The impact of the stimulus package on the agricultural sector in Vietnam

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Contributed paper at the 55th AARES Annual Conference,
Melbourne, Victoria, 8-Ilth February 2011

The global financial crisis in 2008-2009 has affected almost all countries. Vietnam was hit by a large fall in export demand and foreign direct investment. Many governments quickly prescribed stimulus packages and Vietnam was no exception. It reduced taxes and increased government spending, mainly by subsidizing loans to state-owned enterprises. The question is what the stimulated impact is, if any, and whether a better outcome could have been achieved by a different mix of policies. In this paper, we use a simple general equilibrium model to quantify the impact of the various components of the stimulus package on the whole economy as well as agricultural sector. The results suggest that, in the short run at least, the stimulus package marginally stabilised national production and income. The package led to a reduction in total welfare because it favoured the non-agricultural sector. The poor in the agricultural sector could be better off if the investment policy were to boost demand for agricultural products. Furthermore, the risk of inflation and real exchange rate appreciation could undermine national competitiveness.

Key words: Vietnam, fiscal stimulus, agriculture
JEL Codes: E62, D58, Q17
Topics: International Development, Public Economics

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1. INTRODUCTION

The recent global financial crisis affected almost all countries. Vietnam, a small open developing country, was hit by a fall in export demand and foreign direct investment in late 2008 and 2009. Many governments quickly prescribed stimulus packages and Vietnam was no exception. The question is what the stimulated impact is, if any.

To answer the question, we expand the 1-2-3 CGE model of Devarajan et al. (1997) to include the agricultural sector, which plays an important role in developing countries. In its original form, the model has one country, two sectors and three goods. In Vietnam, more than half of the labour force is employed in agriculture. Most of Vietnam's poor are living in rural areas and earning their living from agriculture. Therefore the results of the model have implications for the policy impact on inequality and poverty reduction.

The results suggest that, in the short run at least, the stimulus package marginally stabilised national production and income. The package leads to a reduction in total welfare due to its favouring the non-agricultural sector. The poor in the agricultural sector could be better off if the investment policy were to boost the demand for agricultural products, possibly through investment in industries having strong backward linkage with agriculture. There is also the risk of inflation and real exchange rate appreciation, which could undermine the national competitiveness.

Thanks to its simplicity, the expanded model could be mobilized in the future when policy makers need a quick assessment of a potential policy impact. Estimated results from the model could also be used as inputs for further research using micro models of household-level impact assessment with household survey data.

The following section provides the overview of the Vietnamese economy before and during the crisis. Section 3 examines the reasoning of the stimulus intervention theoretically, then describes the 1-2-3 model and its expansion,

together with data sources for applying the model in Vietnam. Section 4 discusses the simulation results and section 5 concludes.

2. VIETNAM BEFORE AND DURING THE CRISIS

The extended model is applied to the case study of Vietnam, an agricultural-based economy located in the Southeast Asia. According to the national statistical office, the agricultural sector employs more than half of the total labor force but produces one fifth of the total GDP. One fifth of total population live on less than one dollar a day, and most of these are in rural areas and earn their living from agricultural production (Ministry of Agriculture and Rural Development 2009).

The country is in the transition from a central planned to a market-based economy. Vietnam is increasingly integrated into the international economy, marked by its accession into the World Trade Organization in 2007. The total trade volume was up to 170 per cent of GDP in 2007. Nonetheless the financial sector is less open to the rest of the world. As a result, Vietnam was immunized against the sub-prime crisis beginning in 2007. However, it cannot avoid the impact of the global economic crisis through export and foreign investment channels. In 2009, for the first time since the 1997 Asian crisis, total exports and agricultural exports as well as implemented FDI fell.

The growth rates of total exports and agricultural exports fell from 29 percent and 27 percent per year in 2008 down to -9 percent and -7 percent per year in 2009 respectively (Figure 1). These shocks are expected to have large adverse impacts on the agricultural sector and on the whole economy.

The world prices of Vietnam's exports and imports decreased sharply, especially for non-agricultural items. Because export and import prices move together, it is hard to tell initially if these price shocks have a positive or negative impact on the economy (Figure 2).

The implemented foreign direct investment kept reducing in 2008 and 2009 from the peak in 2007 when Vietnam became a member of the World Trade Organization. However, the domestic investment increased in 2009, possibly in response to the government's loan subsidy and loose monetary policy (Figure 3).

The concern is that in 2009, the growth rate of total investment increases due to improvement in domestic investment, while that of investment in agriculture decreases (Figure 4). Thus the share of agriculture in investment keeps reducing from an already low level (6 per cent[2]) compared with its contribution to GDP (20 per cent[3]). This likely hurts the poor who earn their living from agriculture.

To cope with the unfavourable shocks, in late 2008 and 2009, the Vietnam government quickly announced a relatively large stimulus package of about US$6 million (7 per cent GDP in 2008). This includes a short term (only in 2009) intervention of 1 per cent of GDP covering credit subsidy, tax cut, one-time transfer to the poor; and a long term investment in infrastructure, trade promotion, etc. However, there has not been an official announcement detailing the distribution and source of such huge expenditures. Therefore, we choose to calculate the size of the stimulus from the fiscal balances reported by the Ministry of Finance. Figure 5 shows a reduction in tax revenue and increases in expenditure, mostly capital expenditure in 2009 compared with 2008.

The combination of negative external shocks and stimulus policies resulted in the modest growth rate of 5.32 per cent and agricultural growth rate of 1.83 per cent in 2009, lower than those in 2008. Noteworthy, the reduction in agricultural sector growth is much deeper than that of the whole economy (Figure 6). This highlights our concern of an adverse effect on the poor due to the focus of stimulus policy on state-owned enterprises and the non–agricultural sector.

[2] Investment in 2008 and 2009, General Statistics Office 2010, www.gso.gov.vn.
[3] National Account 2009, General Statistics Office 2010, www.gso.gov.vn.

3. STIMULUS PACKAGE, 1-2-3 MODEL AND ITS EXTENSION

Theoretical base of the stimulus package

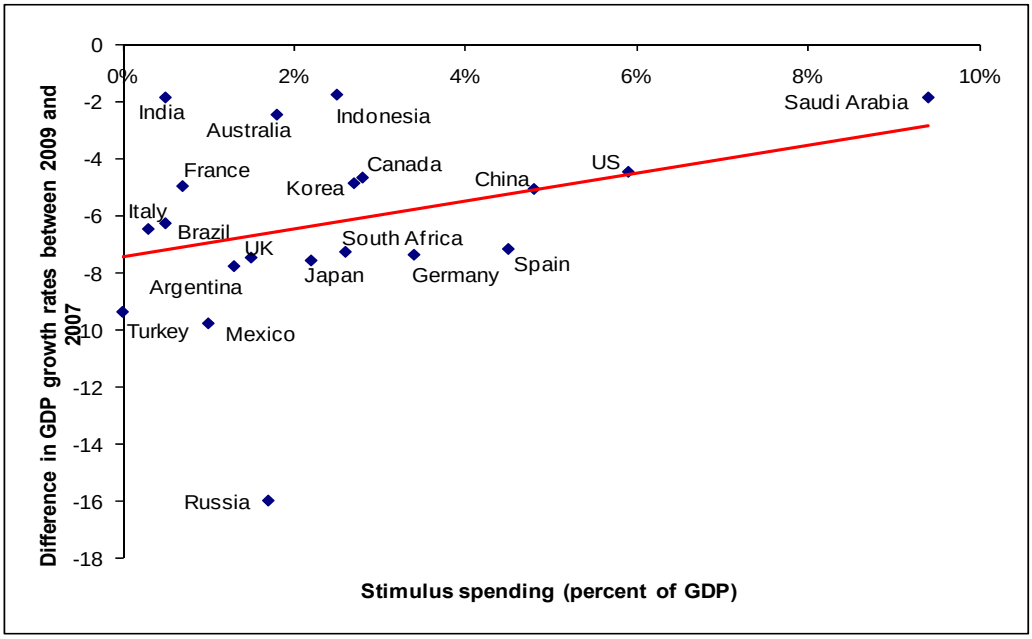
The justification of government intervention in times of crisis dates back to Keynes. Stiglitz (2009) specifies the problem of the current global crisis is an organizational one. Human and physical resources are available just like before the crisis. There is a failure in organizing these resources to produce output.

Stiglitz (2009) mentions two schools of Keynesian thought explaining the root cause of crises. One claims wage rigidities, while the other attributes the lack of aggregate demand as sources of the market failure. However, large wage falls during crises leads to the rejection of the former argument (Stiglitz 2009). Keynes states that in the Great Depression, wage decrease leads to income reduction therefore demand shortage.

Nonetheless, there are different explanations of the demand fall. Stiglitz (2009) argues that the aggregate demand insufficiency at the global level is caused by: (i) the accumulated increase in inequality, transferring money to the rich who spend a lesser part of their income; and (ii) “the massive build-up of reserves” as countries learn from 1997 financial crisis. On the other hand, Willenbockel and Robinson (2009) attribute the declines in the rich countries’ demand for export from developing countries and changes in term of trade unfavourable to primary product exporters are major causes of crisis in developing countries.

According to this line of thinking, government intervention is needed to address the fall in aggregate demand. Monetary policy was used first but with limited impact as it could not stimulate demand. Therefore the G-20 countries choose to use fiscal measures to stimulate demand (Prasad and Sorkin 2009).

Graph – Correlation between stimulus size and GDP growth rate



Sources: Prasad and Sorkin 2009 (Size of stimulus) and World Development Indicators, World Bank 2010 (GDP growth rates)

The above figure shows positive correlation between stimulus intervention and the growth recovery in G-20 countries. The bigger the stimulus package (in percentage of GDP), the lesser the decrease in growth rate between 2007 and 2009. However the correlation is not so strong without Saudi Arabia. The questions are whether there is a causal relationship between stimulus intervention and whether such impact, if any, has a trickle-down effect.

The stylized model of one country, two sectors, and three goods (1-2-3 model)

In order to quantify the stimulus effect, it is essential to separate out the impact of crisis from the observed national economic performance. The computational general equilibrium (CGE) model is a natural tool for such policy analysis as it allows to introduce one shock at a time, like a "laboratory that supports individual, controlled experiments" (Devarajan and Robinson 2002).

Taking the Occam's Razor approach of "Use the simplest model adequate to the task at hand" (Devarajan and Robinson 2002), the one-country, two-sector, three-good model (the 1-2-3 model) is a good start. This model was developed by Devarajan et al. (1997) to analyze the interaction between the external shocks and economic policies and the economy. The model is for one country with two sectors (producing tradable and non-tradables) and three goods (export good, domestic good and import good). There are three actors (a household, a producer and the rest of the world).

The model assumes a small country, facing fixed world prices. Output is a combination of export and domestic goods, assuming constant elasticity of transformation. There is imperfect substitution between import and domestic goods with constant elasticity of substitution.

Devarajan et al. (1997) also assumes fixed output, implying full employment of all resources. Other exogenous variables include tax rate, transfers, saving rate, government consumption and the trade balance. Several parameters (elasticities) are taken from available literature.

The main advantages of the model are the "modest data requirement" and the ability to run in Excel using Solver, an optimization feature. Excel is easier to learn and use than other programming tools.

Extension of the 1-2-3 model to include agricultural production and trade

The 1-2-3 model is useful for analyzing the impact of external shocks and policy packages, but cannot evaluate the extent of such impact on the poor. Our solution is to separate both tradable and non-tradable goods into agricultural and non-agricultural components. Export goods, domestic goods and import goods are also separated accordingly. This is of particular interest for Vietnam, an agrarian economy where the poorest people are self-subsistent farmers.

There are 31 equations (see appendix), which are the direct extension from the 19 equations in the 1-2-3 model. Equations (1) and (2) are domestic production

possibility frontiers for agricultural and non-agricultural production. Equations (3) and (4) are the agricultural and non-agricultural composite commodities consumed by the single household. Equation (5) and (6) are the household demand for the composite agricultural and non-agricultural goods. Equations (7) and (8) describe the efficient ratios of exports to domestic output in agricultural and non-agricultural sectors. Equations (9) and (10) are ratios of desired import to domestic goods in two sectors. Equation (11) describes tax revenue as a composite of revenue from tariffs, direct and indirect taxes. Equation (12) defines the sources of household income. Equation (13) describes aggregate saving as the total of household saving, government saving and trade account balance. Equation (14) calculates aggregate consumption as the difference between disposable household income and savings.

Equations from (15) to (25) describe prices, where the real exchange rate is the numeraire. Equations (26) to (32) are market clearing equilibrium conditions. Equations (33) to (36) are accounting identities and could be derived from equations (21) to (24) respectively. Furthermore, equation (31) of saving-investment identity is dropped as superfluous thanks to Walras Law. Thus there are 31 equations, matching the 31 endogenous variables.

From a small open developing country perspective, external shocks in crisis include reductions in exports and foreign investment. Hence, in the modified model, we change the closure by making exports and investment exogenous and letting output and saving rate be determined by the model. We also assume the share of agriculture in total consumption is fixed. As in the original model, consumption reflects welfare in the extended model.

Data and measurement issues

Vietnam is chosen for the case study as it is a small open developing country suffering from the global crisis and quickly launches a sizable stimulus package. The data used in the model is the non-competitive Input-Output Table (I0 table) for the year 2007, compiled from a survey in 2008 and published by the General Statistics Office in 2009. The original IO table with 138 commodities is

aggregated into two commodities: agriculture and non-agriculture. Output, household consumption, investment, government consumption, exports, imports and tariffs at producer price from the IO table are then adjusted to market price indexes using 2007 national accounts from 2007 Statistical Year Book (General Statistics Office 2008).

Fiscal account data is from the annual State Budget Balance issued by Ministry of Finance. The balance of payment is quoted from Vietnam table in the Key Indicator 2009 (Asian Development Bank 2010).

Indexes in VND from General Statistics Office are in 1994 prices. Indexes from Ministry of Finance are deflated using GDP deflator (in the case of tax revenue) and non-agriculture GDP deflator (in the cases of capital and current expenditure) from General Statistics Office (2010).

Parameters for elasticities of substitution are taken from Cameroon CGE model (Condon et al. 1987). The country shares many characteristics with Vietnam, including being a small open agrarian economy with the share of agriculture in total GDP approximately 20 percent. The agricultural sector in Cameroon is also the country's engine for growth, maintaining the sectoral growth rate of nearly 4 percent since 1988 (World Bank 2009a, World Bank 2009b).

Vietnam's economy is assumed to be at equilibrium in 2007[4]. Shocks are constructed by inflating exogenous variables. The economy in 2008 is got by shocking with 2008 rates. The crisis scenario in 2009 is constructed by shocking export, world prices and foreign direct investment with 2009 rates. The model does not allow direct shock of foreign direct investment. Instead, we separate the change of investment in 2009 into two shocks: reduction in foreign direct investment and improvement in domestic investment. The latter could reflect the indirect impact of the stimulus policy.

[4] We choose 2007 as the base year and 2003-2007 rates for counterfactual scenario as 2003-2007 is a fairly stable period. In contrast, 2008 is a chaotic year with high inflation; the government has to tighten monetary policy; and the economy has to suffer from the world food crisis with a confusing combined impact of export price increases and controversial food policies.

The policy impact scenario is established by adding policy shocks in 2009 to the crisis scenario. The impact is then compared with the outcome in case of a different government intervention with more investment in agricultural sector.

4. SIMULATION RESULTS

In order to analyze the impact of the stimulus package in Vietnam, crisis shocks and policy interventions are introduced into the CGE model one by one. The data is based on 2007. There are 3 aggregated scenarios[5]:

- **S1 (crisis scenario):** the combination of reduction in exports, world prices for exports and imports, and foreign direct investment by their growth rates in 2009.
- **S2 (stimulus package):** the combination of crisis shocks and the stimulus package, including increase in government consumption, tax and tariff by their growth rates in 2009.
- **S3 (assumed shift in investment to agriculture):** Assuming investment policy focuses on boosting industries having strong backward linkages with agriculture, thereby increasing demand for agricultural products (supposing 20 percent of total investment increase is spent for agriculture, other shocks like S2).

[5] We restrict to 3 main scenarios due to the scope of the paper. To assess the impact of separated shocks (for example to consider the impact of government spending distinguished from tax cut), more detailed scenarios are included in the working version of this paper.

Table 1 – The simulated 2008 baseline, the 2009 counterfactual and scenarios

	2007	2008	2009			
			Counter -factual	S1 (E+P+FDI)	S2 (E+P+I+G +tax +tariff)	S3 (E+P+I+G+ tax+tariff +shift in investment)
Agricultural exports	1	1.27	1.22	0.93	0.93	0.93
Non-agricultural exports	1	1.30	1.25	0.90	0.90	0.90
World price of agricultural exports	1	1.26	1.08	0.94	0.94	0.94
World price of non-agricultural exports	1	1.25	1.10	0.88	0.88	0.88
World price of agricultural imports	1	1.22	1.07	0.90	0.90	0.90
World price of non-agricultural imports	1	1.18	1.06	0.88	0.88	0.88
Investment in agriculture	1	1.14	1.10	1.00	1.08	2.14
Investment in non-agriculture	1	1.07	1.17	0.97	1.12	1.08
Government spending	1	1.03	1.11	1.11	1.20	1.20
Direct tax	1	1.02	0.98	0.98	0.75	0.76
Indirect tax	1	1.01	1.03	1.03	1.12	1.64
Import tariff	1	1.21	1.13	1.13	1.35	1.35

Table 2 compares outcome changes of scenarios 2 and 3 from those of scenario 1, in percentage changes. Impacts of the stimulus package are shown by comparing outcomes of scenario 2 with scenario 1. Similarly, the impact of a supposed package in favour of agriculture is shown by comparing scenario 3 with scenario 1.

Table 2 - Impact of the stimulus package and the assumed shift in investment to agriculture

	ΔS2/S1	ΔS3/S1
Variable	**Policy interventions after crisis**	**Assumed shift in investment to boost demand for agriculture**
	%	%
Total income	0.01	0.50
Total production	0.01	0.42
Agricultural production	*-1.01*	*3.11*
Total consumption	-8.39	-7.69
Total import	0.01	-0.04
Total saving	16.97	20.38
Government saving	-11.12	10.93
Agricultural producer price	-0.67	2.06
Non-agricultural producer price	0.00	-0.20
Domestic price (*)	0.23	0.92
Consumer price	1.25	4.65

Note: The exchange rate is the numeraire in this model, thus the changes in domestic price reflect the changes in real exchange rate.

Column 1 of table 2 shows that the stimulus spending could help stabilize income and production at the cost of government saving. However, the total welfare reflected in total consumption is reduced. Agricultural production and producer prices decrease, making farmers worse off. Moreover, the package provides little help to the non-agricultural producers as their production improved a little and their prices remain unchanged. There is also a threat of inflation and real exchange rate appreciation, with consumer prices rising 5 per

cent if investment is directed into agriculture. Inflation and currency appreciation could undermine the economy's competitiveness.

The results indicate that the stimulus package does not help improve living standards and alleviate poverty. This possibly comes from the different elasticities between agriculture and non-agriculture, while most of government spending is in non-agricultural sector.

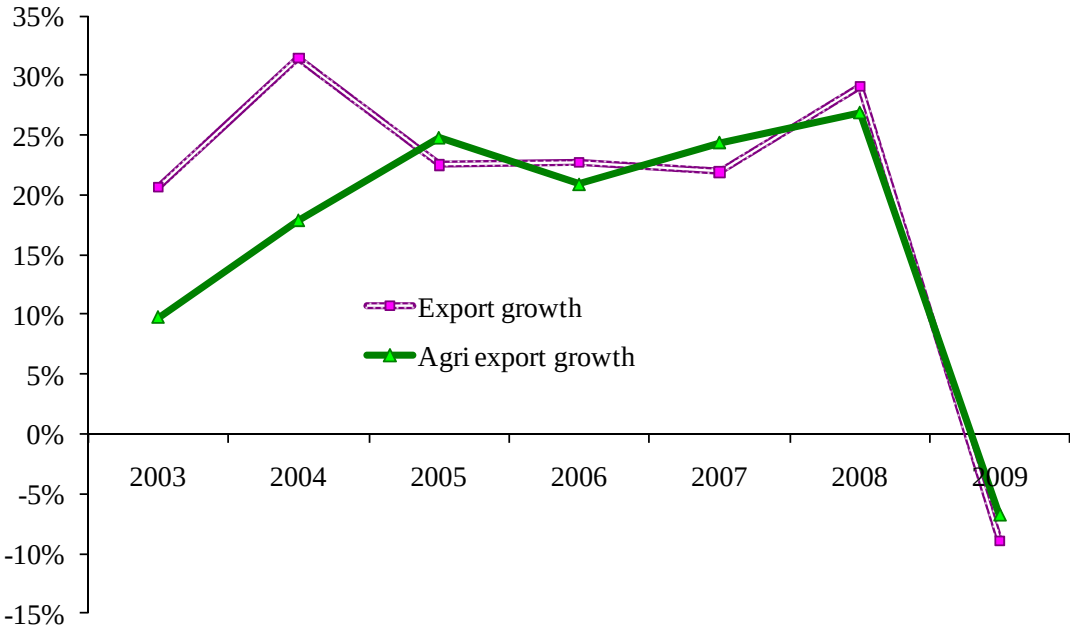
Column 2 of table 2 describes the impact of a stimulus package assuming restructure of investment toward industries using agriculture input intensively, such as food processing industry and tourism. This hypothetical package helps increase income and production, while enhancing government and total savings. Total welfare is still reduced but less than the case of no investment restructuring. The farmers are better off with higher agricultural production together with higher selling prices. However, the cost of inflation and real exchange rate appreciation is higher.

5. CONCLUSION

The 1-2-3 model is a useful tool to analyze the impact of government intervention in the economic crisis. It could be extended by including primary production and trade to trace the impact of government intervention on the poor. The Vietnam case study illustrates that the stimulus package has a positive effect on total income and production, but the poor may not benefit from that.

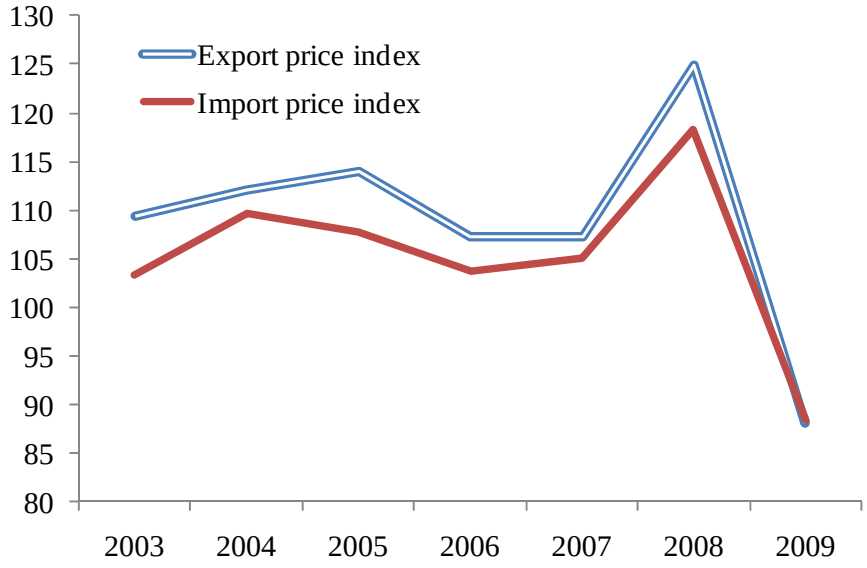
Further research may extend the model further by including factor markets, disaggregating the sectors as well as government consumption and investment. Elasticities could also be calibrated from micro-based data. We also plan to expand the current static model to a dynamic one to capture the longer term effect of stimulus package (taking into account the expected future increase in tax and national debt).

Figure 1 – Export growth



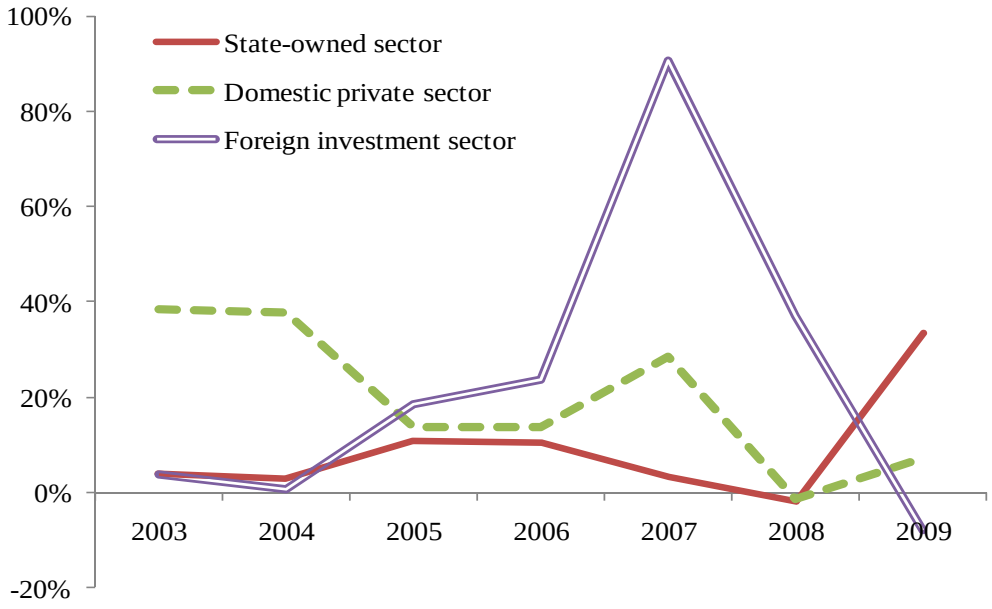
Source: General Statistics Office, 2010

Figure 2 – Change in export and import price (previous year = 100)



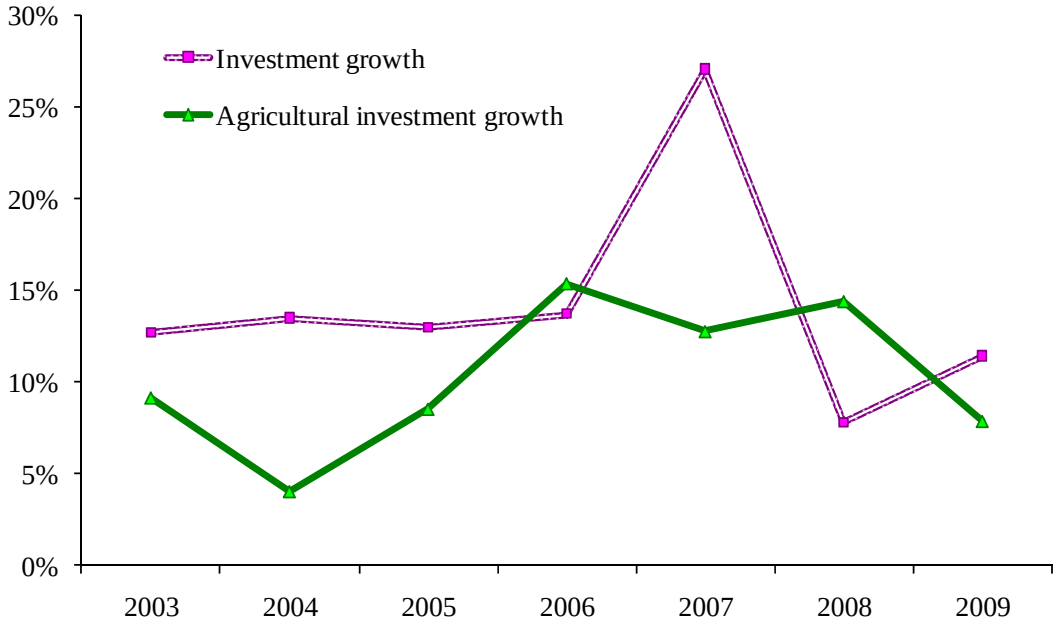
Source: General Statistics Office, 2010

Figure 3 – Growth of investment by ownership



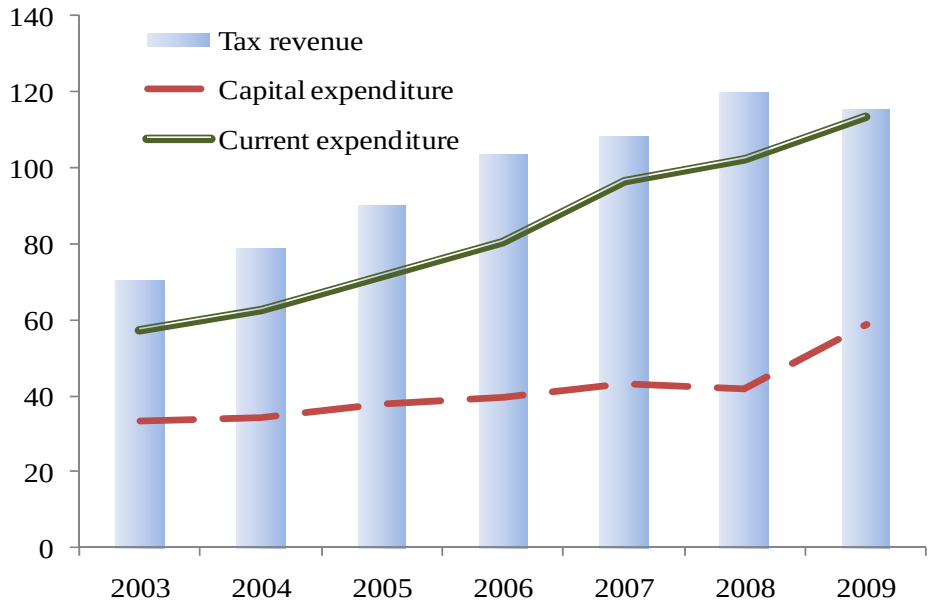
Source: General Statistics Office, 2010

Figure 4 - Investment growth



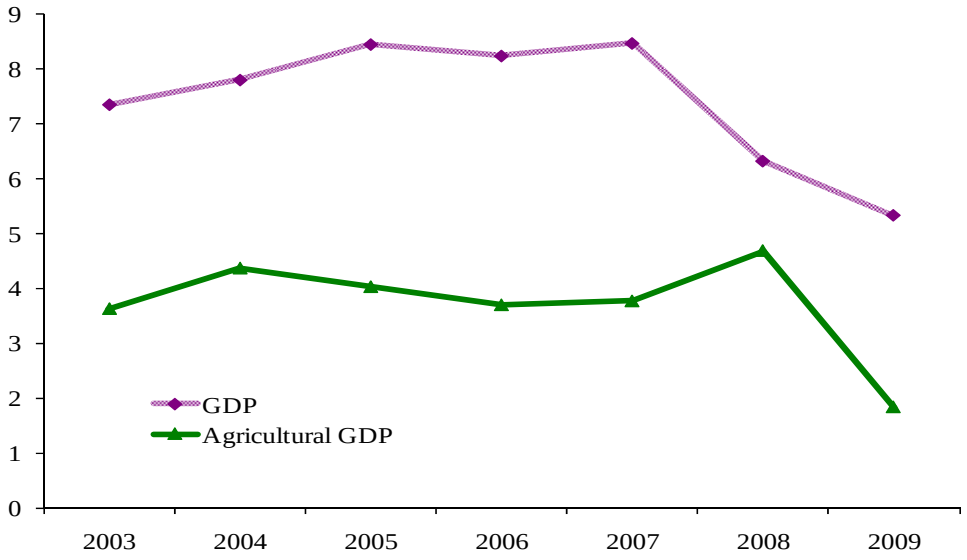
Source: General Statistics Office, 2010

Figure 5: Tax revenue and government expenditure in 1994 price (trillion VND)



Source: Indexes in current prices from Ministry of Finance, State Budget Balances, 2010. GDP deflators from General Statistics Office, 2010.

Figure 6: Total GDP and agricultural GDP growth rates (%)



Source: General Statistics Office, 2010

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APPENDIX 1 - DEFINITIONS

Endogenous variables

XA: Aggregate agricultural output

XN: Aggregate non-agricultural output

MA: Agricultural import

MN: Non-agricultural import

s: average saving rate

DA^S: Supply of domestic agricultural good

DN^S: Supply of domestic non-agricultural good

DA^D: Demand for domestic agricultural good

DN^D: Demand for domestic non-agricultural good

QA^S: Supply of composite agricultural good

QN^S: Supply of composite non-agricultural good

QA^D: Demand for composite agricultural good

QN^D: Demand for composite non-agricultural good

P^{eA}: Domestic price of agricultural export good

P^{eN}: Domestic price of non-agricultural export good

P^{mA}: Domestic price of agricultural import good

P^{mN}: Domestic price of non-agricultural import good

P^{dA}: Producer price of domestic agricultural good

P^{dN}: Producer price of domestic non-agricultural good

P^{tA}: Sale price of composite agricultural good

P^{tN}: Sale price of composite non-agricultural good

P^{xA}: Price of aggregate agricultural output

P^{xN}: Price of aggregate non-agricultural output

P^{qA}: Price of composite agricultural output

P^{qN}: Price of composite non-agricultural output

R: Exchange rate

T: Tax revenue

S^{g}: Government saving

Y: Total income

CA: Aggregate consumption in agricultural good

CN: Aggregate consumption in non-agricultural good

S: Aggregate savings

Exogenous Variables

pw^{eA}: World price of agricultural export good

pw^{eN}: World price of non-agricultural export good

pw^{mA}: World price of agricultural import good

pw^{mN}: World price of non-agricultural import good

t^{mA}: Agricultural tariff rate

t^{mN}: Non-agricultural tariff rate

t^{eA}: Agricultural export subsidy rate

t^{eA}: Non-agricultural export subsidy rate

t^{s}: Sales/ excise/ value-added tax rate

t^{y}: Direct tax rate

tr: Government transfers

ft: Foreign transfers to government

re: foreign remittances to private sector

EA: Agricultural export good

EN: Non-agricultural export good

ZA: Aggregate real investment in agriculture

ZN: Aggregate real investment in non-agriculture

G: Real government demand

B: Balance of trade

A_t^A: Scale parameter of Agricultural CET function

A_t^N: Scale parameter of Non-agricultural CET function

A_q^A: Scale parameter of Agricultural CES function

A_q^N: Scale parameter of Non-agricultural CES function

b_t^A: Share parameter of Agricultural CET function

b_t^N: Share parameter of Non-agricultural CET function

b_q^A: Share parameter of Agricultural CES function

b_q^N: Share parameter of Non-agricultural CES function

r_t^A: Exponent parameter of Agricultural CET function

r_t^N: Exponent parameter of Non-agricultural CET function

r_q^A: Exponent parameter of Agricultural CES function

r_q^N: Exponent parameter of Non-agricultural CES function

APPENDIX 2 - EQUATIONS

(1) $$\overline{XA} = \overline{A_t^A}[b_t^A EA^{r_t^A} + (1-b_t^A)DA^{S r_t^A}]^{1/r_t^A}$$

(2) $$\overline{XN} = \overline{A_t^N}[b_t^N EN^{r_t^N} + (1-b_t^N)DN^{S r_t^N}]^{1/r_t^N}$$

(3) $$QA^S = A_q^A[b_q^A MA^{r_q^A} + (1-b_q^A)DA^{D r_q^A}]^{1/r_q^A}$$

(4) $$QN^S = A_q^N[b_q^N MN^{r_q^N} + (1-b_q^N)DN^{D r_q^N}]^{1/r_q^N}$$

(5) $$QA^D = CA + ZA$$

(6) $$QN^D = CN + ZN + \overline{G}$$

(7) $$\frac{EA}{DA^S} = \left[\frac{(1-b_t^A)P^{eA}}{b_t^A P^{dA}}\right]^{1/(r_t^A-1)}$$

(8) $$\frac{EN}{DN^S} = \left[\frac{(1-b_t^N)P^{eN}}{b_t^N P^{dN}}\right]^{1/(r_t^N-1)}$$

(9) $$\frac{MA}{DA^D} = \left[\frac{b_q^A P^{dA}}{(1-b_q^A)P^{mA}}\right]^{1/(1-r_q^A)}$$

(10) $$\frac{MN}{DN^D} = \left[\frac{b_q^N P^{dN}}{(1-b_q^N)P^{mN}}\right]^{1/(1-r_q^N)}$$

(11) $$T = (t^{mA} pw^{mA} MA + t^{mN} pw^{mN} MN)R + t^s P^q Q^D + t^y Y - (t^{eA} pw^{eA} EA + t^{eN} pw^{eN} EN)R$$

(12) $$Y = P^{xA}\overline{XA} + P^{xN}\overline{XN} + trP^q + reR$$

(13) $$S = \overline{s}Y + R\overline{B} + S^g$$

(14) $$(CA + CN)P^t = (1-\overline{s}-t^y)Y$$

(15) $$P^{mA} = (1+t^{mA})\,pw^{mA}R$$

(16) $P^{mN} = (1+t^{mN})\,pw^{mN}R$

(17) $P^{eA} = (1+t^{eA})\,pw^{eA}R$

(18) $P^{eN} = (1+t^{eN})\,pw^{eN}R$

(19) $P^{tA} = (1+t^{sA})P^{qA}$

(20) $P^{tN} = (1+t^{sN})P^{qN}$

(21) $P^{xA} = \dfrac{P^{eA}EA + P^{dA}DA^{S}}{\overline{XA}}$

(22) $P^{xN} = \dfrac{P^{eN}EN + P^{dN}DN^{S}}{\overline{XN}}$

(23) $P^{qA} = \dfrac{P^{mA}MA + P^{dA}DA^{D}}{QA^{S}}$

(24) $P^{qN} = \dfrac{P^{mN}MN + P^{dN}DN^{D}}{QN^{S}}$

(25) $R = 1$

(26) $DA^{D} - DA^{S} = 0$

(27) $DN^{D} - DN^{S} = 0$

(29) $QA^{D} - QA^{S} = 0$

(29) $QN^{D} - QN^{S} = 0$

(30) $pw^{mA}MA - pw^{eA}EA - ft - re = \overline{B}$

(31) $P^{tA}ZA + P^{tN}ZN - S = 0$

(32) $T - P^{t}\overline{G} - trP^{q} - ftR - S^{g} = 0$

(33) $P^{xA}\overline{XA} = P^{eA}EA + P^{dA}DA^{S}$

(34) $P^{xN}\overline{XN} = P^{eN}EN + P^{dN}DN^{S}$

(35) $P^{qA}QA^{S} = P^{mA}MA + P^{dA}DA^{D}$

(36) $P^{qN}QN^{S} = P^{mN}MN + P^{dN}DN^{D}$