quad & TB\$=EGN\$ - MSN\$
\end{aligned}$$

#### Appendix B : Variable list

CG : real government consumption expenditures (1994 constant prices)

CGN :nominal government consumption expenditures  
 CP : real private final consumption expenditures(1994 constant prices)  
 CPN :nominal private final consumption expenditures  
 D :real depreciation of capital stock  
 E<i,j> :real bilateral export(FOB) from country<i> to country<j> in terms of US\$ converted by exchange rate in 2000  
 EN<i,j> : nominal bilateral export(FOB) from country<i> to country<j> in terms of US\$  
 EG : real merchandize export(1994 constant prices)  
 EGN :nominal merchandize export  
 EG\$ :real merchandize exports in US\$  
 EGN\$ :nominal merchandize exports in US\$  
 EGS :real exports of goods and services(1994 prices)  
 EGSN :nominal exports of goods and services  
 ES\$ :real service exports in US\$  
 ESN\$ :nominal service exports in US\$  
 EXR :exchange rate(dong/\$)  
 EXRI :exchange rate index(EXRI.2000=100)  
 FDI\$ :foreign direct investment inflow in US\$  
 FDIR :real foreign direct investment inflow in local currency  
 GDE :real gross domestic expenditures(1994 constant prices)  
 GDEN :nominal gross domestic expenditures  
 GDP :real gross domestic products(1994 constant prices)  
 GDEI :real GDE index in terms of US \$ (GDPI.2000=100)  
 GDPN :nominal gross domestic products  
 GFCF :real gross fixed capital formation(1994 constant prices)  
 GFCFN :nominal gross fixed capital formation  
 INTLR :lending rate (exogenous variables)  
 J :real inventory changes (1994 constant prices, exogenous )  
 JN :nominal inventory changes  
 K :real capital stock(1994 constant prices)  
 MG :real merchandize imports(1994 constant prices)  
 MGN :nominal merchandize imports  
 MG\$ :real merchandize imports in US\$  
 MGN\$ :nominal merchandize imports in US\$



MGS	:real imports of goods and services
MGSN	:nominal imports of goods and services
MS\$	:real service imports in US\$
MSN\$	:nominal service imports in US\$
NP	:number of population(exogenous)
NE	number of employment:
NL	:number of labor
NU	:number of unemployment
PCG	:implicit deflator of CG
PCI	: per-capita income in US\$
PCP	:implicit deflator of CP
PEG	:implicit deflator of EG
PES	: export price index in terms of US dollar (PES.2000=100)
PEGS	:implicit deflator of EGS
PGDE	:implicit deflator of GDE
PGFCF	:implicit deflator of GFCF
PJ	:implicit deflator of J
PMG	:implicit deflator of MG
PMGS	:implicit deflator of MGS
PMS	:import price Index in terms of US\$ (PMS.2000=100)
TB\$	:trade balance in US\$
WN	:nominal wage rates (index)
YW	:wage income
$\delta$	: rate of capital depreciation(Exogenous)

#### Appendix C: Major Exogenous Variables Set for the Baseline Forecast

	2009	2010	2011	2012	2013	2014	2015
NP	89.829	91.068	92.325	93.599	94.891	96.200	97.528
(million)							
EXR	17065	17406	17754	18109	18471	18841	19218
(dong/US\$)							
INTLR	11.18	11.18	11.18	11.18	11.18	11.18	11.18
(%)							
FDI\$	6900	6900	6900	6900	6900	6900	6900
(million\$)							

## Appendix D: Data estimation for data base

Some data not available are estimated as follows,

- (1) Real capital stock(K)

$$K.91 = GFCF.91 / \Delta GDP.91 * GDP.91$$

From 1992 to 2007,

$$K(t)=K(t-1)+GFCF(t)-0.08*K((t-1)$$

- (2) Import price in terms of US\$ (PMSHAT) from 1990 to 2007

$$\text{PMS}_{\langle j \rangle} = \sum_i (\text{EN}_{\langle i, j \rangle}) / \sum_i (\text{E}_{\langle i, j \rangle}) * 100 \text{ from 1990 to 2007}$$

- (3) Deflators and real GDE components missing before 1993

As real GDE components are not available before 1993, we estimated deflators of GDE components from 1990 to 1993 based on regression results with 1994-2007 data. With the estimated deflators, real GDE components missing are also calculated dividing each nominal GDE component by its deflator from 1990 to 1993

## Appendix E: Regression Results of Macro Exports and imports with OLS

<Exports of goods and services>

$$\begin{array}{ccccccc} \text{EGS} & = & 92,179.34 & + & 23.963 & \text{TWM} & - 7550.1\text{E}+8 & \text{PEGS/EXRI/PTW} & + & 0.631 & \text{GDP} \\ & & (-11.57) & & (3.41) & & (-8.34) & & & & (5.33) \end{array}$$

OLS Sample 1990-2007  $R^2=0.997$  SD=5,018.8 DW=1.695

<Imports of goods and services>

$$\begin{array}{lll} \text{MGS} = -133,945.4 & +1.2637 \text{ GDE} & -10868.6 \text{ PMS*EXRI/PGDP} \\ (8.22) & (40.29) & (-2.39) \end{array}$$

OLS   Sample 1990-2007    $R^2=0.995$    SD=8,363.9   DW=1.955

TWM, PTW refer to real world imports and deflator of TWM, respectively.

(Source: Nakamura 2010)

## Notes: Data Sources

## Main Indicators of SNA, UN

International Financial Statistics(IFS), IMF

Direction of Trade(DOT), IMF

Balance of Payments Statistics(BOP), IMF

Key indicators for Asia and the Pacific, ADB