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**Regional Economic Integration and its Impacts on
Growth, Poverty and Income Distribution:
The Case of Vietnam**

by

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Abstract

The trade liberalization and regional economic integration have recently accelerated in East Asia, with several free trade areas have been established or are under negotiation. As for Vietnam, after acquiring ASEAN membership in 1995, the country has signed a bilateral trade package with the United States and participated in the China-ASEAN free trade area. This paper attempts to analyze impacts on Vietnam of the ongoing regional economic integration, focussing on growth, poverty reductions and income distribution. For this purpose, we have constructed a global linked Computable General Equilibrium (CGE) model and make use of GTAP database version 6.0 and Vietnam's living standards surveys. The simulation analysis shows that the regional economic integration generally has positive impacts, and it is both welfare enhancing and income-distribution improving for Vietnam. Household income and consumption increase, and poor and rural household groups benefit more than high income urban groups.

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1. Introductions

Twenty years have passed since Vietnam began profound social and economic reforms, which have transformed Vietnam from a centrally planned economy to a market one. Since the beginning days of the economic reforms, trade reforms and the open-door policies have constituted an integral part of overall economic reforms. The restrictions and limitations on trade activities have been steadily and progressively removed, and Vietnam has successfully developed trade and investment relations with countries in Asia, Europe and North America. Trade reforms have contributed to the rapid growth of exports and the overall economic growth.

The economic integration with the regional and global economy has recently accelerated in Vietnam. Vietnam became a member of ASEAN in 1995, joined APEC in 1998, while negotiating for WTO membership. Vietnam has also concluded a bilateral trade agreement with the United States in 2000, and has participated in the China-ASEAN free trade area. Given the national target of sustained growth and poverty alleviation, the Vietnamese policy makers are greatly concerned with the possible consequences of these liberalization movements on growth, poverty and income distribution.

This paper attempts to examine the impacts of the ongoing regional economic integration on Vietnam's economy using a global Computable General Equilibrium (CGE) model. The discussion will continue in section 2 analyzing the trade liberalization and regional economic integration in Vietnam. It is followed by section 3 examining poverty and income-distribution issues in Vietnam. The structure of the global CGE model is presented in

section 4, and simulation scenarios are performed and discussed in section 5. Policy implications are drawn and some concluding remarks are given in section 6.

2. Trade liberalization in Vietnam

Since the late 1980s, Vietnam's trade reforms have been progressed steadily, consisting of the creation and amendment of a system of taxation of imports and exports, the gradual removal of non-tariff barriers and progressive deregulation of trade regimes. The entry to trading activities has been liberalized for both state-owned enterprises and private firms. Currently all businesses are allowed to exports or to imports all goods that are consistent with the field of business identified in their business registration license. The deregulation of trading rights has increased the competitiveness and efficiency of trading activities¹.

At the same time, a legal system, including a tariff system, has been established to regulate foreign trade. The tariff system has been simplified and rationalized, and tariff rates have been lowered. The average weighted tariff rate dropped from nearly 20% in early 1990s to around 15% in the late 1990s (SRV, 1999). Quantitative restrictions on imports have been removed for the majority of commodities, with the exception of petroleum products, sugar and some other strategic products. The surrender requirement and other currency control measures introduced in 1997 to cope with the East Asian crisis have been eliminated. Foreign-invested firms are no longer required to balance their foreign exchange account. The number of imports that subject to the minimum valuation procedure has also reduced considerably.

With respect to exports, export duties and quotas have been removed for the majority of products. Only a small number of exports are being levied with export taxes mainly for the purpose of raising revenue, but the tax rates are low. With the exception of some products regulated due to environmental, health or security concerns, quotas are only imposed on the

¹ Vietnam's trade regimes have been the subject in several studies, such as CIE (1998) and CIE (1999a). The non-tariff barriers that were present in Vietnam by 1999 are surveyed in detail in CIE (1999b) and McCarty (1999)

export of garment and textiles to the EU, the United States and Canada. These quotas are imposed by the importing countries, and are determined in the bilateral trade agreements between Vietnam and these countries. The export quotas on garment and textiles are to be removed by WTO members in 2005, as mandated by the Agreement on Trade in Textiles (ATC). However, Vietnam has to acquire WTO membership before it could open the US and EU market for garment and textile products.

Generally high tariff rates and non-tariff barriers are employed to protect consumer goods, while capital goods and production inputs are subject to low tariffs and very few non-tariff barriers. Effective protection provided to many industries is higher than that offered by nominal protection. Several studies have shown that many industries and consumer goods industries in particular have enjoyed very high degrees of effective protection². However, imports of some intermediate inputs, which are being domestically produced such as cement, fertilizers, or steel, have been subject to very high tariffs. Protection through tariffs and non-tariffs barriers is also provided to some so-called infant industries, such as automobile or petroleum products. The protection of upstream industries, however, raises the price of intermediate inputs and negatively affects downstream industries and export activities³.

Together with unilateral reform measures, Vietnam has made important commitments to trade liberalization under various bilateral and multilateral agreements. Vietnam became a member of ASEAN in 1995, joined APEC in 1998, while applying for the membership of the WTO. In 2000, Vietnam agreed on a landmark trade package with the United States. Together with other ASEAN member, Vietnam has participated in the recent formation of a free trade area between ASEAN and China. All these bilateral and multilateral agreements are being implemented, and are integral parts of Vietnam's trade reforms.

² See, for example, CIE (1998) and Fukase and Martin (1999) for the estimates of effective protection rates by industries.

³ Fukase and Martin (1999) show that exports-oriented industries suffers negative effective protection as protection given to intermediate inputs raises the cost of production.

Under the ASEAN free trade area (AFTA), the member countries are obligated to reduce tariffs on intra-ASEAN trade to less than 5% by the year 2002. As a later member of ASEAN, Vietnam is allowed to fulfill its commitment to trade liberalization over a longer period. According to the Common Effective Preferential Tariff (CEPT) agreement, products with current tariff rates under 20% will have tariffs reduced to 0-5% by the year 2003. For products with tariffs above 20%, rates are to be reduced to 0-5% by the year 2006. In addition to the tariff reductions, Vietnam is obligated to remove quantitative restrictions and non-tariff barriers. The AFTA agreement calls for an immediate elimination of quantitative restrictions as soon as products are phased in the Inclusion List⁴.

The implementation of CEPT began in 1996, but progressed slowly until 1999. Most products that were subject to early tariff cuts were not produced in Vietnam or already had tariff rate of less than 5% and were subject to very few non-tariff barriers (Tongzon, 1999). Since 2000, tariff reductions have been carried out for highly protected products and are expected to have greater impact on the economy. When the tariff reduction under AFTA is completed by 2006, over 97% of Vietnam's tariff lines will have their tariffs reduced to under 5%.

In November 2001, China and ASEAN agreed to establish a free trade area within ten years, in which tariffs and non-tariff barriers will be removed by 2010 for China and six old ASEAN members, and by 2015 for four new ASEAN members, i.e. for Vietnam, Laos, Cambodia and Myanmar. The formation of this free trade area is in the interest of both sides with ASEAN members looking for new export opportunities in China's huge market and China seeking for natural-resource based inputs from ASEAN. The China-ASEAN free trade area is, however, one among many efforts made by East Asian countries to liberalize trade and investment regimes in the region. ASEAN is seeking for other free trade areas with Japan, Korea and Australia and New Zealand. Meanwhile Japan has concluded free trade agreement

⁴ See, for example, Forster (1998) and Thang (1999) for the detailed liberalization schedule under AFTA.

with Singapore and Mexico, and is negotiating with Korea and some ASEAN members. It can be said that all these efforts have been going into promoting a broader free trade area in the East Asian region.

The Asia Pacific Economic Cooperation (APEC) grouping was established in 1989 with the objective of liberalizing and facilitating trade and investment. The goals of APEC, as defined in the APEC leaders Meeting in Bogor, Indonesia in November 1994, are to achieve free trade and investment for the region by 2010 for developed countries and 2020 for developing member countries. Member countries are obliged to carry out liberalization measures that they propose in Individual Action Plans. Right after joining APEC, Vietnam submitted its Individual Action Plan (SRV, 1999), which commits Vietnam to unilateral trade liberalization, including free trade, the liberalization of investment regimes and the opening of service sectors to foreign providers.

Vietnam's direction of trade has greatly changed over the last decade, as can be seen in table 1. Until the late 1980s, Vietnam traded mainly with the Soviet Union and the Eastern European countries. The collapse of the former Soviet Union interrupted the trading relations with these countries, and Vietnam redirected trade toward Asian countries, which dominated Vietnam's trade in early 1990s. Since the mid 1990s, and particularly after the Asian crisis led to a sharp contraction of export markets in the region, the country has managed to expand trade toward Europe, North America and the rest of the World.

Table 1: Trade direction of Vietnam 1995-2003

	1995	2000	2001	2002	2003
Exports					
Total value (million dollars)	5448.9	14483.0	15029.0	16706.1	20176.0
Composition of exports (% of total)					
ASEAN	18.3	18.1	17.0	14.6	14.7
of which Singapore	12.7	6.1	6.9	5.8	5.1
Other ASEAN countries	5.6	12.0	10.0	8.8	9.6
NIEs	17.1	9.8	10.2	9.7	8.0
Japan	26.8	17.8	16.7	14.6	14.4
China	6.6	10.6	9.4	9.1	8.7
EU	12.2	19.6	20.0	18.9	19.1
US	3.1	5.1	7.1	14.7	19.5
Others	15.9	19.0	19.6	18.4	15.7
Imports					
Total value (million dollars)	8155.4	15636.5	16218.0	19745.6	25226.9
Composition of imports (% of total)					
ASEAN	27.8	28.5	25.7	24.2	23.6
Of which Singapore	17.5	17.2	15.3	12.8	11.4
Other ASEAN countries	10.4	11.2	10.4	11.3	12.2
NIEs	31.6	27.1	27.3	28.4	25.9
Japan	11.2	14.7	13.5	12.7	11.9
China	4.0	9.0	9.9	10.9	12.4
EU	8.7	8.4	9.3	9.3	9.8
US	1.6	2.3	2.5	2.3	4.5
Others	15.0	10.1	11.8	12.2	11.9

Source: Vietnam's General Statistical Yearbook 2003

Vietnam's trade with its ASEAN neighbors has been relatively small. In 2003, only around 23.6% of imports were sourced from ASEAN, and 14.7% of total exports were shipped to ASEAN. Among ASEAN countries, Singapore is the largest trading partner, accounting for around 13.6% of Vietnam's total imports and over 50% of imports from ASEAN⁵. Around 30% of exports to ASEAN countries or 6% of total exports were shipped to Singapore. The two-way trade with other ASEAN countries has been recently on rise following the tariff reductions

⁵ It should be noted that Singapore, like Hong Kong, has been acting as a sub-contractor for Vietnam's exports and imports. A significant share of trade with these two countries may have been re-exported to or re-imported from other countries and are excluded from the UN statistics.

under AFTA.

East Asian countries are major trading partners of Vietnam, which account for nearly a half of Vietnam's exports and three-quarters of its imports. The two-way trade with China has recently been on a steady and rapid increase since the mid 1990s. Export of Vietnam to China increased more than ten times, and imports from China increased by ten times during the last 10 years. China has recently passed Japan, which was Vietnam's largest trading partner in early 1990s, to become Vietnam's largest import markets. Imports of Vietnam from Asian newly-industrializing countries are also large, which are mainly caused by the investment inflows from these countries. The major exports to Japan are crude oil making up one third of exports to Japan and a half of total oil exports. Other major exports are seafood, coal, wearing apparel, leather products and wood products. Most of imports from Japan, Korea and Taiwan are made up by electronics, machinery and equipment.

While East Asian economies have remained the major import suppliers, the European Union and the United States of America have become increasingly important for Vietnam's exports. The trade with European countries increased rapidly in the latter half of 1990s, partly compensating for the slowdown in trade with East Asia caused by East Asian economic crisis. Until the signing of the bilateral trade agreement between Vietnam and the US in 2000, trade between two countries had been relatively small. The granting of the US's most favored nation status to Vietnam has boosted exports to the US, which now becomes Vietnam's largest export market. Combined together, exports to the US and the EU amounted to nearly \$8 billions in 2003, or equivalent to 40% of Vietnam's total exports. These are also the major markets for Vietnam's exports of labor-intensive products such as agricultural products, wearing apparel, textiles and footwear.

3. Poverty and Income Distribution

When Vietnam started economic reforms 20 years ago, it was a very poor country with income per capita of less than 200 \$US. Most Vietnamese people then lived under the poverty line with the estimated poverty incidence of over 70%. The rapid economic growth over the last decade has not only increased national income, but also sharply reduced the incidence of poverty. The percentage of poor people fell sharply to 50% in 1993, 37% in 1998 and 15% in 2002. The absolute poverty incidence based on the food poverty line also fell from 25% to less than 10% between 1993 and 2002.

Poverty incidence is unevenly distributed among regions. Most of poor people, around 90%, are living in rural areas, while the remaining 10% are urban dwellers (World Bank 1999). Poverty incidence is found very high in mountainous and remote regions, particularly in Northern Uplands and Central Highland. These are also the poorest regions of Vietnam with relatively slow economic growth. This fact indicates that focussing on rural development and allocating more resources toward poor regions are essential for further poverty reductions in Vietnam.

There are several reasons that can explain the rapid reduction in poverty. Firstly, agriculture grew quite fast and contributed to the income increase in rural areas where the majority of the poor lived. The growth of agriculture and agricultural exports also helped Vietnam to stabilize the economy during the late 1980s. Secondly, the agricultural terms of trade changed in favour of agriculture and rural areas. Over the last decade the food prices increased faster than non-food prices largely thanks to the liberalization of the agricultural product market and the increase in export prices. As a result, rural income rose quite fast and brought benefits to the rural poor. Finally, as pointed out by Haughton (2001), a large proportion of population initially lived just below the poverty line. The increase in income, even a small increase, could lift them up above the line. This also means, however, that those people are vulnerable to the change in economic environment, and they could easily fall back below the poverty line.

By international standards, Vietnam has remained a relatively equitable country. However, inequality has increased slightly during the years of rapid economic growth. Gini coefficient increased from 0.33 to 0.35 between 1993 and 1998, and the income ratio between the poorest and the richest quintiles also rose from 4.9 to 5.5 during this period (Kinh et al., 2001). This is largely due to the widening income gap between rural and urban areas which, as indicated by World Bank (1999), accounted for 96% of total rise in equality. The urban economy, which is based largely on manufactures and services, grew as twice as much the rural economy, and the ratio of urban to rural income rose from 1.8 in 1993 to 2.2 in 1998.

Table 2 provides a profile of income distribution with respect to income, expenditure and employment. The table is processed using the new household survey conducted by Vietnam's General Statistical office in 2002. The survey data, which cover 30000 households, is aggregated into 20 household groups based on the level of expenditure. Among these 20 groups, there are 10 urban groups and 10 rural groups. As can be seen in table 2, there are larger income gaps among household groups. Income per capita of the richest urban group is almost 8 times higher than that of the urban poorest, while the figure for rural areas is 6.4. The share of the poorest decile groups in total income is only 3.4%, while the richest decile accounts for nearly 27% of total income. Poor households tend to rely more on agriculture, while the rich have their income mostly sourced from wage-earning jobs and non-agricultural activities.

Unemployment in Vietnam is also moderate, compared to the level in industrial countries. According to the official statistics, the unemployment rate is around 7% of labour force. The Living Standard Survey 1997/1998 shows even a lower rate, at 1.6% of labour force⁶ (GSO, 2000). This figure is much lower when compared to other developing countries like China or Indonesia (Haughton 2001, p. 18). Despite the low unemployment rate, under employment is a serious problem in Vietnam, as shown in table 2.

⁶ This is based on the common definition of unemployment that classifies as unemployed any person of working ages, who doesn't have jobs and is seeking for jobs during the last seven days before the interview.

Table 2: Income distribution in Vietnam

	Unit	Total	Urban			Rural		
			Total	1st decile group	10th decile group	Total	1st decile group	10th decile group
Household income	1000 VND	20972	10516.63	9009.418	53328.7	54221.47	8336.474	36319.45
Share of household income	%	100.0	38.1	0.2	20.9	61.9	3.2	5.9
Composition of income by sources								
Self-employed agriculture	%	31.4	6.9	44.4	2.7	46.5	66.6	25.5
Self-employed non-agricultural	%	21.7	30.6	25.5	30.3	16.2	5.2	26.4
Wage income	%	30.5	42.3	20.0	42.8	23.2	19.8	21.0
Transfers	%	16.4	20.2	10.1	24.2	14.1	8.4	27.2
Income per capita	1000 VND	4510.3	7468.9	1650.6	12905.7	3624.6	1520.1	9790.8
Income ratio	Unit	1.0	1.7	0.4	2.9	0.8	0.3	2.2
Expenditure per capita	1000 VND	3414.1	5829.6	1120.2	10579.9	2691.1	1100.3	9265.3
Expenditure ratio	Unit	1.0	1.7	0.3	3.1	0.8	0.3	2.7
Annual working hours	Hour	1583.2	2034.7	1340.9	2276.8	1474.6	1404.6	1746.8
Average wage rate	VND/hour	3840.9	5537.0	1156.6	7809.9	2854.5	1613.2	5182.4
Wage ratio	Unit	1.0	1.4	0.3	2.0	0.7	0.4	1.3
Composition of employment by economic sectors								
Formal	%	14.8	29.5	6.1	38.8	10.0	2.7	24.8
Informal	%	85.2	70.5	93.9	61.2	90.0	97.3	75.2
Composition of employment by industry								
Agriculture	%	51.3	13.7	69.7	3.6	63.9	87.7	30.2
Industry and construction	%	19.5	27.3	10.3	27.4	16.8	7.1	21.7
Services	%	29.2	59.0	19.9	68.9	19.3	5.1	48.1

Sources: Authors' calculation

Based on the full-time annual work of 2000 hours, around 50% of urban workers and 70% of rural workers can be seen as underemployed⁷. On average, a Vietnamese worker works only less than 1600 hours a year, suggesting an underemployment rate of more than 20%. The incidence of underemployment varies across regions and household groups. Reflecting the limited availability of arable land and off-farm jobs, underemployment is particularly high in rural areas where an average worker uses only three-fourths of his working time. In urban areas, underemployment is generally less serious, with the average year-round number of working hours amounting to over 2000. However urban low-income groups have less working time than high-income groups. A similar trend is also observed in rural areas, where underemployment mainly affects low-income groups.

The difference in underemployment partly reflects the composition of jobs. Low-income groups tend to involve mainly in agricultural activities, where production is subject to seasonality and the availability of land. The urban lowest income group spends nearly 70% of their working time on agriculture, while the figure for the rural lowest income group is 88%. Low-income groups also involve more in trade and other low-productivity services in the informal sector. By contrast, higher income groups tend to work more in industries and formal services⁸. The average wage rates of poor groups are considerable low compared to high income groups. For example, the average wage rate of the rural lowest income group is around 40% of the national average wage, and the figure for the urban lowest income group is only 30%.

4. Model Specification

This section will discuss the major characteristics of the global CGE model used in this paper. Our model generally follows the standard neoclassical CGE model (Dervis et al.,

⁷ This is calculated based on the assumption of full-time work of 40 hours per week and 50 working weeks a year.

⁸ The formal sector consists of the state sectors and foreign-invested sector, while the rest of the economy can be considered as informal.

1982), but extends the standard model by allowing for several countries and regions and international link mechanisms.⁹ Specifically, our model specifies 10 industries and 11 countries or regions. Ten industries consist of crops, other agricultural activities, mining, food processing, light manufactures, heavy manufactures, machinery and equipment, public utilities, construction and services. The specification of countries or regions in the model is chosen with the focus on the East Asian region. Eleven countries and regions are China, Indonesia, Malaysia, Thailand, Philippines, Vietnam, East Asian newly industrializing economies (NIEs), Japan, the North American free trade area (NAFTA), the European Union (EU) and the rest of the world.

4.1. Country models

In country models, domestic output in each sector is a Constant Elasticity of Substitution (CES) function between capital and labour. Domestic output is supplied to domestic or foreign markets, depending on the prices in these markets. Domestic producers, who seek to maximize profits, decide how much they sell in domestic and foreign markets. The treatment of export supply is based on the Constant Elasticity of Transformation (CET) function. The supply for domestic products and exports is derived from the revenue maximization condition.

The factor demand is derived from the profit maximization condition, and factor remuneration is equal to the value added price times the partial derivative of the production function with respect to each factor. Capital is intersectorally immobile, and the capital stock in each sector is fixed, letting the first-order condition to determine capital rents. The treatment of the labour market assumes full employment and allows for labour mobility, but takes into consideration distortions in the labour market. The model generally specifies two kinds of labour, that is, skilled labour and unskilled labour. Sectoral labour demand is a CES function of

⁹ Our model of Vietnam and global link system originate from Nguyen (2003), Nguen (2002), Ezaki and Nguyen (2001), Ezaki (2001), Ezaki and Le (1997), etc.

skilled and unskilled labour, and the demand for each type of labour is derived from the first-order condition. Sectoral wages are equal to the average wage level times fixed coefficients, which represent wage differentials between economic sectors and types of labour.

In regards to Vietnam's model, each type of labour is further divided into formal and informal labour to capture the characteristic of the segmented labour market. Labour can move between these two sectors, but the wage rates of formal and informal labour are subject to different adjustment mechanisms. For workers in the formal sector, which consist of workers in the state sector and foreign invested firms, the real wage rates are fixed by institutional factors. However, the informal sector, inclusive of agriculture and non-agricultural small businesses, is largely unregulated in Vietnam, and the informal wage rate is treated as flexible. The supply of labour to the informal sector is determined as the difference between total supply of labour and the demand for formal labour.

The model specifies two economic institutions, that is, household and government. Household income consists of labour and capital income, which is allocated to each household by using fixed coefficients. Government revenue consists of indirect taxes, import tariffs and export duties. Savings by each institution are the difference between income and expenditure. On the demand side, household consumption demand is based on a Cobb-Douglas utility function, with fixed expenditure shares. Government demand for final goods is defined using fixed expenditure shares of government real spending. The demand for inventory investment is determined by using the fixed proportions of sectoral output. Total fixed investment is determined by available savings, and the demand for capital goods is then computed through exogenous coefficients.

Total domestic demand is satisfied through domestic production and imports. The demand for imports is modeled using the Armington structure, in which domestic and foreign goods are imperfect substitutes. The sectoral composite good, or total domestic demand, is a CES function of imported and domestically produced goods, and the demand for imports is

derived from the cost minimization condition.

4.2. International linkages

Country models are linked through bilateral trade flows. Since the model allows for different tariffs by countries of origin, the prices of imports varies with the import sources. Specifically, the import price at the domestic market is equal to the export price of the country of origin times the corresponding tariff rates. Domestic consumers and producers differentiate imports by sources, that is, imports coming from different countries are considered as imperfect substitutes. This characteristic is also modeled with the Armington structure. At the aggregate level, total imports is a CES function of imports from different sources, and then the demand for imports from each sources is derived from the cost minimization condition.

On the export side, exporters do not differentiate exports by countries of destination, that is, commodities supplied to foreign countries are seen as perfectly homogenous and are sold at the same price. The trade consistency is held so that total exports supplied by home countries must be equal to the sum of imports by foreign countries. To put it more specifically, imports from countries or regions must be summed up to total exports by that country or region. The model does not allow for any movement of labour between countries or regions, that is, labour is internationally immobile. Similarly, since foreign savings are fixed exogenously, capital is also internationally immobile. Thus trade flows provide the only channel, by which any change in economic policies or economic environment in one country transmit its effect to other countries.

4.3. Equilibrium conditions

Equilibrium conditions consist of the conditions in factor, commodity and foreign exchange markets. In the capital market, capital stocks are fixed and capital rents serve as equilibrating variables. In the labour market, total supply of skilled and unskilled labour is held

fixed at the base-run level, and the labour market equilibrium determines wage rates. For Vietnam's model, there are two different equilibrating mechanisms for formal and informal labour markets. In the formal sector, wage rates held fixed by institutional factors and the equilibrium condition determines the demand for formal labour. In the informal labour market, wage rates adjust flexibly to attain the equilibrium between supply and demand.

Equilibrium in product markets equates the supply of the composite good in each sector to the sum of product demand with domestic prices serving as equilibrating variables. The fiscal balance is implied in the treatment of the government sector, in which government consumption and savings are fixed shares of government revenue. In the foreign exchange market, foreign savings held fixed and equilibrium is achieved through price adjustments, i.e. the exchange rate adjusts to balance the market supply of and the demand for foreign exchange. As for the savings-investment identity, we adopt a so-called savings-driven closure, which requires that total nominal investment is equal to total available savings.

Since CGE models determine only relative prices, it is necessary to select a numeraire to define the absolute price level. For the country model, we fix the consumer price index and leave the saving-investment balance as redundant. For the whole system, the exchange rate of the North America is selected as the numeraire, i.e. all prices and nominal variables of the model are defined in terms of the North American exchange rate or US dollars. It should be noted that, since our model is homogenous in all prices, the selection of a numeraire is simply a matter of convenience, and does not affect simulation results. The advantage of fixing the consumer price index is that it allows the country model to determine all variables in real terms, i.e. all variables are being deflated by appropriate price indices. The selection of the North American exchange rate as the international numeraire is to conform with the common practice in international trade, where the US dollar is most frequently used.

5. Simulation Analysis

5.1. Data and the Model calibration

To run the model, we make use of GTAP database version 6.0, which is constructed for 2001. The GTAP database is a highly disaggregated global input-output table, differentiating 57 industries and 87 countries or regions. These data are then aggregated into 10 industries and 11 countries or regions in accordance with the model. We take 2001 as the benchmark year and use GTAP data to calculate most of the parameters used in the model, such as consumption share, saving rates, tax rates and wage rates. As for labour and capital, GTAP database provides only information on total labour and capital stock for each country or region. Total labour and capital stock is then allocated to each industry by assuming uniform wage rates and uniform capital rents.

Data on tariffs and some non-tariff barriers is also available from GTAP database, and is summarized in table 3. The upper part of table 3 shows tariff rates computed from GTAP data, and the lower parts show data on export-tax equivalent rates of the Multi-fibre Agreement (MFA). As can be seen in table 3, high tariffs are mainly imposed on crop products, processed food and light manufactures. The data shows high average tariff rates for Vietnam, China and Thailand, while average rates for other countries and regions are relatively low.

To calculate the share and scale parameters in trade and production functions, we follow the common calibration procedure discussed in Shoven and Whalley (1984). The elasticities of substitution in trade and production function are taken from GTAP database, consisting of the elasticity of substitution between labour and capital, the elasticity of substitution between domestically produced goods and imports and the elasticity of substitution between imports from different sources. Generally GTAP database gives high values to the elasticities in trade functions, while assigning relatively low values to the elasticity of substitution in production functions. We assign a value of 1.2 to the elasticity of transformation in the export supply function for all industries. Given the type of functions and the value of the

elasticities, the scale and share parameters can be calculated directly from the benchmark data.

As for Vietnam's model, the household sector is constructed using Vietnam's living standard survey (VLSS) conducted by the General Statistical Office in 2002. As mentioned above, 20 household groups are specified, consisting of 10 urban and 10 rural groups. From the VLSS 2002, we calculate household income and expenditure, which are disaggregated for around 70 industries. This information is used to allocate GTAP data on total income and expenditure to each household group. Data on household employment is also derived from the VLSS 2002, and is based on working hours instead of the number of workers¹⁰. This data is computed for each type of jobs, i.e. formal and skilled workers, informal and skilled workers, formal and unskilled workers and informal and unskilled workers, and is used to allocate GTAP data on total employment to household groups.

¹⁰ Since each worker can have more than one job, using the number of working hours could reflect better the employment composition.

Table 3: The structure of protection

	China	Indonesia	Malaysia	Philippines	Thailand	Vietnam	NIEs	Japan	NAFTA	EU	ROW
Tariff rates (%)											
Crops	68.52	1.72	28.86	6.00	16.13	12.68	78.42	30.12	3.24	4.09	11.35
Other Agricultural activities	3.54	2.09	0.40	2.90	6.46	3.23	3.02	2.41	0.99	0.95	5.90
Mining	0.37	0.36	1.13	3.05	0.20	3.33	2.62	0.02	0.04	0.00	2.62
Food Processing	18.26	9.08	10.13	11.09	39.10	43.66	12.36	31.36	6.01	4.85	18.98
Light manufactures	16.46	6.82	8.67	5.92	12.08	25.42	2.38	5.66	4.89	1.36	12.17
Heavy manufactures	11.20	4.70	6.63	4.33	10.42	6.84	2.95	0.93	1.77	0.58	6.63
Machinery	12.50	4.57	3.59	1.33	8.63	18.05	1.58	0.04	1.07	0.53	6.93
Utility	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.66
Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average tariff rate	11.70	3.60	4.63	2.77	8.88	10.23	3.41	4.13	1.77	0.81	6.90
MFA export-tax equivalent rates (%)											
Crops	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Agricultural activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mining	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Food Processing	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Light manufactures	3.10	1.51	0.84	1.31	1.72	0.24	0.78	0.00	0.00	0.00	0.51
Heavy manufactures	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Machinery	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utility	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average MFA rate	1.24	0.49	0.07	0.17	0.31	0.10	0.10	0.00	0.00	0.00	0.08

Sources: GTAP database version 6.0

5.2. Simulation Results

The model described in section 4 is employed to analyze the effect on Vietnam of different economic integration scenarios. Five simulations are performed and described briefly in table 4, and simulation results are reported in tables 5 to 8. In all these simulation, we will focus on the impact of tariff reductions and simply assume a complete removal of tariffs. This may be a shortcoming as non-tariff barriers play an important role in protecting domestic industries in many countries. However, data on non-tariff barriers are not available from GTAP database, and it is difficult to collect this sort of data and quantify its tariff equivalent impacts.

Table 4: Simulation Scenarios

S0	Base run
S1	Removing tariffs on the bilateral trade between Vietnam and ASEAN-4
S2	Removing tariffs on the bilateral trade between Vietnam, China and ASEAN-4
S3	Removing tariffs on the bilateral trade between Vietnam, China, ASEAN-4, East Asian NIEs and Japan (East Asian Economic Community)
S4	Removing tariffs on the bilateral trade between Vietnam, China, ASEAN-4, East Asian NIEs, Japan and North America
S5	Multilateral Trade liberalization

Simulation S1 is designed to evaluate the impacts of the ASEAN free trade area on Vietnam. We remove all tariffs on the bilateral trade between Vietnam and four ASEAN members, i.e. Indonesia, Thailand, Malaysia and Philippines¹¹. The tariff removal stimulates the bilateral trade between ASEAN countries, and both exports and imports increase in all countries. The extent to which exports or imports increase, however, depends on the structure of protection and the composition of trade in each countries. Since foreign savings are fixed in the model, the exchange rate will adjust to attain the current account balance. The exchange rate depreciates if imports increase more than exports and it appreciates otherwise. At the aggregate level, the exchange rate depreciates in all ASEAN countries with the exception of Indonesia. GDP falls slightly in Vietnam and Thailand in the real term, but increases in Malaysia and Philippines. The

¹¹ Hereafter we will refer to these countries as ASEAN-4.

increase in imports put a downward pressure on domestic demand and force domestic prices to fall. Combined with the increase in income, this leads to an increase in consumption. The gain in consumption can be seen in all countries, with the biggest gain is observed in Malaysia.

In regards to Vietnam, household income and consumption rise by around 1.7% on average. All income groups have income gains, with the poor groups having slightly higher gains than the rich. This is largely thanks to the increase in income to unskilled labour, which constitute a large share in poor households' income. The tariff removal in ASEAN trading partners helps expand agriculture and labour-intensive industries, and generally have positive effects on poverty reductions and income distribution in Vietnam. However, the AFTA tariff removal also causes trade diversions, although the extent of diversions is not large. Both exports to and imports from ASEAN countries rise sharply, while trade with non-ASEAN countries or regions falls.

The impact of the recently established China-ASEAN free trade area is considered in simulation S2, in which tariffs on the bilateral trade between China, Vietnam and ASEAN-4 are completely eliminated. Similar to S1, exports and imports rise in all countries, and all countries experiences gains in consumption, with the biggest gains can be seen in Malaysia. The exchange rate depreciation occurs in all countries, except for Indonesia and Malaysia. The inclusion of China seems have a negative impact on Japan and East Asian NIEs, with the volume of trade declines slightly in these countries.

For Vietnam, real GDP fall by 0.2% but the gain in consumption increases to more than 4%. Again, all household groups have gains in income and consumption, but the poor has bigger gains compared to the rich. The rural groups also benefit more than urban groups. The establishment of a free trade area between China and ASEAN, however, causes a considerable trade diversion to Vietnam. Imports from China and exports to China rise sharply at the expense of trade with other regions. The biggest falls are seen in imports from Japan and East Asian NIEs, which decline by 37% and 30% respectively from the base-run values. This shows a

strong competition between imports from China and imports from Japan and NIEs.

In simulation S3, we examine the effect of the possible formation of the East Asian economic community. In this simulation, we remove all tariffs on the bilateral trade between East Asian countries, including Japan and East Asian NIEs. The bilateral trade between East Asian countries increases, and both exports and imports rise in all countries. The establishment of the East Asian free trade area, however, causes a trade diversion to the EU and North America, which see a slight decline in exports and imports. All countries experience a gain in income and consumption, and real GDP increases with the exception of China and Vietnam.

Compared to simulation S2, the inclusion of Japan and East Asian NIEs significantly increases the welfare gain for Vietnam. Despite a small drop in real GDP, household consumption and income rise by 8.8% and 8.1% respectively. Income to unskilled labour rises more than income to capital and skilled labour, and benefits mostly poor and rural household groups. As for the trade direction, Vietnam's trade is diverted from the US and the EU, which see exports to Vietnam to fall by 16.5% and 21% respectively. Both exports and imports to East Asian NIEs rise, while imports from Japan fall to a lesser extent compared to S2.

In simulation S4, we remove the tariffs on the bilateral trade between North America and East Asian countries. This simulation is designed to evaluate the effect of the trade liberalization under the APEC forum, which has set the objective of liberalizing trade and investment regimes by the year 2020¹². Imports and exports increase in all APEC members but at the expense of the EU and the rest of the World, and all APEC countries experience gains in income and consumption. The removal of the NAFTA tariff also brings additional welfare gains to Vietnam, where household income and consumption rise by 8.4% and 9.1% respectively. As it may be expected, Vietnam's trade is redirected toward APEC countries, and trade with the EU and the rest of the world falls.

¹² In this simulation, we assume tariffs are removed for only member countries. Indeed, as it is commonly believed, the APEC forum adopts the open regionalism, in which trade liberalization measures are applied to both member and non-member countries.

Finally, the effect of a multilateral liberalization is considered in simulation S5, in which tariffs are completely eliminated for all countries and regions. Exports and imports rise, with the total world exports increase by 3.4%. The welfare gain is also significant, with total world consumption rise by 0.9%, or equivalent to \$180 billions. The tariff removal on a multilateral basis increases significantly the welfare gain for Vietnam, where household consumption increases by 10.8% and exports increase by more than 20%. The multilateral trade liberalization also reduces the extent of trade diversions caused by the regional integration as it is seen in the previous simulations. The increase in Vietnam's imports from ASEAN member falls to only 1.7%, while imports from the EU and North America still decline but to a lesser extent compared to S1 or S2.

We conclude the discussion in this section with some remarks on the implication for foreign investment in Vietnam. Since the model focuses on the trade flows, foreign savings are fixed and the changes in capital inflows or outflows are not taken into account. As can be seen in table 6, capital rents for Vietnam increase in all simulations. Moreover, even it is not shown in details, the increase in the capital rents of Vietnam is the highest as compared to other regions or countries. The rising capital rent is obviously a good signal to foreign investors, who are seeking for profits. This is to say that the regional integration and trade liberalization could make investments in Vietnam become more profitable, and makes Vietnam become more attractive to foreign investors.

Table 5: Effect of economic integration on countries or regions

	China	Indonesia	Malaysia	Philippines	Thailand	Vietnam	NIEs	Japan	NAFTA	EU	ROW
Simulation Scenarios S1											
Real GDP	0	0	0.03	0.01	-0.02	-0.07	0	0	0	0	0
Consumption	-0.02	0.48	4.08	0.77	1.85	1.69	-0.05	-0.01	0	0	-0.01
Imports	-0.08	1.78	2.12	1.24	2.34	1.86	-0.12	-0.13	-0.02	-0.01	-0.03
Exports	-0.02	0.34	0.65	0.73	1.35	3.3	-0.04	-0.05	-0.01	0	-0.01
Simulation Scenarios S2											
Real GDP	0	-0.01	0.06	0.02	-0.01	-0.18	0	0	0	0	0
Consumption	0.47	0.94	5.95	1.17	3.39	4.31	-0.22	-0.04	-0.01	-0.01	-0.02
Imports	1.67	3.67	4.23	1.92	5.16	5.27	-0.47	-0.49	-0.07	-0.04	-0.07
Exports	1.17	0.78	1.11	1.13	2.21	6.27	-0.13	-0.15	-0.02	-0.01	-0.03
Simulation Scenarios S3											
Real GDP	-0.19	0	0.11	0.05	-0.09	-0.42	0.06	0	0	0	0
Consumption	2.28	1.12	6.73	0.92	6.22	8.77	1.93	0.37	-0.04	-0.06	-0.06
Imports	8.93	3.24	4.23	1.2	8.91	11.82	3.02	3.63	-0.44	-0.19	-0.3
Exports	5.2	1.26	2.14	1.52	4.18	14.1	2.42	2.02	-0.12	-0.03	-0.12
Simulation Scenarios S4											
Real GDP	-0.2	-0.01	0.13	0.08	-0.1	-0.25	0	0	-0.01	0	-0.01
Consumption	3.42	1.39	7.76	1.18	6.46	9.12	2.8	0.7	0.2	-0.13	-0.13
Imports	12.11	4.89	5.22	1.64	9.13	12.67	4.38	5.42	1.45	-0.34	-0.53
Exports	6.9	1.17	2.28	1.98	4.56	15.82	3.12	3.47	1.94	-0.04	-0.32
Simulation Scenarios S5											
Real GDP	-0.5	-0.09	0.08	0.1	-0.33	-0.13	-0.01	-0.02	-0.01	0.04	0
Consumption	5.24	2.51	9.25	0.88	8.51	10.82	3.3	0.85	0.3	0.09	2.41
Imports	19.19	9.69	7.86	1.01	12.25	16.26	5.53	6.82	2.05	0.59	6.53
Exports	9.22	1.27	2.59	2.31	5.84	20.52	4.28	4.51	3.47	1	5.09

Table 6: Effect of trade liberalization on Vietnam

	Unit	Base run S0	Percentage change (%)				
			S1	S2	S3	S4	S5
GDP deflator	Unit	1.00	1.74	4.27	8.6	8.85	10.61
Consumer price index	Unit	1.00	0	0	0	0	0
Exchange rate	Unit	1.00	0.84	1.22	3.96	3.24	1.47
Average wage rate	Thousand USD	0.28	1.62	3.98	8.53	9.13	11.17
Skilled labor	Thousand USD	0.55	1.45	3.5	7.77	8.51	10.19
Unskilled labor	Thousand USD	0.21	1.87	4.54	9.33	9.75	12.08
Capital rent	Unit	0.18	1.64	4.17	7.67	7.82	9.13
Real GDP	Million USD	30751.82	-0.07	-0.18	-0.42	-0.25	-0.13
Output	Million USD	66581.06	0.44	0.85	1.87	2.32	3.24
Private consumption	Million USD	27213.03	1.69	4.31	8.77	9.12	10.82
Government consumption	Million USD	2607.10	-12.99	-26.52	-43.96	-43.69	-44.09
Real investment	Million USD	12939.39	-1.13	-0.8	-2.79	-3.43	-4.72
Imports	Million USD	27434.46	1.86	5.27	11.82	12.67	16.26
Exports	Million USD	15426.76	3.3	6.27	14.1	15.82	20.52
Household income	Million USD	28114.30	1.67	4.15	8.09	8.41	10.03
Labor income	Million USD	11590.04	0	0	0	0	0
Labor income (skilled labor)	Million USD	4739.21	1.45	3.5	7.77	8.51	10.19
Labor income (unskilled labor)	Million USD	6850.83	1.87	4.54	9.33	9.75	12.08
Capital income	Million USD	16524.26	1.64	4.17	7.67	7.82	9.13

Table 7: Effect on income distribution of Vietnam

	Total household income					Total household consumption				
	S1	S2	S3	S4	S5	S1	S2	S3	S4	S5
	Percentage change compared to the base run (%)									
Urban group 1	2	4.45	9.13	9.31	11.52	1.99	3.98	10.01	10.38	12.61
Urban group 2	1.85	4.55	9.61	10.01	12.57	1.87	4.12	10.51	11.06	13.66
Urban group 3	1.48	3.59	7.02	6.87	7.85	1.46	3.18	7.7	7.67	8.67
Urban group 4	1.42	3.5	7.75	8.03	9.78	1.35	2.97	8.04	8.42	10.17
Urban group 5	1.55	3.96	8.18	8.68	10.81	1.56	3.59	8.85	9.46	11.6
Urban group 6	1.45	3.95	7.49	7.89	9.55	1.36	3.48	7.57	8.03	9.7
Urban group 7	1.69	3.82	7.8	8.24	9.82	1.62	3.47	7.9	8.39	9.98
Urban group 8	1.46	3.96	8.32	8.92	10.84	1.31	3.53	7.96	8.58	10.5
Urban group 9	1.48	3.54	7.63	8.23	9.89	1.36	3.3	7.43	8.03	9.73
Urban group 10	1.32	3.38	7.27	7.79	9.14	1.31	3.64	7.57	8.09	9.53
Rural group 1	2.48	5.54	9.27	8.79	10.24	2.53	5.22	10.71	10.43	11.95
Rural group 2	2.31	5.28	9.18	8.91	10.59	2.35	4.94	10.4	10.3	12.02
Rural group 3	2.11	5.02	9.01	8.89	10.63	2.15	4.7	10.13	10.16	11.94
Rural group 4	2.14	5.1	9.4	9.49	11.69	2.14	4.75	10.22	10.43	12.67
Rural group 5	1.98	4.91	8.77	8.79	10.52	1.97	4.61	9.48	9.59	11.36
Rural group 6	2.01	5.02	9.17	9.29	11.17	2.02	4.84	9.88	10.08	12.01
Rural group 7	1.82	4.49	8.36	8.53	10.23	1.86	4.53	9.14	9.37	11.14
Rural group 8	1.8	4.58	8.6	8.84	10.57	1.87	4.9	9.49	9.77	11.6
Rural group 9	1.67	4.32	8.25	8.61	10.26	1.79	5.06	9.29	9.66	11.44
Rural group 10	1.43	3.66	7.16	7.54	8.95	1.83	5.76	9.62	9.96	11.63

Table 8: Effect on the trade direction of Vietnam

	Imports					Exports				
	S1	S2	S3	S4	S5	S1	S2	S3	S4	S5
China	-12.95	174.17	101.43	97.73	89.69	-4.41	158.32	132.81	103.91	72.52
Indonesia	130.33	75.88	21.13	17.54	3.60	24.67	16.91	13.80	24.11	31.13
Malaysia	90.88	45.23	3.71	3.18	-5.65	9.22	-7.60	-11.02	-12.53	-17.05
Philippines	110.29	78.95	13.62	9.45	7.96	112.17	103.90	90.69	95.15	89.36
Thailand	140.10	43.44	8.01	8.60	5.56	176.03	157.65	124.32	120.76	92.93
NIES	-13.18	-29.77	30.20	30.00	27.29	-4.87	-10.51	22.91	20.34	5.60
Japan	-14.63	-36.87	-12.87	-11.68	-11.96	-6.37	-9.47	15.52	9.08	-2.47
NAFTA	-3.06	-6.25	-8.94	-2.11	1.68	-6.98	-10.59	-11.27	33.20	20.50
EU	-5.33	-11.94	-16.51	-15.64	-3.28	-0.69	-3.46	1.96	-0.45	27.23
Rest of the World	-6.63	-11.51	-21.01	-20.73	-5.07	-4.59	-9.57	-8.34	-6.47	8.87
ASEAN-4	121.28	51.12	9.14	8.44	1.70	99.29	85.70	69.33	70.30	58.92
ASEAN-4 plus China	52.69	114.00	56.30	54.06	46.66	58.86	114.01	94.08	83.40	64.22
East Asia	9.78	19.64	31.71	31.05	27.12	12.47	25.12	39.78	33.22	18.62
Total	2.55	5.04	8.64	9.35	12.73	3.30	6.27	14.10	15.82	20.52

6. Summary and Conclusions

In this paper, we have constructed a global CGE model, which specifies 10 industries and 11 countries or regions. We have employed the model to examine the impact of the regional economic integration on Vietnam's economy, focussing on growth, poverty reductions and income distribution. Five simulation scenarios have been carried out to analyze different economic integration options facing Vietnam, including the ASEAN free trade area, the China-ASEAN free trade area, the possible formation of an East Asian economic community, APEC trade liberalization and the world-wide multilateral trade liberalization.

As discussed in the previous section, the impact of the trade liberalization and regional economic integration on Vietnam's economy is generally positive. The regional integration is both welfare enhancing and income-distribution improving for Vietnam. Household consumption and income rise significantly, and the poor and rural groups benefit more than the rich. Moreover, the removal of tariffs in trading partners provides Vietnam with a greater market access, and exports rise in all simulations. In terms of growth, trade liberalization may cause real GDP to fall largely due to the sharp decrease in tariff revenue, but the overall output loss is small.

From the above discussion, it is obviously desirable for Vietnam to actively participate in the ongoing regional integration, including the ASEAN free trade area and the recently established China-ASEAN free trade area. However, Vietnam should not confine itself to these trading blocs. As shown in the simulation results, the gain from these trade areas is limited, and the welfare gain for Vietnam could increase significantly when trade liberalization is carried out on a broader basis, involving Vietnam's major export markets such as Japan, the United States or the European Union. The multilateral trade liberalization also reduces the extent of possible trade diversions and further increases the market access for Vietnam's exports.

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Appendix A: Global Linked CGE Model

A1. Equations of the Model

Price Relations

$$(1) \quad PMS_{irk} = PM\$_{irk} \times ER_r \times (1 + tm_{irk})$$

$$(2) \quad PM_{ir} = a_{S_{ir}}^{-1} \left(\sum_k \omega_{S_{irk}}^{1/(1+\theta_{ir})} PMS_{irk}^{\theta_{ir}/(1+\theta_{ir})} \right)^{(1+\theta_{ir})/\theta_{ir}}$$

$$\text{where } M_{ir} PM_{ir} = \sum_k MS_{irk} PMS_{irk}$$

$$(3) \quad PE_{ir} = PE\$_{ir} \times ER_r / (1 + te_{ir})$$

$$(4) \quad P_{ir} = a_{M_{ir}}^{-1} \left(\omega_{M_{ir}}^{1/(1+\delta_{ir})} PM_{ir}^{\delta_{ir}/(\delta_{ir}+1)} + (1 - \omega_{M_{ir}})^{1/(1+\delta_{ir})} PD_{ir}^{\delta_{ir}/(\delta_{ir}+1)} \right)^{(\delta_{ir}+1)/\delta_{ir}}$$

$$\text{where } P_{ir} Q_{ir} = PM_{ir} M_{ir} + PD_{ir} D_{ir}$$

$$(5) \quad PX_{ir} = a_{E_{ir}}^{-1} \left(\omega_{E_{ir}}^{1/(1-\gamma_{ir})} PE_{ir}^{\gamma_{ir}/(\gamma_{ir}-1)} + (1 - \omega_{E_{ir}})^{1/(1-\gamma_{ir})} PD_{ir}^{\gamma_{ir}/(\gamma_{ir}-1)} \right)^{(\gamma_{ir}-1)/\gamma_{ir}}$$

$$\text{where } PX_{ir} X_{ir} = PE_{ir} E_{ir} + PD_{ir} D_{ir}$$

$$(6) \quad PN_{ir} = PX_{ir} - \sum_i iocf_{ir} \times P_{ir} - PX_{ir} \times tind_{ir}$$

$$(7) \quad PINDEX_r = \sum_i cpcf_{ir} \times P_{ir}$$

Production functions (for competitive sectors)

$$(8) \quad X_{ir}^S = a_{X_{ir}} \left(\omega_{X_{ir}} L_{ir}^{-p_{ir}} + (1 - \omega_{X_{ir}}) K_{ir}^{-p_{ir}} \right)^{-1/\rho_{ir}}$$

$$(9) \quad D_{ir}^S = a_{E_{ir}}^{\gamma_{ir}/(1-\gamma_{ir})} \left((1 - \omega_{E_{ir}}) PX_{ir} / PD_{ir} \right)^{1/(1-\gamma_{ir})} \times X_{ir}^S$$

$$\text{where } X_{ir} = a_{E_{ir}} \left(\omega_{E_{ir}} E_{ir}^{\gamma_{ir}} + (1 - \omega_{E_{ir}}) D_{ir}^{\gamma_{ir}} \right)^{1/\gamma_{ir}},$$

$$(10) \quad E_{ir} = a_{E_{ir}}^{\gamma_{ir}/(1-\gamma_{ir})} \left(\omega_{E_{ir}} \times PX_{ir} / PE_{ir} \right)^{1/(1-\gamma_{ir})} \times X_{ir}^S,$$

Factor markets

$$(11) \quad L_{ir} = a_{X_{ir}}^{-\rho_{ir}/(1+\rho_{ir})} (\omega_{X_{ir}} PN_{ir} / W_{ir})^{1/(1+\rho_{ir})} \times X_{ir}^S$$

$$(12) \quad LK_{lir} = a_{L_{ir}}^{-\lambda_{ir}/(1+\lambda_{ir})} (\omega_{L_{ir}} W_{ir} / WK_{lir})^{1/(1+\lambda_{ir})} \times L_{ir}$$

$$\text{where } L_{ir} = a_{L_{ir}} \left(\sum_l \omega_{L_{ir}} LK_{lir}^{-\lambda_{ir}} \right)^{-1/\lambda_{ir}}$$

$$(13) \quad W_{ir} = a_{L_{ir}}^{-1} \left(\sum_l \omega_{L_{ir}}^{1/(1+\lambda_{lir})} WK_{lir}^{\lambda_{lir}/(\lambda_{lir}+1)} \right)^{(\lambda_{lir}+1)/\lambda_{lir}}$$

$$\text{where } W_{ir} L_{ir} = \sum_l WK_{lir} LK_{lir}$$

$$(14) \quad WK_{lir} = \text{wagcf}_{lir} W_{ir}^E, \quad \text{here } \text{wagcf}_{lir} = \text{constant}$$

$$(15) \quad K_{ir} = a_{X_{ir}}^{-\rho_{ir}/(1+\rho_{ir})} ((1-\omega_{X_{ir}}) PN_{ir} / R_{ir})^{1/(1+\rho_{ir})} X_{ir}^S$$

Income and saving

$$(16) \quad YH_r = \left(\sum_i \bar{K}_{ir} \times R_{ir} + \sum_i L_{ir} \times W_{ir} \right)$$

for $r \neq \text{Vietnam}$

$$(17) \quad YH_{hr} = \left(\sum_i ykcf_{hir} \times R_{ir} \times \bar{K}_{ir} + \sum_i ylcfc_{hir} \times W_{ir} \times L_{ir} \right)$$

for $r = \text{Vietnam}$

$$(18) \quad YG_r = \left(\sum_{ik} MS_{irk} \times PM\$_{irk} \times ER_r \right) \times tm_{irk} + \\ \sum_i X_{ir} \times PX_{ir} \times tind_{ir} + \\ \sum_i E_{ir} \times PE_{ir} \times te_{ir}$$

$$(19) \quad SH_r = s_{P_r} \times YH_r$$

for $r \neq \text{Vietnam}$

$$(20) \quad SH_r = \sum_h s_{P_{hr}} \times YH_{hr}$$

for $r = \text{Vietnam}$

$$(21) \quad SG_r = s_{G_r} \times YG_r$$

$$(22) \quad S_r = SH_r + SG_r$$

Consumers

$$(23) \quad C_{ir} = cpcf_{ir} \times (1-s_r^p) \times YH_r / P_{ir}$$

for $r \neq \text{Vietnam}$

$$(24) \quad C_{hir} = cpcf_{hir} \times (1-s_{hr}^p) \times YH_{hr} / P_{ir}$$

for $r = \text{Vietnam}$

$$(25) \quad C_{ir} = \sum_h C_{hir}$$

for $r = \text{Vietnam}$

$$(26) \quad C_r = \sum_i C_{ir}$$

$$(27) \quad PC_r = (1-s_r^p) \times YH_r / C_r$$

Government

$$(28) \quad G_r = (YG_r - SG_r) / PG_r$$

$$(29) \quad G_{ir} = cgc_{ir} \times G_r$$

$$(30) \quad PG_r = \sum_i P_{ir} \times cgc_{ir}$$

Capital formation

$$(31) \quad I_r = I_r^n / PI_r$$

$$(32) \quad ID_{ir} = invcf_{ir} \times I_r$$

$$(33) \quad V_{ir} = invtr_{ir} \times X_{ir}^S$$

$$(34) \quad PI_r = \sum_i invcf_{ir} \times P_{ir}$$

External sectors

$$(35) \quad Q_{ir} = \sum_j X_{jr}^S \times iocf_{ijr} + C_{ir} + G_{ir} + ID_{ir} + V_{ir}$$

where $Q_{ir} = a_{M_{ir}} (\omega_{M_{ir}} M_{ir}^{-\delta_{ir}} + (1-\omega_{M_{ir}}) D_{ir}^{-\delta_{ir}})^{-1/\delta_{ir}}$

$$(36) \quad D_{ir} = a_{M_{ir}}^{-\delta_{ir}/(1+\delta_{ir})} ((1-\omega_{M_{ir}}) P_{ir} / PD_{ir})^{1/(1+\delta_{ir})} \times Q_{ir}$$

$$(37) \quad M_{ir} = a_{M_{ir}}^{-\delta_{ir}/(1+\delta_{ir})} (\omega_{M_{ir}} P_{ir} / PM_{ir})^{1/(1+\delta_{ir})} \times Q_{ir}$$

$$(38) \quad F\$_r = \overline{F\$}_r$$

Linkage between Countries or Regions

$$(39). \quad MS_{irk} = a_{S_{ir}}^{-\theta_{ir}/(1+\theta_{ir})} (\omega_{S_{irk}} PMS_{irk} / PM_{ir})^{1/(1+\theta_{ir})} M_{ir}$$

$$\text{where } M_{ir} = a_{S_{ir}} (\sum_l \omega_{S_{irk}} MS_{irk}^{-\theta_{ir}})^{-1/\theta_{ir}}$$

$$(40) \quad E_{ir}^S = \sum_k MS_{ikr}$$

$$(41) \quad PM\$_{irk} = PE\$_{ik}$$

$$(42) \quad \sum_r F\$_r = 0$$

Equilibrium conditions

$$(43) \quad K_{ir} = \overline{K}_{ir}^S$$

$$(44) \quad \sum_i LK_{lir} = \overline{L}_{lr}^S$$

$$(45) \quad D_{ir}^S = D_{ir}$$

$$(46) \quad \sum_{ik} MS_{irk} PM\$_{irk} - \sum_i E_{ir} PE\$_{ir} - F\$_r = 0$$

Walras' law

$$(47) \quad W_{lr}^E \times (\sum_i LK_{lir} - \overline{L}_{lr}^S) + R_r \times (\sum_i K_{ir} - \overline{K}_r^S) + \sum_i PD_{ir} (D_{ir}^S - D_{ir}) +$$

$$(S_r + F_r - I_r^n - \sum_i P_{ir} V_{ir}) + ER_r \sum_{ik} (MS_{irk} PM\$_{irk} - \sum_i E_{ir} PE\$_{ir} - F\$_r) = 0$$

$$(48) \quad \sum_r (\sum_{ik} MS_{irk} PM\$_{irk} - \sum_i E_{ir} PE\$_{ir} - F\$_r) = 0$$

Appendix A: Global Linked CGE Model

A2. Model Notation

Sets

i	industries
r, k	countries or regions
l	labour types
h	Household groups (for Vietnam's model)

Price Variables

PM_{irk}	world price of imports
PMS_{irk}	domestic prices of imports by sources of imports
PE_{ir}	world price of exports
PM_{ir}	domestic prices of imports
PE_{ir}	domestic prices of exports
PX_{ir}	output prices
PD_{ir}	domestic prices of domestically produced products
P_{ir}	prices of composite goods
PN_i	value added prices by sectors
W_{ir}	wage rates by sectors
WK_{lr}	wage rates by sectors and types of labour
W_{lr}^E	average wage rates by types of labour

R_{ir} capital rents by sectors

R_r average capital rent

PI_r investment price index

$PINDEX_r$ consumer price index

ER_r exchange rate

Quantity variables

X_{ir}^S domestic output

L_{ir} composite labour demand

LK_{lir} labour demand by types of labour

\overline{K}_{ir} capital demand by sector

\overline{K}_r^S total supply of capital

\overline{L}_{lr}^S supply of labour by types

Q_{ir} composite good demand

D_{ir} domestic supply of domestically produced products

E_{ir} export supply

M_{ir} composite imports

MS_{ir} imports by country of origin

C_{ir}, C_{hir} household consumption by sectors

C_r total demand for household consumption

G_{ir} demand for government consumption

G_r	total demand for government consumption
$\overline{F\$}_r$	foreign savings
I_r	total real fixed investment
ID_{ir}	demand for capital goods
V_{ir}	demand for inventory investment
DEP_r	total depreciation expenditure

Nominal variables

YH_r, YH_{hr}	household income
YG_r	government revenue
SH_r	household savings
SG_r	government savings
S_r	domestic savings
I_r^n	nominal fixed investment

Parameters

$a_{X_{ir}}$	scale parameters in production functions
$\omega_{X_{ir}}$	share parameters in production functions
ρ_{ir}	exponent parameters in production functions
$a_{L_{ir}}$	scale parameters in labour demand functions
$\omega_{L_{ir}}$	share parameters in labour demand functions
λ_{ir}	exponents in labour demand functions

$a_{M_{ir}}$	scale parameters in composite goods functions
$\omega_{M_{ir}}$	share parameters in composite goods functions
δ_{ir}	exponents in composite goods functions
$a_{S_{ir}}$	scale parameters in import demand functions
$\omega_{S_{irk}}$	share parameters in import demand functions
θ_{ir}	exponents in import demand functions
$a_{E_{ir}}$	scale parameters in export supply functions
$\omega_{E_{ir}}$	share parameters in export supply functions
γ_{ir}	exponents in export supply functions
$iocf_{ijr}$	intermediate input coefficient of good j in industry i
$cpcf_{ir}$, $cpcf_{hir}$	household consumption shares
$cgcf_{ir}$	government consumption shares
$invcf_{ir}$	fixed investment shares
$invtr_{ir}$	ratios of inventory investment to real production
s_{P_r} , $s_{P_{hr}}$	household saving rates
s_{G_r}	government saving rates
tm_{ir}	import tariff rates
te_{ir}	export duty rates
$tind_{ir}$	indirect tax rates

Appendix B: A Social Accounting Matrix for Vietnam

Table B1: Input-Output table of Vietnam (US\$ million)

	Crops	Other agri- culture	Mining	Food pro- cessing	Light ma- nufactures	Heavy ma- nufactures	Machi- nery	Utility	Constru- ction
Crops	299	223	0	2600	116	20	0	0	2
Other agriculture	7	154	6	372	226	141	1	0	13
Mining	1	3	107	1	11	460	1	90	888
Food processing	6	150	0	480	4	3	0	0	0
Light manufactures	20	18	72	83	3321	312	71	45	345
Heavy manufactures	928	113	344	299	1114	1434	596	187	3770
Machinery	54	53	123	20	142	117	853	248	514
Utility	35	8	15	48	125	159	42	264	121
Construction	6	0	14	2	10	11	2	13	64
Services	692	285	1185	740	1780	1579	937	37	799
Sub-total	2047	1007	1867	4647	6850	4236	2505	885	6515
Labour income	1173	514	129	473	899	447	258	341	1651
Capital income	1621	894	800	299	423	510	110	119	1009
Production taxes	251	103	310	292	1334	225	77	27	273
Total value added	3045	1511	1239	1064	2656	1182	445	487	2933
Total	5092	2518	3106	5711	9506	5418	2950	1372	9448

Table B1: Input-Output table of Vietnam (US\$ million), continued

	Services	Sub-total	Household consumption	Investment	Government consumption	Exports	Imports	Import Taxes	Total
Crops	46	3306	911	0	0	1195	284	36	5092
Other agriculture	41	961	1463	17	0	140	62	2	2517
Mining	19	1581	32	0	0	1524	30	1	3106
Food processing	252	895	4522	0	0	1949	1152	503	5711
Light manufactures	464	4751	1364	0	0	6588	2549	648	9506
Heavy manufactures	1005	9790	1120	0	0	957	6036	413	5418
Machinery	773	2897	1567	3265	0	1387	5223	943	2950
Utility	95	912	466	0	0	3	9	0	1372
Construction	67	189	0	9660	0	93	494	0	9448
Services	2503	10537	15763	1	2607	1988	9041	0	21855
Sub-total	5264	35823	27209	12942	2607	15413	24879	2546	66975
Labour income	5712	11597							
Capital income	10727	16512							
Production taxes	152	3048							
Total value added	16591	31156							
Total	21855	66979							

Table B2: Income to formal and skilled labour (US\$ million)

	Crops	Other agriculture	Mining	Food processing	Light manufactures	Heavy manufactures	Machinery	Utility	Construction	Services	Total
Urban group 1	0.0	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.3
Urban group 2	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.6	0.9
Urban group 3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	1.5	2.0
Urban group 4	0.0	0.0	0.6	0.2	1.4	1.3	0.0	0.0	0.0	4.4	7.8
Urban group 5	0.0	1.8	0.8	0.1	3.7	0.7	2.1	2.0	0.8	18.6	30.6
Urban group 6	0.9	0.0	2.1	4.0	2.6	3.4	0.0	11.6	8.0	29.7	62.4
Urban group 7	0.2	9.2	4.3	5.5	8.3	2.0	7.2	13.5	6.3	61.5	118.2
Urban group 8	4.2	7.0	12.2	13.1	15.9	12.1	11.8	24.7	23.6	102.8	227.5
Urban group 9	6.4	19.9	19.0	25.3	39.0	14.7	26.2	41.8	74.2	253.9	520.4
Urban group 10	11.7	53.6	34.5	94.6	122.2	59.4	49.4	95.0	290.9	820.5	1631.8
Rural group 1	1.8	0.0	0.0	1.8	0.7	0.0	0.0	0.0	2.6	4.1	11.0
Rural group 2	1.3	0.5	0.0	0.5	3.1	0.6	0.0	0.5	0.0	7.5	14.1
Rural group 3	1.0	0.0	0.4	0.8	2.3	0.0	0.3	0.0	0.0	23.2	28.1
Rural group 4	4.5	6.0	0.2	0.0	3.3	1.2	2.2	0.0	2.2	22.1	41.7
Rural group 5	4.8	5.8	0.0	0.0	4.7	4.4	2.7	1.5	4.5	40.4	68.7
Rural group 6	2.2	1.1	1.9	3.0	3.7	3.5	1.0	2.8	10.4	75.9	105.6
Rural group 7	6.4	0.0	0.7	5.1	17.0	9.3	0.4	4.9	6.1	115.0	165.0
Rural group 8	5.3	4.9	1.2	3.8	8.7	9.4	5.1	6.5	9.9	130.3	185.3
Rural group 9	9.3	2.1	3.7	12.5	7.9	14.1	16.5	35.7	11.0	141.0	253.8
Rural group 10	5.0	0.0	1.1	10.9	5.8	16.8	3.7	3.9	6.3	122.1	175.6
Total	65.2	112.0	82.9	181.6	250.6	152.8	128.8	244.5	457.1	1975.2	3650.8

Table B3: Income to informal and skilled labour (US\$ million)

	Crops	Other agri- culture	Mining	Food pro- cessing	Light ma- nufactures	Heavy ma- nufactures	Machi- nery	Utility	Constru- ction	Services	Total
Urban group 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.6
Urban group 2	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.9	3.5
Urban group 3	2.0	0.0	0.0	0.0	0.3	0.1	0.0	0.0	5.1	3.1	10.6
Urban group 4	5.8	0.4	0.0	0.2	0.9	0.1	0.0	0.0	7.8	6.6	21.8
Urban group 5	5.4	0.0	0.0	0.0	1.9	0.1	0.0	0.0	4.2	5.5	17.1
Urban group 6	7.9	4.5	0.0	0.0	0.0	0.3	0.4	0.0	9.2	18.3	40.6
Urban group 7	11.0	18.4	0.4	5.9	3.4	2.0	1.4	0.0	17.2	41.8	101.5
Urban group 8	33.9	0.0	0.2	4.1	18.6	8.9	0.4	0.0	34.4	103.7	204.2
Urban group 9	9.1	27.1	0.9	10.7	15.8	15.7	3.7	0.0	83.8	157.8	324.7
Urban group 10	6.1	7.3	0.6	22.9	97.2	44.1	18.2	1.7	84.6	646.2	929.0
Rural group 1	35.7	0.0	0.0	0.0	3.7	2.7	0.0	0.0	10.2	1.8	54.2
Rural group 2	26.8	4.2	0.2	1.6	2.3	0.6	0.0	0.0	23.1	2.8	61.5
Rural group 3	51.2	10.2	0.0	0.0	1.6	2.3	0.0	0.1	31.3	12.6	109.3
Rural group 4	52.1	13.9	0.2	3.1	11.4	3.0	0.4	0.5	20.4	13.6	118.8
Rural group 5	57.2	1.8	0.6	3.1	4.4	3.5	0.4	0.0	36.8	18.3	126.1
Rural group 6	48.4	12.1	0.4	4.6	6.9	6.1	0.0	2.0	26.7	27.5	134.7
Rural group 7	41.4	13.7	2.0	2.0	6.8	5.3	0.0	0.2	41.2	36.7	149.2
Rural group 8	50.3	8.2	1.0	4.1	12.3	5.4	0.3	0.5	19.8	37.9	139.8
Rural group 9	41.3	6.8	0.0	14.5	14.2	16.5	0.3	3.5	49.2	86.4	232.7
Rural group 10	24.5	0.0	0.0	4.2	10.5	2.3	3.4	0.0	16.6	90.2	151.6
Total	512.6	128.6	6.5	81.0	212.3	118.9	28.9	8.5	521.7	1312.4	2931.4

Table B4: Income to formal and unskilled labour (US\$ million)

	Crops	Other agri- culture	Mining	Food pro- cessing	Light ma- nufactures	Heavy ma- nufactures	Machi- nery	Utility	Constru- ction	Services	Total
Urban group 1	1.6	0.0	0.0	1.3	0.1	0.0	0.0	0.0	0.0	0.6	3.6
Urban group 2	0.8	0.7	0.0	0.0	0.0	0.8	0.0	0.0	0.7	1.6	4.5
Urban group 3	0.2	5.1	0.1	0.4	0.2	0.0	0.0	0.0	0.0	1.1	7.0
Urban group 4	0.5	7.1	0.3	0.5	1.7	0.0	0.0	0.0	1.1	2.4	13.7
Urban group 5	0.2	0.6	0.7	1.6	4.4	3.3	0.0	0.0	0.0	6.0	16.8
Urban group 6	4.2	0.9	0.7	4.5	2.7	1.6	0.0	4.4	10.1	2.9	32.0
Urban group 7	2.1	0.0	1.4	2.5	5.3	0.5	2.2	5.8	1.3	13.2	34.3
Urban group 8	0.8	10.8	5.1	8.4	16.1	4.4	4.6	1.7	7.5	30.8	90.2
Urban group 9	2.7	3.9	1.9	12.9	16.4	6.5	14.0	12.8	20.3	27.4	118.8
Urban group 10	0.1	10.4	4.2	20.0	43.7	14.5	6.9	40.0	42.3	62.9	245.0
Rural group 1	10.5	1.2	0.6	0.3	0.7	0.6	0.0	0.5	0.4	2.9	17.8
Rural group 2	15.9	0.5	0.0	2.9	3.3	0.2	0.0	0.2	8.2	6.9	38.0
Rural group 3	18.7	3.4	0.4	6.9	6.3	2.5	0.1	0.0	7.7	9.7	55.9
Rural group 4	14.6	2.3	1.1	6.8	6.4	2.6	0.2	0.0	16.0	14.8	64.8
Rural group 5	26.2	15.7	0.7	6.1	10.7	3.0	0.7	0.0	13.5	14.7	91.3
Rural group 6	19.0	1.0	3.7	7.1	12.1	5.9	0.2	0.0	4.4	21.0	74.5
Rural group 7	24.1	4.6	5.0	6.8	12.5	2.5	3.6	5.9	6.1	23.5	94.5
Rural group 8	21.2	7.5	2.2	5.1	21.7	6.2	3.3	1.5	8.7	30.1	107.5
Rural group 9	20.3	10.5	0.2	9.2	21.5	12.2	5.8	2.5	9.5	23.1	114.9
Rural group 10	6.0	11.3	0.8	5.9	13.3	0.2	0.0	2.6	5.7	10.9	56.7
Total	189.9	97.3	29.2	109.3	199.0	67.5	41.6	78.0	163.4	306.6	1281.9

Table B5: Income to informal and unskilled labour (US\$ million)

	Crops	Other agri- culture	Mining	Food pro- cessing	Light ma- nufactures	Heavy ma- nufactures	Machi- nery	Utility	Constru- ction	Services	Total
Urban group 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	1.7
Urban group 2	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	4.9
Urban group 3	2.0	0.0	0.0	0.0	0.5	0.1	0.0	0.0	2.2	0.2	5.0
Urban group 4	3.1	1.0	0.0	0.0	0.4	0.1	0.0	0.0	9.9	1.4	15.9
Urban group 5	3.6	0.0	0.0	0.0	1.3	0.1	0.0	0.0	4.7	3.2	12.9
Urban group 6	3.6	1.5	0.1	0.0	0.0	0.3	0.4	0.0	9.2	29.6	44.7
Urban group 7	4.8	21.6	0.1	5.4	2.8	1.4	2.2	0.0	17.4	37.0	92.5
Urban group 8	52.8	0.0	2.5	1.6	19.1	3.2	0.5	0.0	25.0	121.2	226.0
Urban group 9	1.3	50.5	0.9	15.2	20.8	18.4	1.1	0.0	86.3	262.2	456.7
Urban group 10	0.9	15.4	0.6	47.7	120.0	39.2	48.4	0.0	96.5	1159.6	1528.3
Rural group 1	22.5	0.0	0.0	0.0	6.4	3.3	0.0	0.0	9.2	2.7	44.1
Rural group 2	27.7	13.0	0.1	2.7	2.5	0.8	0.0	0.0	23.7	2.6	73.1
Rural group 3	50.3	7.2	0.0	0.0	2.6	1.4	0.0	0.1	27.5	16.5	105.6
Rural group 4	29.2	26.9	0.3	4.4	2.2	3.5	0.5	0.3	23.3	12.7	103.3
Rural group 5	38.5	0.3	0.6	1.5	4.1	3.2	0.5	0.0	35.3	19.3	103.3
Rural group 6	33.8	12.7	0.6	2.9	8.2	5.7	0.0	1.7	25.9	27.9	119.3
Rural group 7	25.7	17.7	2.5	1.9	10.2	4.9	0.0	0.2	36.6	55.0	154.6
Rural group 8	44.5	1.2	1.9	4.1	13.0	5.1	0.4	3.1	22.5	70.5	166.3
Rural group 9	52.2	7.1	0.0	12.6	9.3	15.4	0.4	4.6	33.9	131.4	266.9
Rural group 10	4.4	0.0	0.0	1.1	13.8	1.7	4.3	0.0	19.7	162.8	207.7
Total	405.3	176.1	10.3	101.1	237.2	107.7	58.7	10.0	508.8	2117.7	3732.9

Table B6: Total labour income (US\$ million)

	Crops	Other agri- culture	Mining	Food pro- cessing	Light ma- nufactures	Heavy ma- Nufactures	Machi- nery	Utility	Constru- ction	Services	Total
Urban group 1	1.6	0.1	0.0	1.3	0.1	0.2	0.0	0.0	0.0	2.9	6.3
Urban group 2	7.7	0.7	0.0	0.2	0.1	0.8	0.0	0.0	1.1	3.3	13.8
Urban group 3	4.2	5.1	0.1	0.5	1.0	0.2	0.0	0.0	7.5	6.0	24.7
Urban group 4	9.3	8.5	0.9	1.0	4.4	1.5	0.0	0.0	18.8	14.7	59.2
Urban group 5	9.3	2.4	1.5	1.7	11.4	4.2	2.1	2.0	9.6	33.2	77.4
Urban group 6	16.6	7.0	2.9	8.5	5.3	5.7	0.7	16.1	36.5	80.5	179.6
Urban group 7	18.1	49.2	6.2	19.4	19.8	5.8	12.9	19.3	42.1	153.6	346.5
Urban group 8	91.8	17.8	20.1	27.2	69.6	28.6	17.3	26.4	90.5	358.5	747.9
Urban group 9	19.5	101.4	22.7	64.1	92.1	55.3	45.0	54.6	264.6	701.3	1420.6
Urban group 10	18.9	86.6	39.9	185.2	383.1	157.2	123.0	136.8	514.3	2689.2	4334.1
Rural group 1	70.6	1.2	0.6	2.1	11.4	6.6	0.0	0.5	22.5	11.6	127.0
Rural group 2	71.7	18.2	0.3	7.7	11.2	2.2	0.0	0.6	54.9	19.8	186.7
Rural group 3	121.2	20.8	0.8	7.7	12.8	6.2	0.4	0.2	66.5	62.1	298.8
Rural group 4	100.5	49.0	1.9	14.4	23.3	10.2	3.3	0.8	61.9	63.2	328.6
Rural group 5	126.7	23.5	2.0	10.7	23.8	14.1	4.2	1.5	90.1	92.8	389.4
Rural group 6	103.4	27.0	6.7	17.6	30.9	21.1	1.2	6.5	67.5	152.4	434.2
Rural group 7	97.7	35.9	10.3	15.8	46.5	22.0	4.0	11.1	89.9	230.2	563.3
Rural group 8	121.3	21.9	6.2	17.1	55.7	26.1	9.2	11.7	60.8	268.8	598.9
Rural group 9	123.1	26.5	3.9	48.8	52.9	58.1	23.1	46.4	103.6	381.9	868.3
Rural group 10	39.8	11.3	2.0	22.0	43.5	21.0	11.4	6.5	48.3	386.0	591.7
Total	1173.0	514.0	129.0	473.0	899.0	447.0	258.0	341.0	1651.0	5712.0	11597.0

Table B7: Total capital income (US\$ million)

	Crops	Other agri- culture	Mining	Food pro- cessing	Light ma- nufactures	Heavy ma- Nufactures	Machi- nery	Utility	Constru- ction	Services	Total
Urban group 1	4.9	1.6	0.6	0.0	2.5	0.0	0.0	0.0	0.0	23.4	33.1
Urban group 2	2.8	1.5	7.4	0.3	0.3	0.0	5.9	0.0	2.1	32.5	52.8
Urban group 3	6.8	3.3	0.5	0.4	0.6	0.5	0.0	0.0	8.1	60.0	80.3
Urban group 4	7.2	4.2	1.2	0.8	1.8	0.1	0.0	0.0	0.0	84.4	99.5
Urban group 5	6.6	6.9	8.4	1.9	2.6	0.3	0.0	0.0	0.0	137.4	164.0
Urban group 6	15.5	9.3	26.1	2.8	4.4	3.5	4.0	21.1	1.7	267.9	356.2
Urban group 7	15.9	12.4	7.0	7.8	9.5	8.2	3.9	0.0	16.7	398.1	479.5
Urban group 8	15.5	11.2	21.4	7.8	14.5	35.3	2.1	3.3	116.8	703.4	931.3
Urban group 9	18.1	21.4	52.3	12.5	48.0	34.7	23.8	0.0	69.4	1213.4	1493.5
Urban group 10	14.3	27.1	35.8	75.4	106.2	168.4	53.7	1.6	464.0	3203.5	4150.0
Rural group 1	115.9	55.8	27.3	2.8	4.4	1.9	1.0	0.0	14.9	74.2	298.1
Rural group 2	141.6	69.7	35.7	10.8	12.0	7.0	0.0	6.0	5.4	173.5	461.7
Rural group 3	150.1	78.8	46.5	11.1	18.7	11.4	0.0	0.0	5.2	277.5	599.4
Rural group 4	169.4	85.4	73.0	16.2	24.1	14.7	0.9	0.0	34.6	298.8	717.2
Rural group 5	179.5	86.1	71.6	22.1	22.4	23.2	0.7	20.8	19.2	445.5	891.1
Rural group 6	189.0	95.0	60.8	20.6	34.1	51.3	4.0	5.3	24.9	500.2	985.1
Rural group 7	186.8	96.8	87.4	19.1	25.6	28.1	4.2	0.0	44.4	616.6	1109.0
Rural group 8	177.4	84.0	69.6	24.3	37.8	53.2	2.1	49.9	92.5	666.9	1257.6
Rural group 9	137.7	92.6	83.9	25.9	34.2	46.1	0.0	11.2	36.8	786.8	1255.3
Rural group 10	65.9	51.1	83.5	36.5	19.4	22.1	3.7	0.0	52.1	763.0	1097.4
Total	1621.0	894.0	800.0	299.0	423.0	510.0	110.0	119.0	1009.0	10727.0	16512.0

Table B7: Household expenditure (US\$ million)

	Crops	Other agri- culture	Mining	Food pro- cessing	Light ma- nufactures	Heavy ma- nufactures	Machi- nery	Utility	Constru- ction	Services	Total
Urban group 1	3.2	2.4	0.1	7.8	2.0	2.1	0.1	0.7	0.0	15.2	33.6
Urban group 2	3.4	3.5	0.1	11.2	3.1	3.0	0.2	1.0	0.0	23.9	49.3
Urban group 3	5.3	6.1	0.2	18.6	5.2	4.1	1.0	1.6	0.0	44.9	87.1
Urban group 4	6.7	9.0	0.3	25.9	6.8	6.6	1.2	2.3	0.0	70.1	128.8
Urban group 5	9.8	15.8	0.3	45.8	10.9	11.2	3.4	4.1	0.0	111.3	212.6
Urban group 6	15.6	25.3	0.6	70.9	20.5	18.0	6.7	8.1	0.0	229.2	394.8
Urban group 7	20.9	39.1	0.6	109.7	28.7	28.3	16.0	14.0	0.0	366.6	624.0
Urban group 8	30.3	67.7	0.7	179.8	46.6	47.8	32.5	26.9	0.0	733.9	1166.2
Urban group 9	47.7	113.1	0.8	331.9	92.0	82.6	89.1	51.5	0.0	1445.7	2254.4
Urban group 10	94.7	272.4	0.5	1011.1	292.8	243.6	509.8	152.2	0.0	4725.8	7302.8
Rural group 1	65.4	40.9	3.0	144.6	45.9	31.0	4.3	6.3	0.0	251.6	593.0
Rural group 2	74.3	65.8	3.3	204.8	64.6	48.4	8.1	9.6	0.0	399.6	878.6
Rural group 3	76.3	79.6	3.2	246.9	75.1	57.5	12.5	12.5	0.0	517.7	1081.3
Rural group 4	78.0	92.1	3.4	276.4	82.2	67.2	19.0	15.3	0.0	659.5	1293.0
Rural group 5	77.6	102.1	3.3	295.6	95.7	73.3	29.9	18.2	0.0	785.6	1481.3
Rural group 6	74.9	108.8	3.1	311.9	98.0	80.0	49.0	21.4	0.0	878.5	1625.9
Rural group 7	72.3	114.4	3.1	338.8	105.9	86.5	85.0	26.7	0.0	1039.1	1871.8
Rural group 8	67.4	116.0	2.6	343.4	104.4	85.3	138.1	30.5	0.0	1164.0	2051.7
Rural group 9	56.2	112.8	1.9	324.8	101.3	84.4	223.1	34.6	0.0	1313.2	2252.3
Rural group 10	30.9	76.0	0.8	222.2	82.6	59.3	337.8	28.4	0.0	987.5	1825.5
Total	911.0	1463.0	32.0	4522.0	1364.0	1120.0	1567.0	466.0	0.0	15763.0	27208.0

Appendix C: The Elasticities of Substitution

Table C1: The Elasticity of Substitution in Trade and Production Functions

	Elasticity of substitution in the production function	Elasticity of substitution in the composite goods function	Elasticity of substitution in the import demand function
Crops	0.24	2.67	5.17
Other Agricultural activities	0.22	2.11	4.02
Mining	0.20	5.26	12.69
Food Processing	1.12	2.49	5.04
Light manufactures	1.26	3.46	7.20
Heavy manufactures	1.26	3.15	6.39
Machinery	1.26	3.84	7.83
Utility	1.26	2.80	5.60
Construction	1.40	1.90	3.80
Services	1.38	1.90	3.80