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Exploring Investment Linkages

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Publication date:
2008

Document version
Publisher's PDF, also known as Version of record

Citation for published version (APA):
Abbott, P., Boys, K., Tarp, F., & Pham, H. L. (2008). *Trade and Development in Vietnam: Exploring Investment Linkages*. Hanoi, Vietnam: Central Institute for Economic Management, CIEM.

Trade and Development in Vietnam: Exploring Investment Linkages

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August, 2008

Keywords – Trade and development, Trade liberalization, Bilateral trade agreements, WTO
Accession, Vietnam

JEL classification: F13, F14, O24, O53

* This paper was prepared with Professor Abbott as corresponding author. It has been presented at the Symposium on Globalization and the Rural-Urban Divide initiated by the International Agricultural Trade Research Consortium (IATRC), Seoul, Korea, June 29-July 1, 2008. It has also been presented at seminars in Vietnam at CIEM and is published in its present form as a CIEM working paper. Financial support from Danida in making this research possible is gratefully acknowledged.

Trade and Development in Vietnam: Exploring Investment Linkages

Introduction

Vietnam has been a very successful low income country, exhibiting rapid growth, increasing openness and reduced poverty following the 1986 Doi Moi reforms. According to the World Bank's (2007) assessment of the Vietnamese economy, growth in Vietnam has accelerated since 2000, in part because Vietnam has been investing well over a third of GDP, and that share has been increasing, reaching 40% in 2006. Investment is high, especially for a low income country, and nearly half is still directed by the state, either directly into infrastructure, through loans to state owned enterprises (SOEs), or through grants to municipalities and private enterprises. But the state's share in investment has declined from 60% in 2000, as private domestic investment increases and WTO and bilateral agreement reforms attract more foreign direct investment (FDI).

Trade liberalization initiatives also accelerated around 2000, with the U.S. bilateral trade agreement (U.S.BTA) and with efforts since then to complete WTO accession. In January of 2007 Vietnam joined the WTO, having signed bilateral agreements with 20 members prior to accession (WTO, 2006). But efforts to increase openness to international markets began much earlier. A significant agreement was reached with the European Union in 1992, Vietnam joined ASEAN in 1995, and it had signed over 100 bilateral trade agreements by 2000 (Thang, 2004). Those agreements entailed not only tariff concessions, but also commitments to important institutional reforms.

From this economic performance, and given the significant institutional and trade reforms undertaken throughout its recent history, Vietnam would seem to be a particularly illuminating case in which to study the linkages between trade liberalization, economic growth, and poverty reduction. Investment is clearly a key mechanism in Vietnam by which both development and trade outcomes are determined.

While political pronouncements, especially in connection with the WTO Doha Round negotiations, have taken as given the importance of the relationship between trade and development, the academic literature has been unable to document the extent of this effect. Econometric studies on cross-country growth performance report conflicting results on the role of trade (Hall and Jones, 1999; Frankel and Romer, 1999; Rodrik and Rodriguez, 1999; Andersen and Dalgaard, 2007). Effects of trade variables are collinear with (some argue dominated by) macroeconomic variables and other globalization indicators, and tariff reductions per se are seldom found to matter. Computable general equilibrium models have been used to illustrate the linkages between trade and development, and to highlight the gains from liberalization accruing to developing countries (World Bank, 2002; Anderson, Martin and van der Mensbrugge, 2005; Hertel and Keeney, 2005). But critics of this approach use the very numbers generated in those papers to argue that the link between trade liberalization and development is weak (Tokarick, 2008; Ackerman, 2005; Polanski, 2006; Taylor and von Armin, 2007). Rodrik and Rodriguez (1999) further argue that tariff reductions generate only one time, long run impacts and not more rapid growth. It has long been recognized that large trade impacts follow from "dynamic" not static reforms.

CGE models have been used extensively in Vietnam to assess trade liberalization impacts (see Rama and Sa, 2005 and Abbott, Bentzen, Huong and Tarp, 2007 for reviews). Some analysts have been critical, but Vietnam has been much more successful than critics armed with CGE model results have suggested. These critics argue that Vietnamese trade policy has remained protectionist and dominated by state intervention, such as State Owned Enterprises (SOEs), leading to inefficiencies (Nimi et al, 2003; Thang, 2004; Thanh, 2005). But those models have significantly under-predicted both trade outcomes and accompanying development progress. Abbott, Bentzen and Tarp (2007) show that predictions from CGE models of the impacts of joining ASEAN and of the U.S. bilateral trade agreement were substantially and systematically underestimated. They argue that “history following the implementation of past trade agreements, not model based results, would appear to justify the belief that WTO accession will lead to more rapid economic development” (Abbott, Bentzen and Tarp, 2007, page 23).

We believe that the academic debate persists partly because CGE models as specified so far are inadequate in capturing potential linkages between trade and development. Models that would capture trade-development linkages must be dynamic; must capture effects of institutional reform and market access as well as tariff reduction, which likely work through incentives to investment; must better integrate macroeconomics and growth; and must avoid specific problematic functional forms (e.g. the Armington specification). Particular emphasis is placed on the investment channels in the research presented here.

This paper presents and uses a new, stylized single country dynamic CGE model to explore the trade-development linkages in Vietnam. Application of this framework involves addressing three basic questions:

1. Does a model that properly determines capacity additions and more fully captures macroeconomic accounting and growth dynamics predict trade levels in a satisfactory manner?
2. Are those capacity additions determined by trade liberalization, and if so, which aspects of trade liberalization?
3. Under this framework what are expected impacts of trade liberalization initiatives, such as past bilateral trade agreements and recent WTO accession, taking into account their potential effect on incentives to invest via both tariff changes and institutional reforms?

We also explore the role of the state in determining investment patterns, since the government of Vietnam has played a crucial role in setting both the aggregate level and sectoral pattern of investment in the past. But recently there has been a recovery of foreign investment as well as an upsurge of investment by the domestic private sector. Moreover, Vietnam’s WTO accession agreement was as much about incentives to FDI as it was about tariff concessions, and it spurred ongoing institutional reforms that impact the investment climate.

The stylized 35 sector CGE model developed here has been used to predict net trade levels by Vietnam starting from 2000 through 2005. Those results are compared to actual trade levels as well as to predictions from a more traditional CGE model of trade following the 2000 U.S. bilateral agreement. The predicted total net trade level is close to actual trade, and sectoral

composition is highly correlated with observed trade (at 97%). In the traditional CGE predictions of U.S. BTA effects (Fukase and Martin, 1999), export growth from 2000 to 2005 was underestimated by over 500% while the correlation between actual and observed sectoral trade was only 19%.

Model results highlight the role of the state in both investment allocations and savings mobilization in Vietnam, and the importance of capital accumulation to Vietnam's development success. Reasonable predictions of trade levels and growth rates are obtained using simple behavioral specifications. It remains to be shown that trade policy significantly influences that investment story, and whether recent liberalization following WTO accession will indeed launch another, more rapid round of growth as recent economic performance suggests (World Bank, 2007).

The next section provides additional information on Vietnam's economic development, emphasizing the roles played by investment and by the foreign sector. Section three explores the underlying logic of the model developed here as well as the issues raised by more standard CGE methodology that need to be addressed. Section four presents the detailed model specification and section five elaborates on data sources and model implementation. Section six examines the predictive performance of the base model since 2000, while sections seven and eight explore the consequences of trade reform and the role of the state in investment. The final section concludes by drawing lessons from this research and identifying issues that need to be addressed in future work.

Vietnam's Growth and Trade - Background

Vietnam's Success

Vietnam has experienced successful, export led development since the Doi Moi reforms in 1986. Figure 1 shows how GDP, trade, foreign direct investment (FDI) and poverty over that period have evolved. Table 1 reports macroeconomic data to illustrate this strong economic performance. In 1986 GDP was growing at only 2.8% per year, and that increased to 8.1 % by 1993. GDP growth slowed to 5.8 % in the late 1990s due to the Asian financial crisis, and resumed growing thereafter. Growth was at 7% in 2002 and recently has once again exceeded 8%, with expectations for continued rapid growth as WTO accession reforms are implemented, although very recent anti-inflation fiscal policy measures may dampen the growth performance somewhat (World Bank, 2007). Per capita GDP measured in purchasing power parity (2000) dollars rose from \$807 in 1986 to \$1448 by 1998 and to \$2,290 in 2006 (World Bank, 2008).

Data on trade (imports and exports) show much more rapid growth than GDP. In 1986 trade was only 23% of GDP. It reached 97% by 1998 and in 2006 was 150% of GDP. Figure 1 demonstrates that this growth is as much due to increases in exports as in imports. Table 1 indicates that while exports and imports both increased by a factor over 14, the trade deficit went from 12.3 trillion dong in 1986 to only 32.4 trillion dong in 2006. Obviously, with trade in excess of GDP, intermediate imports that are subsequently re-exported must account for a large share of trade. This performance reflects Vietnam's development strategy based in part on exports of labor intensive goods.

Rapid economic growth has also brought reduced poverty. Using the World Bank's \$1 per day headcount index, extreme poverty had already decreased to 15% by 1993 and to only 2% by 2002. Vietnam's own standard puts poverty at much higher levels, but they nevertheless decreased from 58% in 1993 to 37% in 1998 and only 29% in 2002 (VASS, 2007).

In summary, Vietnam has been one of the most successful East Asia economies in the past couple of decades, growing faster than all its neighbors except China (World Bank, 2007), and its growth is notable for the extent to which it has reduced poverty. While the trade data shows correlation, not causation, it suggests that trade reform has played a role in this success, and that Vietnam is an illuminating example of the potential linkage between trade and development.

Investment and Growth

Investment and capital formation have played a key role in Vietnam's successful economic growth strategy. Table 1 also reports information on the extent and nature of Vietnam's investment as well as sources of savings to fuel that investment. Several sources of data are available – including GDP accounts from the World Bank (2008), IMF (2008) and Vietnam's own General Statistical Office (GSO, 2008). GSO also reports on its website more detailed information on investment including items in investment budgets not counted in national income accounts that mostly funded infrastructure. The GSO numbers are used here, and they are typically 15% higher than I in GDP.

According to the GSO data, investment in Vietnam was over 50% of GDP in the early 1990s, falling to 32% in 1998, but rising again to 37% by 2002 and over 40% by 2006. Using I from GDP accounts has investment at only 25% of GDP in 1998, but at 35% by 2003. Rapid growth should not be surprising in a country that saves and invests such a high share of GDP, and the difference between I and GSO investment data reflect both the substantial share of public and foreign investment in the early 1990s, and the increasing role of the private sector since 2000. But these data also show that investment have gone into more capital intensive production. GDP data, investment data and assumptions on depreciation (at the Vietnam standard 10% rate) were used to calculate incremental capital output ratios (ICORs). This production parameter increased according to our calculations from 1.18 in 1993 to over 2.2 in 1998 and to over 2.3 from 2003 to 2005. Detailed sectoral ICORs show some efficiency gains since 2000, however.

The state has played an important role in maintaining these high investment rates. The state's share of investment, including both infrastructure and equity in state owned enterprises (SOE's) was 42% in 1995 and remained at 46% in 2006. That share had increased to 56% in 1998 and remained high through 2002 as foreign investment shrunk during the Asian financial crisis. The government maintained investment levels, and increased its share to minimize the effects of the crisis and avoid recession, so Vietnam continued to experience growth and less effect from the crisis than most of its neighbors. The recent decline in the state's share is due more to the increased private investment than to new inflows of foreign investment.

State investment included substantial investment in infrastructure. Since 2002 roughly a quarter of investment was from government budgetary expenses on infrastructure. Off budget expenditures on infrastructure accounted for 17% of investment in 2002 and 10% in 2006. Investment in equity of state owned enterprises amounted to only 5% of investment in 1995, but

reached 17% as the governments share of investment increased in 1998, and has since steadily fallen to 15% in 2002 and 11% in 2006.

Data on foreign direct investment (FDI) are conflicting and somewhat controversial. Vietnam requires registration of intended FDI, and not all of those registrations are implemented. Moreover, differences exist between GSO statistics and Vietnam's reports to the IMF. So controversy persists as well on how important FDI has been in fostering Vietnam's rapid growth. Nevertheless, those data tell a similar qualitative story, shown in Table 1 using implemented FDI as reported by GSO. That FDI accounted for 35% of savings and 30% of investment in the mid 1990s, and led many to assert that it was a key to Vietnam's rapid growth. In 1998 FDI fell to 9.1% of savings and the foreign invested sector accounted for only 24% of investment. By 2002 FDI accounted for only 16% of savings, and as the economy grew this share declined to 9.6% in 2006. The foreign invested sector increased, however, reflecting Vietnamese ownership in that sector.¹ Very recently, new large FDI inflows have emerged, in part as a result of reforms committed to as part of WTO accession that relaxed rules restricting FDI and making Vietnam a more attractive FDI destination (World Bank, 2007).

Foreign investment in Vietnam has also been fueled by foreign aid (ODA) which increased in 1998 to 9% of saving to help the government maintain investment after the Asian financial crisis, falling slowly to 5.5% by 2006. Private sector investment, on the other hand, has increased from 32% in 1998 to 53% by 2006. Data from the 2003 Vietnamese social accounting matrix (Jensen and Tarp, 2006b) indicate that private savings to fund private sector investment comes as much from retained earnings of firms as from savings by households. Reinvestment of corporate profits appears to be an important mechanism to maintain high rates of investment and growth as well as in determining sectoral allocations of investment funds. Both continued involvement of the state and increased saving and investment by Vietnam's private sector have contributed to continuing high rates of economic growth.

Rapid growth, a small trade deficit and larger inflows of FDI, ODA and even some foreign portfolio investment and commercial loans have led to accumulating reserves in several years since 2000. Reserves accumulation amounted to over 18% of savings in 2002 and 17.3% in 2006. Vietnam has maintained an effectively fixed exchange rate, pegged to the dollar, in the face of this reserves accumulation, allowing a possibly overvalued exchange rate to keep its exports inexpensive in overseas markets. Thus, trade policy has reinforced the export and investment led development strategy.

Trade Policy and Trade Flows

Reforms of trade policy began shortly after the Doi Moi reforms of 1986, and have been almost continuous since, culminating in accession to the WTO in 2007. In the late 1980s Vietnam eliminated state monopoly of trade, introduced currency convertibility, and established tariffs. Preferential tariffs, duty-drawbacks and export processing zones were established shortly afterwards. Since 1986 Vietnam has negotiated well over 100 bilateral trade agreements (Thang, 2004), including important bilateral agreements with the EU in 1992 and 2002 and the U.S. in 2000.

¹ Some confusion on FDI arises because investment in the foreign invested sector is financed partly by Vietnamese who live abroad and send remittances home (or to relatives).

Observers disagree as to the extent of openness of the Vietnamese economy and on the magnitude of tariffs imposed on imports. Niimi et al. (2003) characterize Vietnam as a relatively closed economy, noting that their estimate of the average tariff increased from 10.7% in 1992 to 16.2% in 2000. Neither the bilateral agreements since 2000 nor minor concessions for WTO accession have substantially reduced the average tariff, although some quotas have been converted to tariffs over time and that led to an increased average tariff in some cases. According to Nguyen Quynh Nga, one of Vietnam's WTO negotiators, the simple average tariff before WTO accession in 2007 was 17.2%, and its final bound MFN rate would fall to 13.4% based on Vietnamese commitments. CIEM data indicate a trade weighted average tariff of 10.5% in 2006, taking into account preferential agreements. Both that data and Vietnamese SAMs indicate that trade agreements have led to tariff collections on average well below these reported average and MFN tariffs.² In the 2000 SAM (Jensen et al., 2004) tariff revenue was only 5% of import value. The explosion of imports, mostly of intermediate and capital goods, also contradicts the characterization of Vietnam as a relatively closed economy since 2000.

Following the U.S. BTA, institutional reforms have been a significant component of Vietnamese trade reforms. The U.S. bilateral agreement spurred legal reforms well beyond those that had already begun occurring in the majority of years from 1986 to 2000. That agreement led to new enterprise and competition law and to a more FDI friendly economy. In 2007 Vietnam joined the WTO after negotiating bilateral agreements with 20 separate members that solidified the prior reforms, and which focused as much on services trade, foreign investment and institutional reforms as they did on tariffs. Trade reforms have been as much about institutional reform as they have been about tariff reduction, and have also focused on the incentives to invest in the economy. Moreover, those changes that made Vietnam a more hospitable place for foreign investors improved the investment climate for domestic firms.

Each time Vietnam negotiated a new agreement, trade to that region accelerated, with little apparent effect on trade with other partners. Figure 2 shows data on exports from Vietnam to its principal trading partners. Acceleration of exports to the EU is evident following both the 1992 and 2002 agreements. Prior to 1995 there was very little trade between Vietnam and the U.S., but following the 2000 bilateral agreement trade has expanded rapidly. Now the U.S. is Vietnamese leading export destination, and the EU is second. Vietnam joined ASEAN in 1995 and agreed to phased tariff concessions as part of APEC in 1998. While some decline in exports to Asian partners occurred in 1998 due to the Asian crisis, exports began their increase in the mid 1990s before tariff concessions took effect and they continued to increase as trade partners recovered and additional agreements were reached.

In their assessment of the relationship between trade and development, Abbott, Bentzen and Tarp (2009) observe that each time Vietnam reached a significant bilateral agreement, trade with that partner surged. They argue that this historical evidence suggests a strong trade-development linkage, which standard methodologies as presently used are unable to capture.

² Duty drawbacks on imported intermediates which are re-exported must also account for the low tariff revenue collection.

An Investment Based Model – Issues and Concepts

A key challenge of trade policy analysis is to identify the mechanisms through which trade influences development and in doing so to better understand the determinants of trade and growth acceleration. Several limitations are evident in standard methodology. They impede its ability to capture these mechanisms. Computable general equilibrium (CGE) models as used so far in Vietnam as well as elsewhere lack the dynamic linkages characteristic of development, as macroeconomic growth paths are exogenously imposed – even in the dynamic variants of this approach (van der Mennesbrugge, 2005). The econometric literature on trade and growth also finds productivity (TFP) improvements as countries develop, and it has been argued that trade brings greater productivity, though econometric evidence on causality is controversial (Frankel and Romer, 1999; Rodrik and Rodriguez, 1999). Productivity increases are also exogenously imposed (rather than modeled) to get more realistic results from CGE model projections (Anderson and Martin, 2005; Roland-Holst et al., 2002).

Macroeconomic closure of a medium run, dynamic CGE model is critical to sorting out these effects and determining their influence on growth, investment flows and sectoral capital allocations. Closure determines the macroeconomic performance and tells the growth story of the model. Past specifications have made problematic closure assumptions for modeling convenience, typically with investment or savings as a residual. We will try in the model developed here to capture constraints observed in recent economic performance of Vietnam through more realistic closure assumptions.

The savings-investment balance appears resolved by foreign savings, but with substantial reserves accumulation under a fixed exchange rate regime. FDI also does not seem critical, as the huge declines in FDI inflows after the Asian financial crisis of 1997-98 did not slow appreciably the Vietnamese economy. Foreign savings inflows now lead to reserves accumulation. Public foreign borrowing (including foreign aid – ODA) appears to have made up for the lost resource inflows in the late 1990s (Jensen and Tarp, 2006a). Private savings has been substantial and increasing, apparently driven in part by corporate savings (retained earnings), enabling but not necessarily constraining growth. Standard savings driven investment closures have this backwards, and behaviorally driven investment demand seems to make far more sense in the Vietnamese context. Any projection of future trade flows, which in turn depends on allocation of capital, must pay attention to how both the level and allocation of capital vary over time.

Evidence for Vietnam suggests that capital accumulation constrains (determines) growth, but not labor availability (at least not unskilled labor). Unemployment persists, and some assert that underemployment is an important problem in rural areas. Employment growth accompanying the past rapid economic growth has been limited (Niimi et al., 2003), and over 60% of the labor force remains in “agriculture” (World Bank, 2008). The unemployment closure of the Vanzetti and Huong (2007) CGE model projections yields more realistic, if still small impacts from trade liberalization. Data on limited employment growth, but wage increases, following from Vietnam’s rapid growth since 1986 is also consistent with a (single overall) labor constraint not binding output (Niimi et al., 2003), and institutionally determined but rising wages. ILO evidence suggests managerial capacity, so highly skilled labor, may constrain Vietnam’s growth. Both disaggregation of labor, and exploration of different closures by skill type, are therefore called for.

Explaining Vietnam's export led growth, and examining how export supply is determined in models is instructive on how to set a new specification. Existing static models allocate a fixed long run capital stock, and move labor from protected import industries to export activities as tariffs are reduced. But if market imperfections (such as un- or under-employment) matter, it is the allocation of capital, not labor that determines sectoral output and hence exports. Rates of return to capital may not equalize over time frames of interest, as well, as suggested by our data. Trade policy may affect incentives to invest, which influence not only the sectoral allocation of capital but also the long run magnitude of aggregate investment. This may also be influenced by institutional change that matter to investment incentives as well as improvements in market access opportunities abroad.

Where investment is endogenized, frequently the use of highly or inappropriately aggregated sectors masks the investment flows which drive actual economic growth. For many manufacturing products techniques, and by consequence inputs into production, vary considerably dependent upon whether products are destined for domestic or international markets. The standard fix to this problem is to add a CET nest to production functions, differentiating export and domestic goods. But this brings the same problems that plague the usual CES Armington specifications of imports - very large price changes and large or unstable substitution elasticities are needed to capture the big changes underway. We believe that it is necessary, in order to appropriately track resource use and investment flows, economically important sectors for which these products differ, to rely on decisions about sectoral aggregation and identification of goods as primarily intermediate imports, exports or home goods, rather than using CES or CET specifications. This will prevent us from explaining two way trade flows - but those specifications in current models fail to do so realistically in any case.

One of the challenges then of formulating a new model is to avoid problematic modeling practices (especially Armington and CET assumptions) that prevent the model by design from capturing mechanisms that relate trade to development, and from moving away from the status quo, and so do not allow the kind of market dynamics one observes in a country like Vietnam. Our experience suggests returning to simpler functional forms and specifications actually improves model performance.

Incorporating Investment

An improved understanding of the incentives that trade reform provides to investment is important to understanding the links between trade and development. Changes in trade policy, market access, and institutional reforms induce adjustments in the quantity and allocation of new sectoral capacity. These investment incentives may lead to new products, expanded capital accumulation, better technology and higher productivity. Hence, an appropriate investment model, driven by trade policy changes, institutional reforms, and new market access opportunities, can incorporate both economic growth along the lines of traditional growth theory, and productivity effects.

An important feature of the investment mechanism is the treatment of new vintage (relative to pre-existing or old) capital, but data availability makes this problematic. Capital is most usually assumed to be fully mobile across sectors (in long run models). In dynamic models the aggregate capital stock is typically fixed each year and is allocated in fixed proportions (Ichnavinnia, McDougall and Hertel, 2000) or following some allocation rule to equalize returns

across sectors (van der Mennesbrugge, 2005). This model will follow the Ricardo Viner specification, where capital is allocated each period to specific sectors, based on conditions in earlier periods, and then remains immobile in that sector. For simplicity, this will be embodied in incremental capital and labor output ratios, and additions to capacity expressed in terms of past output, not capital stock. In static CGE models investment by sector is treated as a recursively exogenous variable. Depreciation will be assumed the same across types of accumulated capital, for simplicity (and due to lack of better information).

In Vietnam capital-output ratio's since 2000 appear to be higher than before (Jensen and Tarp, 2006a), consistent with a more capital intensive development path. For productivity improvement, given fixed intermediate requirements, it would need to be the case that labor-output ratio's are falling, which may seem contradictory to Vietnam's comparative advantage. But if capital intensive exporting firms and capital intensive modern technologies strictly dominate labor intensive traditional firms, development could give rise to this dynamic as well as to the observed labor market outcomes. This follows along the lines of theory on heterogeneous firms and FDI reviewed by Helpman (2006). Trade and openness enable the more efficient firms to expand.

Given predetermined values of TFP (and so incremental capital or labor output ratios) and stocks of productive factors, short-run (single period) equilibrium simultaneously determines output, employment (and unemployment), price levels, current account balance and the levels of investment into new productive capacity (available next year). Detailed sectoral investment patterns determine the stocks of productive factors in the next period, and since they are of new vintage, this effectively raises TFP. This is implemented here by assuming incremental capital-output ratio's by sector that are lower than average capital output ratio's for Leontief production functions, and existing capital stocks are unnecessary in the specification as written.

A necessary innovation is to explain the level and allocation of investment in response to the driving forces of trade agreements – trade policy, institutional reforms and market access opportunities. It will need to reflect the rigidities of investment allocations typically observed, and gives rise to this recursive dynamic specification, while allowing new sectors to expand or even emerge. Market access opportunities must be captured in that specification. The initial version of the model in this paper treats investment allocations as exogenous, but in the longer term we will establish the extent to which those allocations are indeed related to trade policy and its impacts on sector rents.

To capture investment flows and their impact resulting from trade policy changes over time, a medium run (several period) dynamic CGE model is developed below. It incorporates new capital accumulation in a Riccardo-Viner specification. The econometric model of investment allocation remains to be specified and estimated, but our model structure suggests explanatory variables.

Basic Model Structure

The basic structure of this modeling framework is described in the flow chart presented in Figure 2. That flow chart incorporates a traditional single period CGE model, repeated for each year simulated. This is essentially delineated by the brown box, and includes a demand system, production functions, closure assumptions (goods market equilibrium, trade balance or foreign

capital mobility assumptions, government budget accounting, and savings-investment balance) and accounting to determine agent incomes (GDP, firm income and disposable household income). Typical trade linkages for a small country, where world prices may be assumed fixed, are shown in purple. The new investment specification, discussed above, is shown in red, with feedback from the traditional single year CGE models shown in green. This incorporates determination of new investment by sector of destination, growth dynamics, and FDI impacts.

The model may also be represented as behavioral relationships inserted into a social accounting matrix (SAM), with some important (ex-SAM) components to capture growth dynamics and labor market issues. Table 3 presents the basic SAM underlying our model, which starts from the 2000 and 2003 SAMs developed for Vietnam (Jensen et al., 2004; Jensen and Tarp, 2006b). One innovation is to add a row and column to capture the capital account, given our emphasis on investment and the role the foreign sector may play in that. Market equilibrium and macroeconomic closure assumptions are then captured in the SAM accounting. Table 4 presents ex-SAM model components, including capital accumulation (by firm type) and labor market equilibrium in terms of workers rather than wage costs. The labor market is in fact in the SAM, but we want to see more detail on how employment is impacted. Similarly, prices matter to the SAM, but we want to explicitly present domestic versus international prices. Growth also determines production which shows up in the SAM. So the ex-SAM components each provide more detail and determine key SAM elements.

Both the flow chart and the SAM highlight the basic structural elements of this model. Trade policy and institutional reforms determine not only sectoral prices, but also capacity additions. The savings- investment balance, part of the macroeconomic closure, determines growth dynamics. Paying attention to the role of the public sector, and specifically infrastructure investment and equity investment in state owned firms, facilitates understanding the dynamics of capital allocation. FDI and other forms of foreign investment, including ODA and reserves accumulation, are an integral part of the savings-investment balance, and require keeping track of both the current account and capital account when looking at foreign exchange balance.

Model Specification

This section presents the detailed specification of the new, stylized single country CGE model developed to explore the trade-development linkages in Vietnam. The model employs simple functional forms and makes heavy use of accounting identities in developing a dynamic growth component. Production functions are Leontief and demand is represented by a linear expenditure system. Armington functions are eliminated in favor of a small country model – only net trade and not bilateral flows are predicted. Dynamics are modeled using a sectoral incremental Harrod-Domar structure in order to capture productivity improvements, and careful attention is paid to public sector, savings-investment and foreign exchange accounting. The underlying SAM incorporates separately public investment, the foreign capital account, and investment by destination as well as investment by origin. Alternative macroeconomic closures will eventually be explored, including those that permit underemployment. The motivating logic is that tariff reforms, market access opportunities and institutional reform all influence both the level and pattern of sectoral investment (capacity additions), which in turn determine growth, employment, trade, income distribution and poverty reduction.

Descriptions of the notation used for this model are contained in Table 2. The complete algebraic model specification, including all equations, is presented in Table 3. The nature of those equations is briefly discussed here. All this can also be represented in a social accounting matrix (SAM), modified to handle the capital account (see Figure 4), though many cells of that SAM are exogenous. Indeed, one implementation of this model is based on an Excel spreadsheet presentation of SAMs. Components of the model based on a standard social accounting matrix (SAM) are described next. First, equations used to establish market equilibrium and set prices are discussed. Then, the equations that establish macroeconomic closure – savings-investment balance, foreign exchange balance, and government budget balance – are discussed. Finally, agent income- expenditure accounting is explained.

Market Equilibrium

Market equilibrium for 35 sectors constituting the Vietnamese economy sets production plus imports equal to intermediate demand plus private and government consumption plus public and private investment demand plus exports (equation 1 in Table 3). Consumption is disaggregated by household type. Investment includes separately inventory changes by sector. Both goods and factor market equilibria are represented.

A Leontief production technology is assumed, so intermediate demands are a fixed share of production based on an input-output coefficient matrix (α_{ij}). Output is determined by capacity (equation 3) on a firm type basis using GSO investment data (for SOEs, foreign invested firms and private firms). If there were excess capacity then output would be determined by demand. For simplicity, we now ignore errors in investment and business cycle influences, so capacity constraints will generally bind. Aggregate sectoral production is the sum of production by firm type (equation 2).

While acknowledged to potentially be relevant to some agricultural commodities, this analysis does not incorporate an endogenous stock accumulation mechanism. Inventories are exogenous except for selected services treated as home goods. In those cases inventories adjust to equilibrate those sectors, as we expect that capacity constraints may not bind there. But in the cases of tradable goods, inventories are exogenous (equations 31 and 32) and generally small.

Production is accomplished through the use of two aggregate factors: labor and capital. Land and old vintage capital are immobile, and we believe land movements are restricted across crops as well as determined by investments in land (e.g. planting trees). Thus, we will include land as part of the sector specific capital stock. Capital accumulation is explained by the growth dynamics captured in equation 3. Investment by sector of origin (I in the SAM) is computed from investment by sector of destination based on the patterns of investment observed in the 2000 and 2003 SAMs and equation 5. Depreciation is assumed constant due to data limitations.

Labor of several types is assumed to be available in surplus, and as such does not constrain output. Labor use is differentiated by skill level (unskilled, medium skilled, high skilled). This is mostly to keep track of labor demands and perform a feasibility (reality) check on this assumption. A neo-Keynesian/Kaldorian labor closure is assumed for unskilled, skilled and semi-skilled labor, in which unemployment is permitted, and wages are assumed to be

institutionally determined and differ across sectors and by labor type.³ Equations 7 and 8 compute labor demand and unemployment by skill type.

Household consumption is based on a linear expenditure system (LES) as in equation 6. The marginal budget shares are based on estimates of income elasticities of demand by household type. A fixed share of income is saved, determining disposable income. Demand functions are benchmarked to consumption in the 2000 SAM, to determine subsistence consumption, using the Frisch parameters estimated in Huong (2000).

Government spending (consumption, G , transfers and infrastructure investment) is treated as exogenous. Full use is made of the tax information available in the 112 sector SAM. Taxes modeled are indirect (the VAT), tariffs, corporate income taxes, and personal income taxes.

Trade

Imports to Vietnam are mostly intermediates or capital, contrary to the assumptions of the Armington model. Specific data on non-competitive imports are unavailable, but it makes more sense to assume imports and domestic goods are perfect substitutes – and that the small country assumption prevails so that firms are allowed to use imported imports, as has been the case. Exports and production of exportables are jointly determined, reflecting the role of capacity, and export demand and market access opportunities over reallocation of labor in a labor surplus economy as the model behind export supply determination. Carefully considered disaggregation assumptions rather than an Armington specification are therefore used to capture disconnects between export and domestic prices. The limitations of the Armington trade flow by origin specification will not be imposed, and the second (minor) direction of any two-way trade flows will be assumed exogenous

Either imports or exports under this formulation adjust to equilibrate equation 1 for tradable sectors. Since this structure cannot explain two-way trade, backflows (the minor trade direction of a sector, such as exports for an importable sector) are set exogenously as in equations 27 and 28. Thus, the model only predicts net trade. Moreover, for the few sectors identified as home goods, trade flows in both directions are exogenously set as in equations 29 and 30, and trade is simply not predicted.

Standard pricing rules follow from these assumptions. For importables, domestic prices equal import prices converted to local currency, with tariffs and indirect taxes then applied (equation 25). For exportables, there are not border measures in the SAM, so domestic prices equal export prices converted to local currency (equation 26). Prices of backflows (the minor trade direction) are adjusted to respect these pricing rules, and are indices in any case. Rents to capital are assumed to adjust to changing domestic prices, given intermediate and wage costs as well as tariffs and taxes, with prices for the few home goods set exogenously (equation 4). We have tried variants of the model with prices rather than inventories equilibrating home goods markets and found unreasonably large price changes, inconsistent with historical price data.⁴

³ Future work will look at alternative labor closures, especially to see the consequences of scarce skilled labor.

⁴ We will also need to examine imperfect price transmission, as domestic prices appear not to fully adjust to international price changes.

Macroeconomic Closure

Macroeconomic accounting identities are assumed to hold. A standard SAM identifies relevant assumptions and incorporates necessary closure conditions. Specifically, the following is assumed:

- 1) Fiscal balance: government savings (or the budget deficit) is the difference between government revenue and government spending (equations 11 and 12). We look separately at public current expenditures and revenue, generating public savings, and public investment, funded by that savings plus public borrowing on both domestic and foreign capital markets (equations 16 and 17).
- 2) Foreign exchange balance: supply and demand for foreign exchange is equated (the current account must equal the capital account). The capital account includes FDI, public and private borrowing, and reserves accumulation.⁵ Recent data indicate a fixed exchange rate regime, and reserves accumulation is assumed to balance the foreign exchange market (equation 9). Numerous exogenous components of net factor payments to/from abroad (NFP) are set to incorporate realistic foreign exchange balance assumptions. Reserves are our residual, and if simulated reserves fail to meet feasibility/reality checks, devaluation will be examined in another simulation, but exchange rates will remain fixed.
- 3) Savings-investment balance. Investment is now recursively exogenous, determined by sectoral capital rents and other variables. At this point the econometric model has not been estimated, so investment by sector of destination is simply exogenous. Savings is balanced by foreign capital inflows, taking into account government, household, corporate and foreign savings (equations 18-21).
- 4) Goods market equilibrium – supply equals demand in goods markets (equation 1). For tradeables net imports or exports adjust to bring equilibrium. For home goods inventories adjust.
- 5) Factor market equilibrium – labor availability by skill type is not binding – unemployment is permitted (equations 7 and 8). Capital is sector specific and dynamics of growth determine allocations of resources available for investment (equation 3).

Agent Income-Expenditure Accounting

Disposable household income by household type is determined by first determining wage and capital income (dividends), and then applying shares to each household type for those income streams. Exogenous transfers and remittances are added, and household taxes are taken away as a fixed share of household income (equations 13 and 14). Household savings is a fixed share of disposable income (equation 20).

Firm net income is computed by multiplying the residually determined rents to capital (from equation 4) times sectoral output and then deducting corporate income taxes and repatriated earnings accruing to foreign firms (equation 15). Corporate savings is a fixed share of firm income before earnings are repatriated (equation 21).

⁵ Data availability requires that we lump reserves and short term capital flows into a single variable, and assume exogenous values for long term flows.

Income equaling expenditure, as represented in the SAM (Figure 4) for each of the disaggregated economic agents (households, labor, firms, government and foreigners) is embodied in the closure conditions and agent income-expenditure accounting just discussed. This corresponds to row sums equaling column sums for each disaggregated agent in the SAM.

Model Implementation

The model equations reported above and the SAM in Figure 4 disaggregate sectors, households, labor and firms. Beginning from the detailed Vietnamese input output tables (GSO, 2000) – that identifies 112 sectors- we aggregate sectors into 35 goods. Details of the specific aggregations used in this analysis are presented in Table 4, showing how those 112 sectors map into our 35 sectors. In it goods disaggregation has been motivated by trade status, indicated in the second column. In that table goods are identified as exportables, importables or home goods based on past trade flows.⁶ We report a six sector aggregation for presentation purposes only, as the model is always solved in what follows in its 35 sector format.

Households are disaggregated into three rural and three urban types. Rural households include farm, informal sector and wage earning households, taken from the 2000 SAM (Jensen et al., 2004). Urban households are included according to that same classifications from the same source. Firm types include state owned enterprises, foreign invested enterprises and private (domestic) enterprises. Labor types include unskilled, semi-skilled and skilled workers, also according to definitions in the 2000 SAM. Notation on these categories is set in Table 2. Data problems prevented full use of this disaggregation in the model.

Data and SAM

The research reported in this paper has been enabled by acquiring from GSO in Vietnam a data set on investment by sector of destination for 112 sectors, from 2000 to 2005 (GSO, 2007). In addition, we received data from GSO on trade, border prices and tariffs for the 112 sectors of the IO table. This is the primary source of information upon which subsequent analysis is based. Data were also collected from numerous other sometimes conflicting sources to implement the model described above.

We started from the existing 2000 SAM (Jensen et al., 2004), having established 2000 as our base year from which to project, in part because of the existence of the SAM and because that is the first year in which the investment data are available. The 2000 SAM pays less attention to some of the macroeconomic issues underlying this approach than we desire. For example, the SAM imposes trade balance and ignores the foreign capital account and so significant sources of foreign savings. We decided to respect the SAM as much as possible, but also to use a better representation of the macroeconomic accounting identities. We therefore utilized GSO macroeconomic data, and in particular the larger investment series (that is consistent with our new sectoral investment data) rather than I in the SAM.⁷

⁶ Trade data indicate that some sectors change status – switching from net imports to net exports. Status is also hard to set for goods where trade is a small share of use. Thus, some of our “importable sectors will show future net exports.

⁷ In order to avoid rebalancing the base 2000 SAM we use I as reported in national income accounts, for that year only. In 2001 to 2005 investment is at the higher level as reported to us by GSO.

Our ultimate procedure was to respect data sets in order of importance to our objectives. So we used the data first obtained directly from GSO on investment, and the accompanying data obtained from GSO. Then we used the GSO macroeconomic data obtained from its website. Foreign macroeconomic data in particular was needed to be supplemented by country reports Vietnam has submitted to the IMF. The 2000 SAM was then updated to accommodate this information, with a few inputs from the 2003 SAM where we wanted to exploit detail or disaggregation available there.

The Vietnam Household Living Standards Survey (VHLSS) and to a very limited extent the Vietnamese enterprise surveys were used to determine behavioral parameters that could not be estimated from the SAM and macroeconomic data. For example, input-output ratios and production coefficients can be directly computed from SAM data. Savings propensities and income shares to the extent possible came from the SAM. Wages and demand information utilized the household surveys. Our attempts to base production parameters on the enterprise surveys led to unacceptable inconsistencies. That is why we abandoned disaggregation of most parameters by firm type. Labor-output ratios among production coefficients could be sensibly disaggregated on that firm type basis from the household survey. Source data computations in some instances led to inconsistencies and that is in part why we decided to set the priority ordering of data sources.

A 2000 revised SAM was first established, and is presented as Table 5. Behavioral relationships were benchmarked to this information. Exogenous variables in the SAM (see Table 3) were then taken from the same data sources described above, and combined with the equations of the model as contained in Table 3 to generate a base forecast for 2001 through 2005. Hence, endogenous variables in the base model for years after 2000 are predictions and can be compared to actual outcomes. We are especially interested in how well we can project endogenous macroeconomic and trade variables.

Full documentation of data sources and full 2001 through 2005 SAMs are available from the authors on request. Results reported in what follows will focus on aggregate SAM and summary data, principally on trade and macroeconomic predictions. The 6 sector 2000 base SAM is presented in Table 5 and the initially projected 2005 aggregated 6 sector SAM is presented in Table 6.

Solution and Simulation Strategy

In the base case, a 35 sector 2000 SAM is established, and then SAMs from 2001 through 2005 are predicted from exogenous data. In addition, results are summarized in a 6 sector SAM and macroeconomic and trade predictions are summarized.

Solution of this model begins by writing a 35 sector SAM as in Figure 4 in Excel. One worksheet incorporates the base year data for 2000 and subsequent worksheets project 2001 through 2005. In the SAM exogenous data go into appropriate cells and in a separate worksheet which includes all exogenous information of the model. Behavioral relationships driven by that exogenous data are in appropriate SAM cells. Closure corresponds with equating row sums row corresponding column sums. Ex-SAM components are also included in the Excel spreadsheet and include pricing relationships, growth dynamics and labor market outcomes.

For some closures we expected dynamic equilibrium to require the GAMS programming software but so far all closures may be solved using the solver tool in Excel, even when home goods prices are endogenous. GAMS solves more easily from a feasible starting point, so initial values are also included in the spreadsheet containing model exogenous information. As now formulated, the model is recursive, which greatly facilitated writing the model in a solvable way. If some closures require GAMS to arrive at a solution, it will still be the case that spreadsheets facilitate reading and interpreting results.

The first exercise with the model is to compare the resulting trade and macroeconomic outcomes to actual outcomes for the Vietnamese economy. That tests the extent to which we can benchmark economic performance, and shows how well these simple structures predict trade. The base model also generates other useful information, such as rents to capital stocks by sector, which can be converted to a rate of return by dividing by incremental capital output ratios. One can then identify where rates of return are high or low, and assess by how much they diverge and whether they are related to trade outcomes.

After assessing base model performance, exogenous variables will be varied and new SAMs containing new trade flows will be predicted. This paper considers two sets of scenarios. The first set examines the role of the state in investment by considering alternative investment allocations, and the second examines trade liberalization impacts.

Base Model Predictions

The base model simulations generate SAMs for 2001 through 2005 based on the information in the 2000 SAM, actual information on exogenous variables, and behavioral relationships explaining supply and demand behavior according to the model specification laid out in Table 3. Table 5 presented the 6 sector aggregation of the 2000 base data, and Table 6 presents the 6 sector aggregation of the 2005 results. 35 sector SAMs for 2000 through 2005 are available upon request and yield predictions for sectoral and aggregate trade, macroeconomic performance, and impacts on labor markets and the income distribution. This section reports base predictions and makes comparison to actual performance of the Vietnamese economy to gauge how well this model explains those outcomes. Our assessment is the model has performed well, particularly in comparison to predictions of models based on the more standard CGE specification. One reason is that this framework makes much more extensive use of exogenous information about the economy – data that should inform any prediction. Another is that the simple mechanisms employed here capture well economic behavior, and many of the more complex structures of a CGE model actually move its results away from actual behavior, especially in the short to medium run period (up to 5 years) modeled here.

Table 7 compares the macroeconomic performance of this model against actual macroeconomic performance for Vietnam. The model yields GDP in 2005 at 767 trillion dong, as compared to the actual GDP of 634 trillion dong, reflecting a 20.9% error. The error in consumption is similar at 18.8% and government revenue is slightly better predicted at a 14.7% error. Trade measures fared better, as the model underestimated actual exports by 1.4% and imports by 4.3%. The largest error is in investment, at 35.9%.

Investment is exogenous, and the error in investment reflects our decision to use the GSO series for investment data rather than investment from national accounts data. This leads to both

the error in investment and the over prediction of GDP. More investment over time will generate more production and value added, and in demand accounting is a direct addition to GDP. Errors in production are compensated for in computation of the capital output ratios, and consumption is benchmarked to observed demand, leading also to better trade results. Given information available from GSO and the opportunity to use the new data set in this model, we decided that using the higher investment numbers was justified.

Like other variables, GDP is better predicted the closer one is to the base year, as it is very likely some parameters change over the forecast period. GDP is determined largely by exogenous information in a closure that captures well the actual growth of the economy. Moreover, the fixed exchange rate trade balance, with reserves adjusting, allows that variable to capture errors in savings-investment balance as well as in the foreign exchange balance. In the standard approach, this macroeconomic growth path is entirely exogenous. Here the growth path is largely determined by the data on investment by sector of destination and incremental capital output ratios. Results suggest that knowing such data leads to a good macroeconomic forecast. That begs the questions we must return to at the end: what explains these investment decisions and the extent of resources available for investment? What role does trade policy play in influencing that behavior?

Table 8 compares predictions of trade flows from this model by sector to actual net trade flows (exports minus imports). Table 9 summarizes trade flow predictions and compares them to actual trade for the six sector aggregation. Both tables show a strong correspondence between actual and predicted trade flows. Using the 35 sector predictions, the correlation between actual and projected trade flows for 2001 through 2005 is 97%. The model is particularly good in the aggregate results, which mask larger errors for specific sectors. The model is especially good at predicting manufactured goods trade and agricultural exports. Prediction errors are 0.4% for aggregate manufacturing exports, 1.2% for agricultural exports and 4.4% for manufacturing imports. Agricultural imports, services and energy were more problematic, where errors were about 100% in the aggregate categories. For agricultural import goods, even the projected direction of trade was wrong in most cases. Several explanations lie behind this result. Capacity determination is probably a better explainer of supply for manufactured or agricultural goods than it would be for services. Moreover, services and agricultural import goods are for the most part very close to being home goods. Only a small share of domestic supply or use is exported or imported. Hence, small errors in predicted supply or demand lead to large percentage errors in trade. But the trade flows for these goods are small, both relative to the size of those sectors and relative to the trade flows for goods that are better projected. Especially for agricultural import goods, consumption has grown faster than model prediction, suggesting income elasticities of demand in this category may be low.

Sectoral trade projections in Table 8 show differing errors by sector that are larger than the aggregate errors. For manufacturing exports errors range from 5.6% to -48.3%, for example. Typically, the larger sectors are better predicted and the “other” categories are less well predicted. In the case of services, the errors come largely from social services, for which trade is not important. Errors for electricity are quite small, whereas mining and oil and gas show larger errors. Given problems due to two-way trade in energy, and the lags in investments, these results are not surprising. In mining, production and trade outcomes may depend more on demand variations and on changes in resource endowments than on investment.

Overall, these results for trade performance of this model are much better than its competitors. Several features of the model contribute to this, notably more prior information in forecasts and abandoning functional forms that prevent the model from straying from base case outcomes. As was true of the macroeconomic results, the closer one is to the base case, the better are the predictions, as parameters certainly change over time.

Sensitivity analysis

Given uncertainties over income elasticities and the (in)ability to project consumption for some goods, and that parameters likely vary over time, we decided to conduct sensitivity analyses of key parameters in several categories to determine how model predictions vary as those parameters are changed. Parameters were chosen to examine from each category of model relationship: the household and firm propensities to save for macroeconomic behavior, institutional wages for the labor market, incremental capital output ratios for production functions, depreciation rates for the growth model, and marginal budget share, derived from income elasticities of demand, for consumption.

In the case of household savings, the propensity to save was increased 10% in an alternative scenario. The share of firm profits that are retained earnings was also increased 10% in an alternative scenario. Both are mechanisms by which different channels can increase resources available for growth, but the current closure will mute that effect as increased reserves may capture additional savings. We think that retained earnings is an important reason why savings and investment are high in Vietnam, and why particular sectors grow steadily in the face of capital constraints and regulation restrictions.

Marginal budget shares are currently based on income elasticities of demand estimated by Huong (2000), and in the alternative case they are based on income elasticities of demand estimated by Cranfield et al. (2004). The Cranfield et al. estimates do not address household type, include somewhat fewer categories of aggregate goods, and show lower elasticities for food expenditures. Those were carefully estimated from a cross-section of countries, so may better reflect changing conditions and higher incomes than existed in the period on which Huong's estimates are based. Neither estimates show the differences in food demand that might explain underestimation of consumption for agricultural import goods.

For labor markets and institutional wages two cases were considered. In the first, all wages were raised 10%. In the second, only high-skilled wages were raised by 10%. The second case is probably the most useful, as some believe Vietnam's development demands more skilled labor, and so would put pressure on wages for that skill type. Wage rates are also critical to GDP determination in an institutional wage model like this.

Two cases were also examined for depreciation rates. The first decreased all rates to 7.5% (from 10%). The second reduced depreciation rates for agricultural goods to 5%. Lower depreciation rates would lead to faster output growth, but that effect would be lessened if incremental capital output ratio's were also calculated using the lower depreciation rates.

The final case used incremental capital output ratio's estimated from data for 2000 to 2001 only, rather than over the entire period over which investment and output data were

available (2000-2005) to reflect both information available initially and that changes over the latter period are not reflected in output increases in the earlier period.

Table 10 summarizes the various sensitivity analysis scenarios projected.⁸ Table 11 summarizes impacts on key macroeconomic variables in these alternative scenarios.

Savings propensities have negligible impact, due to closure assumptions – additional savings is matched by changes in short term foreign capital flows and changes in reserves. Since output and GDP don't change, other macro variables are also constant. Changes in marginal budget shares have a small impact on macroeconomic outcomes, as well. The current account is affected more than GDP because production and demand composition will affect trade. Wage rate impacts are similar to impacts of marginal budget shares. The changes in depreciation and in incremental capital output ratios, on the other hand, generate greater future output and so much bigger GDP impacts. GDP impacts are on the order of 2.5% for depreciations and 4% for ICORs. In general, macroeconomic results are not very sensitive to individual parameter assumptions, and changes in a key parameter likely would be matched by compensating changes in other parameters.

Table 12 presents the sensitivity test results for trade by aggregate sector. The savings propensities again have a very small impact, as trade predictions change under 2.0%, except for agricultural imports and services, the near home goods that were badly predicted in the base case. Changes in marginal budget shares result in bigger trade changes. Agricultural exports go up as do net exports of agricultural import goods due to the lower food income elasticities of demand. Manufacturing exports in this and other cases change little due to the large share of production exported. Wage rate changes are of similar magnitude, but with a different sectoral pattern. In the case of the general wage increase the biggest impacts are on agricultural trade, and reflect about a 4% change from baseline predictions. Skilled wage increases have a smaller effect, as a smaller share of production costs is increased. The growth and production parameters have the biggest effect, as trade and GDP are a direct result of these parameters. The ICOR is clearly more important than depreciation, especially if ICORs are re-estimated to take into account different depreciation rates. Manufacturing exports continue to remain quite stable in these cases, but the ICOR changes alter agricultural exports by nearly 11% and agricultural imports by a significant 320%.

Table 13 compares labor and household income results across the sensitivity test scenarios. The retained earnings assumption did impact income and expenditure results more so than trade or macroeconomic outcomes, as less income is returned to households. Rural and informal sector households saw drops in income of about 2.5-3%, while wage earning households saw only a 1% drop in income. Wage rates also influenced income distribution, only slightly when only skilled wages were raised, and by much more when all wages were raised. The wage earning households fared better, earning about 7% more, while informal and rural farm households saw less than a 3% increase. These parameters seem to affect income distribution more so than labor demand, and also more so than GDP or trade. Once again, bigger effects results from changing the production parameters, but the effects varied less across household types. These were the only parameters to significantly influence labor demand.

⁸ More detail on specific sensitivity analysis assumptions is available from the authors.

In summary, macroeconomic results in most cases stay close to baseline predictions, due largely to the closure assumptions invoked. Trade outcomes vary more, and depend more strongly on the simple supply and demand parameters. Getting supply and demand right is necessary to realize good trade predictions. In retrospect, the alternative income elasticities and the ICORs estimated over a shorter period resulted in slightly better predictions. More work on setting the right income elasticities of demand and reconsideration of the ICOR choice is warranted for future work. The demand and saving parameters did influence income distribution, and institutional wage assumptions should also influence macroeconomic outcomes. In several cases more variation was found for household income and income distribution than for other outcomes. In all cases, results were relatively insensitive to individual parameter assumptions, however. The factors that matter to these sensitivity tests, nevertheless, and the explanations of which parameters matter most and why, will also help in understanding the nature of simulation results to be presented below.

Alternative Investment Strategies

Vietnam's government has shaped investment patterns not only through infrastructure investment but also via building equity in state owned enterprises. One goal of trade partners and potential investors has been to reduce the role of the state in investment, and move Vietnam away from presumed inefficiency of SOEs. As history has evolved and events changed availability of foreign capital, the sectoral composition of investment has changed. As one looks ahead, the continued role of the state could influence which sectors expand, and where exports are enhanced or restricted. Moreover, rates of return differ substantial by sector, affecting incentives that potentially determine investment allocations and so trade and output.

Table 14 reports estimated rates of return to investment by sector, calculated using the rents to capital generated by the SAM data and incremental capital output ratios, for 2000 through 2005. That data shows substantial variation across sectors, even when looking at a highly aggregated level. The average return to capital is quite large, at 44.5%, and is especially high for agricultural goods.⁹ This is likely because capital stock and investment are underestimated in rural areas. There are also some low return sectors, including manufacturing imports that return only 2.2% and services that average 19.3%. Transportation and agricultural services yield only a 2.2% return, and several of the manufacturing sectors show negative returns. This is because, as border prices change, the rents to capital as a residual become negative. It is likely than price transmission is not complete, as assumed here, and that input-output relationships may change over time. Rents are not negative in the base year. These results highlight not only the apparent variability in returns to capital, but also the difficulty in accurately estimating it with the aggregate data used in these modeling approaches. Forcing these rates of return to equalize, as done in some dynamic CGE models, given likely errors in estimated returns to capital, will compound those errors in results.

Table 14 also reports the allocation, on average, of investment by destination across sectors, highlighting the different investments made by state owned enterprises versus foreign invested enterprises and private domestic firms. Some striking differences in firm type shares of new investment are evident. SOEs are prominent in the agricultural, manufacturing import and energy sectors. They account for over a third of new investment in each of these aggregate

⁹ There is no consideration of differing degrees of risk across investment options.

sectors, and over 75% of the energy sector. Foreign invested enterprises are most important in manufacturing, accounting for half of new investment in export sectors and 40% of investment in import sectors. Their presence is much smaller in agriculture, energy and services, where they account for less than a quarter of investment. Private firms are most important in agriculture, accounting for 46% of export good investment and 38% of import good investment, and in services, where they account for half of investment. We explore below the consequences of these investment patterns, as the share of overall investment by these firm types is expected to change over time, with both foreign invested and private firms becoming more important.

Several scenarios examine the influence of investment patterns by firm type on macroeconomic performance, trade, labor markets and income distribution. In the first four scenarios we consider the consequences of a 10% increase in investment, allocated in different cases according to observed allocations of each firm type. The first scenario considers outcomes when all new investment is made by foreign invested firms. The second assume all that additional investment is made by state owned enterprises, again according to the allocations that firm type pursued over 2001-2005. The third scenario considers the case where all new investment is by private domestic firms, according to their allocation patterns. A fourth scenario assumes that 10% increment in investment is made by all firm types according to the existing allocation pattern, for comparison. A final scenario looks at the exports targets of the most recent five-year development plan, expanding investment in sectors targeted in that plan. Since export growth targets were roughly equal, the 10% increment in investment considered in the previous scenarios in this case will be allocated proportionally across the targeted sectors, based on base investment levels. We will not only compare this case to the other allocation patterns for that investment, but also consider how well it meets export targets. More detail on the assumptions of these scenarios is provided in Table 15.

Before examining these simulation results it is useful to consider how an investment shock works through this model. The initial effect is that new investment increases sectoral capacity and that in turn raises output (according to the sector's ICOR). The differing patterns of investment across scenarios will elicit differing output increase mixes. This additional output adds to GDP, as it generates both wage income to new workers hired and rents to the new capital. A number of reactions to greater output and income mitigate their effects. First, additional output requires additional intermediate inputs. The mix of inputs required depends on which new goods are produced. Additional income also brings additional consumption by those receiving that income. In this model trade adjusts to restore equilibrium, where output increases in sectors would expand net exports, but intermediate and consumption demand increase net imports. The resulting pattern of trade then depends on both the output pattern and the differential demand patterns it brings. Since different sectors expand, and since for those sectors not only do wage and capital income differ, but wage income varies by skill level. Thus, the income increases generated will change the income distribution, dependent upon the shares of each income stream accruing to each household type. Separate tables report macroeconomic, trade and income distribution impacts under these investment scenarios.

Table 16 reports the macroeconomic changes under the alternative investment scenarios. If a 10% investment increase is allocated according to the existing overall investment pattern, GDP increases 3.39%. Total trade, as measured by the gross current account, increases 3.46% and government revenue by 3.20%, which are comparable to GDP growth. If the investment

pattern is that followed by SOEs, GDP grows faster but trade grows more slowly. Energy plays a big role in this, and SOEs also pay higher wages, leading to the greater GDP impact. Foreign invested enterprises and private firms generate the same GDP increase, at 2.9%. Both also generate more trade, at 3.5% for foreign invested firms and 4.0% for private firms. Government revenue tracks GDP increases except for the scenarios of foreign investment, as foreign invested firms pay substantially higher tax rates. Investment in the sectors targeted in the five year plan generate a larger GDP increase, even as some low or negative return sectors are targeted (in particular machinery). This shows its trade/import substitution bias since trade grows more slowly than in the other cases.

Table 17 examines net trade impacts in these alternative investment scenarios for the aggregated sectors. Trade changes follow closely from the output and investment changes discussed above. The foreign invested firms specialize in manufacturing, and particularly the export sectors. In that scenario manufacturing exports rise 13% and manufacturing imports fall 5.8%. If investment were allocated as in the past, manufacturing exports would have increased 4.1% and imports would have fallen 5.6%. So the effect is most pronounced for the export sectors. If private firms were the ones to increase investment, manufacturing exports rise only 2.5%. Agricultural exports, on the other hand, rise 5.9%. If SOEs increase investment, manufacturing exports only increase 1.3% while agricultural exports increase 3.0%. For agricultural imports and services, large percentage changes arise because trade is a small share of output and use – these are nearly home goods. Moreover, the agricultural import sectors are net exporters in all scenarios, with the largest increases following investment by SOEs, and then private firms. Energy exports increase substantially (13%) when the SOE investment pattern is followed, and they decline by about 3.7% in the other scenarios as greater output requires more energy as an intermediate input. In the scenario examining plan targeted sectors, bigger net exports are generated for the agricultural import good sectors and for manufacturing exports.

Table 18 explores labor and income distribution impacts under these scenarios. In the scenario when investment follows historical patterns, labor demand increases about 2.8% for all skill types. For foreign invested firms, high and medium skill labor demand grow faster, and demand for unskilled labor grows a good bit slower, at 2.4%. Investment by SOEs also generates less demand for unskilled workers, but with demands for skilled workers not growing as fast, and particularly slowly for high skilled workers. If private firms invest more, labor demand grows much faster for unskilled workers, at 3.9%, and just as fast for the higher skill categories. It would appear that private firms use more labor intensive methods, while particularly the SOEs invest in capital intensive sectors and methods.

Income distribution impacts in table 18 reflect the labor demand impacts just discussed. Household incomes grow at rates comparable to labor demand increases. Overall, informal and wage earning households do better than farm households. Farm households do especially poorly, with incomes only growing around 2%, in the foreign invested firm scenario. Rural households do best when investment patterns follow those of the private firms, and except for farm households, do as well as urban households under the SOE investment pattern.

In summary, there are distinct differences in the sectors targeted for investment by the different firm types in Vietnam. SOEs pay higher wages (to fewer workers) and invest in high return sectors, and so generate bigger GDP increases. This result is heavily influenced by the SOE dominance in energy. It also appears to be the case that SOEs are more capital intensive,

largely due to sectors of specialization. Foreign invested firms specialize in manufacturing, and their biggest impact is on manufacturing exports. Private firms invest more heavily in agriculture and especially in services, demand more labor, and generate more household income. Both SOEs and foreign invested firms appear to exploit trade opportunities, while private firms focus more on servicing the needs of the domestic economy. Emphasizing exports in sectors highlighted in the five year plan also advances trade and improves household welfare. Among sectors targeted in this scenario, however, are a few in which demand was previously satisfied by imports and which generate relatively (i.e. machinery) low returns. Unless that investment can bring new techniques and greater efficiency, it will generate less additional income that could have been realized had other sectors been targeted and this investment allocated elsewhere. This scenario nevertheless shows the potential to grow faster under alternative investment allocations.

Trade Liberalization Impacts

As noted earlier, Vietnam has been opening its economy in continuous steps since the Doi Moi reforms of 1986, and that has resulted in rapid expansion of trade. It very recently joined the WTO, solidifying reforms inspired by earlier bilateral agreements and taking new steps toward greater openness. According to Nga (2007), simple average tariffs fall from about 17% to 13% as a consequence of WTO accession. The negotiations focused more on institutional reform, services trade, and making Vietnam a foreign investment friendly environment, however. In this analysis, we will first look at the direct consequences of tariff reforms. Since they are likely to be small, both because tariff changes are small and because of model design that sets investment and (hence supply) exogenously, we will also look at changes in investment patterns that are likely to arise from this agreement, including for service sectors that were targeted in WTO negotiations.

Table 19 summarizes the tariff change we used in this analysis, and that were committed to in Vietnam's WTO accession agreement. We will apply changes in tariffs that are to take place by 2015 in this analysis, as Vietnam's commitments involved delays in reducing tariffs for several key goods, and by 2015 the most important reductions will have taken place. Since our base data reflects tariffs actually collected, and those are much lower than tariffs reported in Vietnam's commitments to WTO, we shall reduce tariffs in proportion to the changes following from WTO commitments, applied to the observed tariffs in our base data. The numbers reported in table 19 are $(\text{new tariff} - \text{old tariff}) / \text{old tariff}$, and are quite low for most sectors. For agriculture, the biggest reductions are for sugar and fish and seafood. For manufacturing, some export sectors – notably clothing, and a few import sectors see tariff reductions greater than 2%. It should be noted that Vietnam expects to increase its tariffs in the energy sectors, and this will be quite important to results generated here, as that raises intermediate costs for many sectors.

Table 19 also reports our estimates of the effects of these tariff changes on returns to capital. The tariffs are assumed to be fully passed through to domestic prices, and the input-output structure is used to compute the effects of tariff changes also changing intermediate costs – in essence computing the effective tariff consequences of Vietnam's WTO commitments. The changes in returns to capital, due to changes in rents to capital, are much larger than the changes in tariffs themselves. This is in part because rents to capital are a residual, and Leontief production functions assume no price responsive change in input mix. As noted above, the increases in energy tariffs are important, as they contribute to declines in returns to capital for 20 of our 35 sectors. Rents to energy increase, given the projected tariff increases there.

Interestingly, rents also increase for the sectors that have been rapidly expanding net exporters in the past – fish and seafood, processed agricultural exports, clothing, leather goods, wood products, and other manufactured goods. While service sectors show no direct tariff changes, some significant changes in sectoral rents are observed there, as well. Higher energy prices make transportation more expensive. Returns to social services fall dramatically. But returns to wholesale and retail trade, construction and agricultural services improve.

Table 20 summarizes the scenarios we have investigated to gauge the consequences of these tariff and return to capital changes. The first scenario altered tariffs from 2001 through 2005 according to the base tariffs and WTO reduction commitments as described above and reported in table 19. It asks what would have happened had these tariff reductions been taken much earlier, and so this scenario will give an indication of how effective direct tariff changes are in altering trade, output and income distribution. Since investment patterns are exogenous and determine supply, we constructed two scenarios in which investments are increased in a manner consistent with incentives from the tariff changes.

Since it is effective and not nominal tariffs that matter, and incentives are likely generated through rents to capital, we first constructed Scenario 2, in which a 10% increment in investment goes to sectors seeing positive returns. In this scenario it is assumed that capital that potentially can be invested in a particular sector is available in proportion to the current size of that sector. Further, as investors will seek the highest available rates of return, it is assumed that the demand for investment in a particular sector reflects that return that that sector provides relative to remainder of the economy. In this scenario then, investment is allocated across positive return sectors in proportion to the following measure: $\text{share of investment} * (\text{Change in Sector R/ICOR})$. For this test the changes in capital rents/ICORs in table 19, were used. Investment was allocated across firm types in proportion to their baseline levels.

Scenario 3 seeks to broadly assess the potential impact of accession and so jointly considers the effect of the tariff reform and the likely increase in investment. For this analysis, the tariff adjustments introduced in Scenario 1 were introduced into the model in conjunction with the new investment allocation described for Scenario 2.

Finally, since WTO negotiations emphasized services trade and making Vietnam more foreign investment friendly, we added a scenario in which the 10% increment in investment went to foreign invested firms and specifically to the services highlighted in WTO negotiations.

Before exploring the results from trade liberalization scenarios, it will again be useful to trace changes to be expected under this model specification from the scenarios just described. In the previous section we described the consequences of an investment increase, and those mechanisms apply here as well. The difference is that in these cases the sectors targeted for increased investment are different, so the magnitudes of effects are different. Only in the simple tariff reduction scenario are the mechanisms substantially different. In the case of a tariff reduction, the direct effect is that domestic prices change (remembering that the small country assumption is invoked so border prices are constant). In the first scenario, those price changes will induce demand adjustments, and will alter rents by sector, but supply is fixed due to the exogeneity of investment. The demand and price changes will result in no change in output, some change in trade and, since rents change, there will also be some change in income distribution. In general, unless investment and so supply is altered, we expect that the effects of

these price changes will be quite small. Larger changes are both expected and found for the scenarios that alter investment, a channel we believe is important to capturing consequences of trade reform.

Table 21 present the macroeconomic impacts of the changes made in these trade liberalization scenarios. In the tariff reduction scenario, trade increases only 0.22% and GDP increased 0.35%. Government revenue increases 5.51% due to the higher energy tariffs. In the scenario targeting investment to positive return sectors, GDP increased 9.70% and it increased 9.33% when positive return sectors are targeted and tariffs are applied. When the WTO emphasized service sectors receive the additional investment GDP increased only 2.51%, as capital earning are partially repatriated by foreign invested firms. The scenario targeting investment to positive return sectors generated the greatest increase in trade, at 5.98%, followed by the positive return with tariffs scenario, at 5.74%. The trade increase in the WTO service sector scenario is 5.68%.

Table 22 presents the aggregate trade impacts under these trade reform scenarios. As before, big percentage changes are noted for the near home goods, poorly projected sectors – services and agricultural imports. Moreover, scenarios in which tariffs are reduced, and only demand mechanisms matter, generate much smaller trade changes than when investment patterns are adjusted. In the scenario targeting sectors where tariffs increase returns to capital, manufacturing export sectors see exports increase 7.02%, manufacturing imports fall 9.16%, and agricultural exports increase 26.6%. These are all greater trade changes than when investment increases follow historical patterns. Energy exports also increase almost 24%, brought by the higher tariffs and so higher returns to those activities. When investment goes to the WTO liberalized service sectors, the biggest trade changes are the net exports for services, that almost triple. Manufacturing exports, manufacturing imports, and agricultural exports fall in that scenario. It should be noted that the WTO liberalized service sectors serve the domestic market, and the trade balance assumptions may be somewhat unrealistic in those cases. But the most significant trade changes occur if incentives to investment drive changes in investment patterns, as assumed in the third scenario examined here.

Table 23 present labor and income distribution impacts under the trade liberalization scenarios. Labor demand changes follow GDP impacts. They are zero under the simple tariff reduction scenario, as they depend on output changes. They are bigger when investments respond to tariff incentives, and smaller when allocated to WTO targeted foreign invested service firms. Increases in demand for unskilled labor are quite low for that scenario, increasing at 1.7%. When positive return sectors are targeted, demand for labor of all types grows faster than under the other scenarios, and especially so for unskilled workers, whose demand increases 6.3% in that case. That scenario seems best at capturing Vietnam's comparative advantage. Wage income follows the demand mostly for unskilled workers, and increases 6.2% for urban wage earners in the positive return scenario. Wages actually fall under the simple tariff reduction scenario, and only increase around 2 % when WTO service sectors are targeted. Farmers also do best when investment is increased in the positive return sectors Informal households see income changes comparable to farmers and wage earners, as these sectoral differences in investment generate similar impacts across the various household types.

These results verify our expectations that tariff reforms have much bigger impacts when they alter incentives to investment, and those incentives in turn alter investment patterns. GDP,

trade, labor and income distribution outcomes all improve if those sectors seeing lower effective tariffs, and more importantly higher rents to capital, expand in response to incentives. This once again highlights the importance of establishing the extent to which these incentives are in fact passed through to firms, and the extent to which investment changes have in the past followed from tariff induced incentive changes and so determined investment patterns. As noted earlier, there is great variation in capital returns across sectors, and reason to be concerned with the accuracy of estimations of those returns at the aggregate level captured in an input-output table.

Conclusions

This paper reports on research to develop a model that better captures linkages between trade and development, utilizing Vietnam as an illustrative case where rapid economic growth has accompanied trade reform and subsequent trade expansion. The underlying premise of this work is that incentives to investment determine capacity, so production and trade. Trade policy reform, including institutional reform and market access opportunities gained through trade agreements, provide incentives that determine both the level and allocation of investment. Particular emphasis is put on explaining Vietnam's export expansion, rather than focusing on shifts out of imported goods.

This research was enabled by access to a data set provided by the General Statistical Office (GSO, 2007) of Vietnam which included investment by sector of destination, for 112 sectors disaggregated by firm type (state owned enterprises -- SOEs, foreign invested enterprises, and domestic firms). Design of the model and experiments with it were partially motivated to take advantage of this new data set.

Results reported here strongly suggest that with better knowledge of the patterns of investment, much better predictions of trade patterns are possible. This model performed well in predicting trade patterns. For the projected period of 2001 to 2005, the correlation of predicted trade levels with actual trade was 97%. This is much better than predictions of standard CGE models, even recognizing that those models were done ahead of the actual prediction period.¹⁰ The model performs especially well for agricultural exports and for manufactured goods (both imports and exports). Services trade predictions were not as good, in part because the assumption that capacity determines output and so trade works less well for those sectors. Poorer performance was also found for agricultural imports. In the cases of services and agricultural imports, only small shares of production or use are traded. These are similar to home goods, and small errors in production or demand forecasts lead to larger errors in trade forecasts. Energy was also somewhat problematic, and is an important export of Vietnam. But Vietnam currently exports crude oil and imports refined products. Investment in this sector likely reflects the construction of refinery capacity, an activity that stretches over several years before output and trade are impacted. Moreover, this model is not designed to explain two-way trade, as is observed for energy. But it does very well at explaining net trade for the sectors that the model structure is designed for.

¹⁰ The standard CGE methodology as implemented in Vietnam is not a difficult straw man to beat, as its predictions of past agreements have under predicted trade typically by more than a factor of five and correlations between actual and predicted trade were only 19% (Abbott, Bentzen and Tarp, 2007). Even at the 97% correlation found here, however, some significant sectoral prediction errors occur, highlighting that trade remains difficult to predict.

Model predictions were accurate in part because careful attention was paid to the macroeconomic closure of the model, and to exogenous determinants of savings, investment and so growth. In addition, links between the savings investment closure and foreign exchange balance were carefully developed. Much information was available after the fact that facilitated a better macroeconomic scenario upon which trade behavior was projected, highlighting the extensive information needs to get a good forecast. The model was subsequently relatively insensitive to macroeconomic parameters like savings propensities, again because the fixed exchange rate closure let foreign exchange reserves residually accommodate changes in savings or investment as well as foreign exchange balances. Exploring alternative closures will help to understand how the growth story in Vietnam could evolve differently under different policy and trade assumption, but will depend in the end on how that affects the availability of saving to invest and expand capacity.

Implementation of the model led us to see how important the government of Vietnam has been in determining investment levels and shaping their allocation patterns. Not only has the government heavily invested in infrastructure development, but it has also directed investment toward specific sectors (notably energy) and toward social services via investments in equity of state owned firms. And the state has been important in mobilizing saving to maintain high shares of investment in GDP, especially after the Asian financial crisis. Data on investment by sector of destination and firm type show very different patterns of investment, depending on who makes decisions and it is likely that as the private sector continues to expand its role, that the composition of output and trade will be affected. While the state has dominated particularly in energy, foreign invested firms have focused on manufacturing, and private domestic firms have emphasized agriculture and services. We explored several scenarios to illustrate the specific focus of each firm type in investment, indicating how different patterns of development and trade might arise depending on whether investment is increasingly by foreign invested or private domestic firms. Trade impacts followed the differences in investment patterns. Labor and wage impacts also differed, with foreign invested firms more heavily demanding skilled labor, while private domestic firms increased substantially the demand for unskilled labor.

Investment patterns, and especially investment by foreign interests, will be affected by Vietnam's commitments as it joined the WTO. That accession agreement focused more on foreign investment friendly service sectors than on tariff concessions. Trade liberalization impacts were greater in the scenarios that changed investment patterns in ways likely to follow from trade agreements rather than as a consequence of tariff reductions, which determine demand patterns and only output if they also influence investment. We looked at scenarios that examined both tariff concessions and investment allocation changes, and found bigger impacts in the latter cases. The tariff reform scenario generated the weakest GDP impacts and even reductions in labor demand. If investment were allocated to sectors seeing reduced tariffs, outcomes are similar to those found when investment is targeted to high return sectors. Effects are dominated by intermediate cost changes and particularly that now Vietnam intends to raise its tariff on imported energy. Changes in incentives to invest due to tariff reductions are small relative to the observed variability in rates of return across sectors, however. To capture the effect of trade liberalization, impacts on incentives from market access opportunities for exports and from institutional reforms must be captured. In addition, the observed development of Vietnam's economy and trade may have been to expand labor intensive goods, but has used

increasingly capital intensive methods, suggesting serious problems for traditional models based strongly on Heckscher-Ohlin theory.

A number of changes from standard modeling practice were employed to get these better results. Explaining two-way trade was abandoned, allowing us to avoid problematic Armington and CET assumptions. Knowing investment allocations allowed us to avoid modeling assumption that require allocations to equalize returns to capital across sectors for a period when that clearly has not yet occurred. Use of simple modeling structures, such as Leontief production functions, allowed us to develop a simple, easily solved model that captures well Vietnam's trade performance. We believe that this is a useful framework to understand how trade and development in Vietnam are related, and that exploration of that relationship in this simple framework will reinforce the notion that this relationship is indeed important.

In the process of building this model and examining its performance, a number of unresolved issues arose. The most important of these deal with concerns about investment patterns and the role of the state not fully addressed within our model, concerns with parameters of production functions to cope with heterogeneous firms, labor market closure assumptions, and assumptions concerning price linkages and market integration.

One role the state plays in Vietnam is to invest in infrastructure. A substantial share of its investment now goes to infrastructure, and if the state were to assume a diminished role on economic management in the future, this part of investment might decline. Undoubtedly, some of the success in Vietnam, particularly in maintaining a more equitable income distribution and in reducing poverty, is due to the high level of infrastructure investment found there. Moreover, that infrastructure development has likely facilitated expansion of even the agriculture and manufacturing sectors, and especially social service sectors. But infrastructure is now exogenous to our model, and there are no relationships specified relating that infrastructure investment to either growth or to sectoral output. More work in the future needs to focus on how infrastructure investment contributes to both growth and equity.

Controversy also made assumptions on the role of foreign investment difficult, and one of the greatest uncertainties in making any future projections arise due to uncertainty over both the future level of foreign investment and what sectors will be targeted. While we did look at scenarios examining alternative investment paths that may be influenced by decisions taken by foreign investors, many issues and alternatives need to be examined to get a better handle on the role foreign investment may play in Vietnam's future. Moreover, it is asserted in the literature that foreign invested firms, and firms that trade, may be more efficient than domestic firms, and in particular relative to state owned enterprises. Vietnamese data do not as yet clearly support those presumptions, and need to be examined more carefully in the future. Our evaluation of efficiency by firm type from enterprise survey data raised more questions than answers, and at this point that information is not used in this model.

The concern with efficiency of foreign invested and trading enterprises, and their relation to development theories based on heterogeneous firms, highlights the need to estimate well the production function parameters of this model. Our sensitivity analysis showed that these parameters can make an important difference in the projections of the model, and some of the forecast errors seem likely have arisen due to problems in setting these parameters. We abandoned trying to set different incremental capital output ratios by firm type. Better data let us

retain for now different labor requirements by firm type, but surely capital allocation decisions are not independent of labor decisions. In addition, these parameters would reflect any total factor productivity growth (technical change) which is currently not considered, except to the extent that using incremental parameters captures more current behavior. More work is called for using enterprise survey data to assess questions related to productivity, by firm type, and the allocation of labor versus capital. The increasing capita output ratios – that nearly doubled from the early 1990s – in an economy seemingly pursuing a development strategy to exploit abundant labor, reinforces the concern that we need to get a better handle on these fundamental parameters. The controversy over labor implications of past development also suggests more work on labor requirements, and on implications of those parameters for labor demand as the economy grows.

Labor market outcomes are strongly conditioned by closure assumptions. In this case we have assumed institutional wages and under- or unemployment. While our assessment of earlier CGE work suggests strongly that is a better approach than assuming full employment, work remains to assess the implications of how labor markets are now assumed to clear, and what might happen under alternative closures. In particular, it may be the case that unskilled labor does not constrain growth, whereas skilled labor endowments may bind particular activities. Experiments with alternative labor market closures, addressing the skilled-unskilled labor mix, are needed.

The model also treats Vietnam as a small trading country with integrated markets for tradeables. Work on exchange rate pass through, and studies of market integration (e.g. Minot and Goletti, 2000 for rice in Vietnam) suggest that changes in world prices are not fully passed to domestic prices, as now assumed. Inspection of the predicted pricing of sectors under this assumption suggests that the assumed changes are likely to be bigger than actual price changes, as would follow from imperfect market integration. This assumption is especially important to assessing tariff impacts, which under current assumptions presume that tariff change are fully passed on to domestic prices. That probably means the already small tariff impact projections are exaggerated. Building a mechanism that allows imperfect transmission of world prices to domestic prices, and estimating the extent of this price transmission, would surely lead to better model predictions, especially for trade policy.

The most fundamental unresolved concern remains that investment allocations by sector are not yet modeled as functions of trade policy. Does trade policy reform explain investment patterns? While we use a scenario to get at the likely implications of this concern, future work must try to establish clearly whether there is a relationship between investment by sector of destination and trade policy changes. More importantly, that work needs to sort out the role of tariff changes, institutional reforms, and change in market access faced by Vietnamese exporters. This is likely to be a challenging exercise, as time series for investment allocations is short. More importantly, variations in sectoral rates of return are substantial, and are large relative to changes in sectoral returns generated by tariff changes.

In the Vietnamese case, reforms to accede to the WTO involved domestic institutions, such as legal reform, more so than changes in border pricing passed on to sectors. Trade agreements also brought market access opportunities, and these are not always apparent in the price changes that models predict. The combination of institutional change and market access openings surely has influenced Vietnamese investment decisions. This work has shown those

investment decision lie behind, and can be used to predict, both sectoral output changes and change in trade patterns. The link between trade and development rests on these changes that go beyond tariffs, and capture the role that broader trade policy plays in shaping investment.

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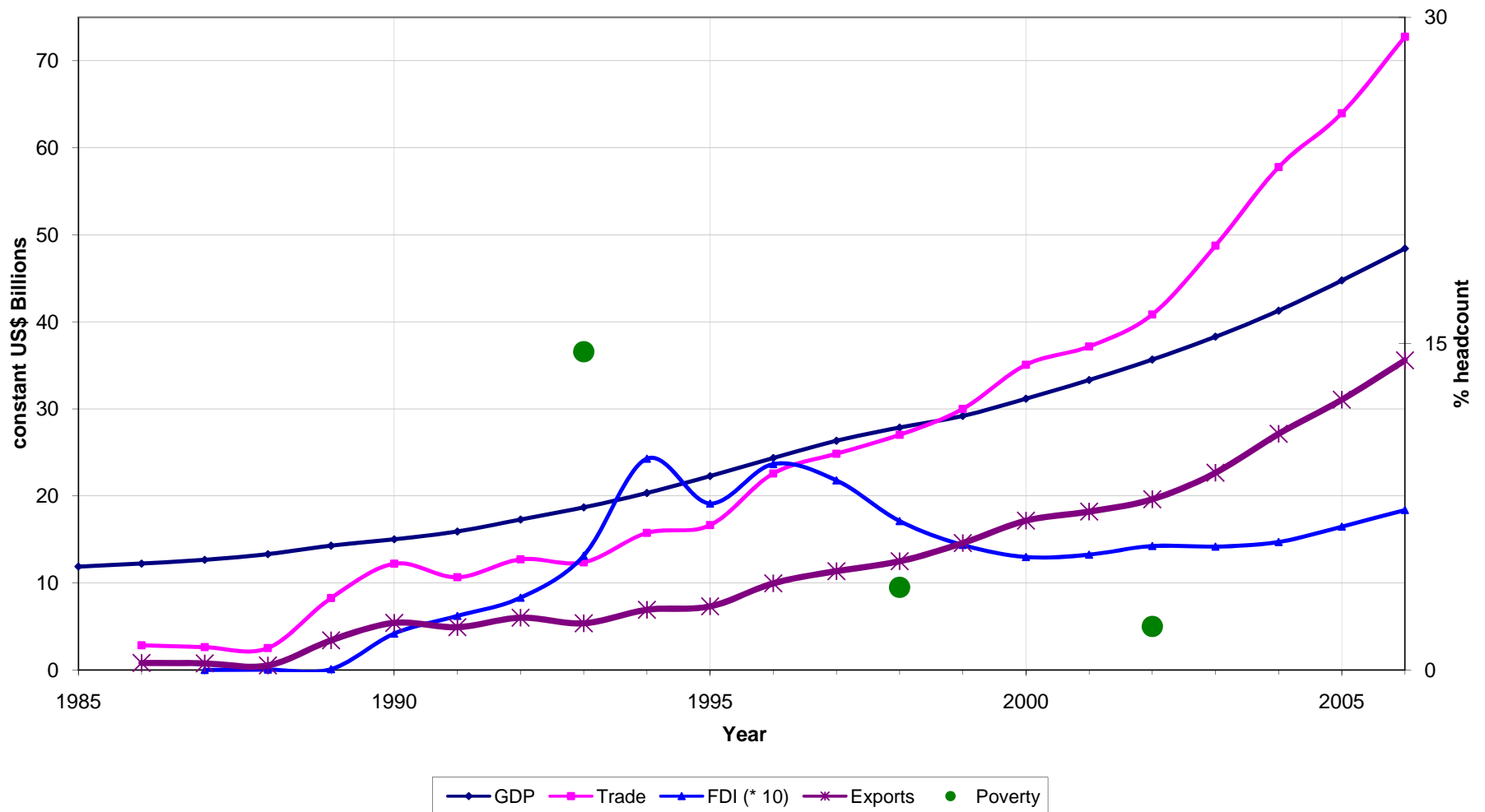
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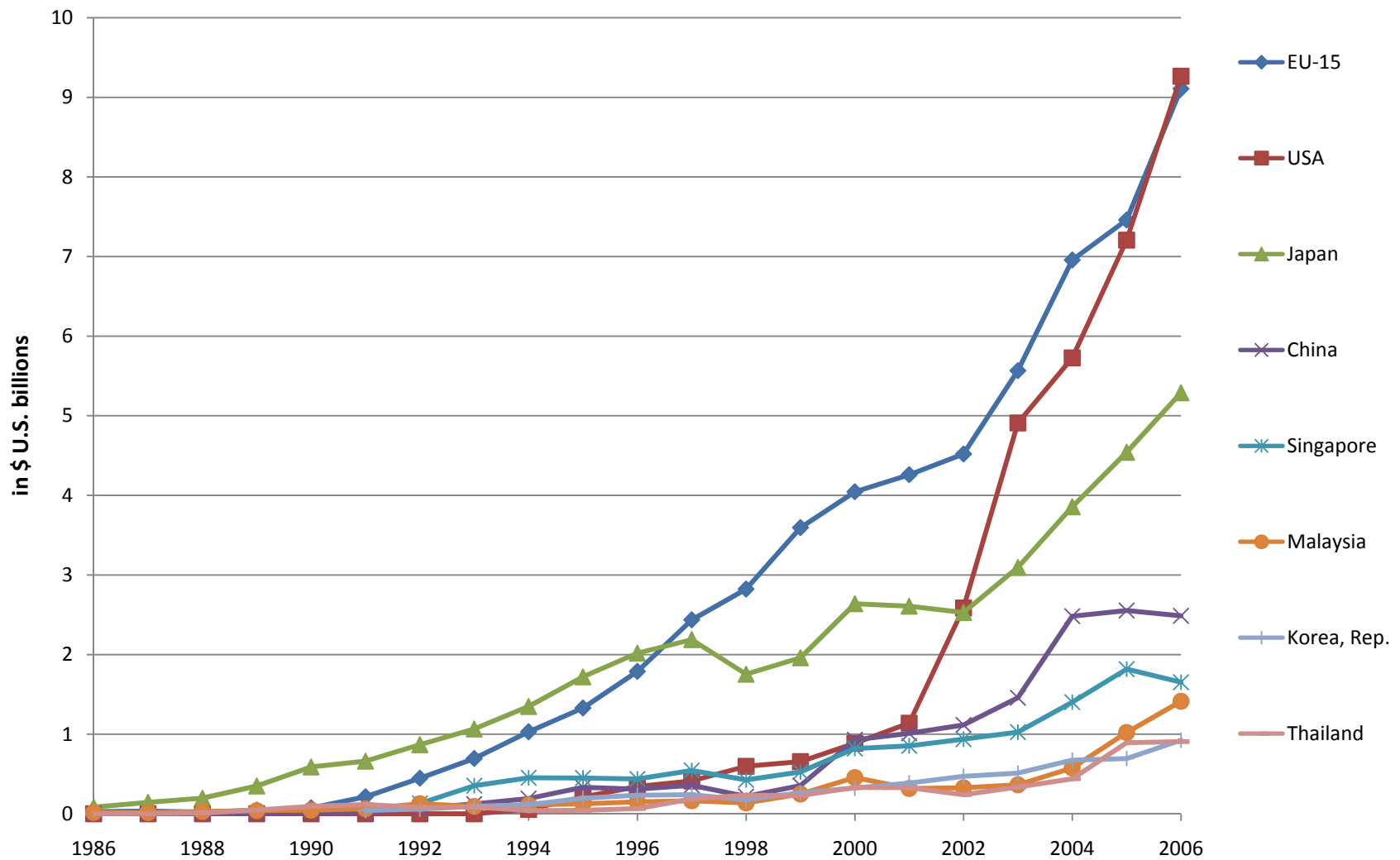
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Figure 1. Economic Growth, Trade, FDI and Poverty in Vietnam



Source: World Bank, World Development Indicators (2008)

Figure 2. Vietnamese Bilateral Export Flows - 1986 to 2006



Source: UN Comtrade (2007)

Figure 3. Model Flowchart

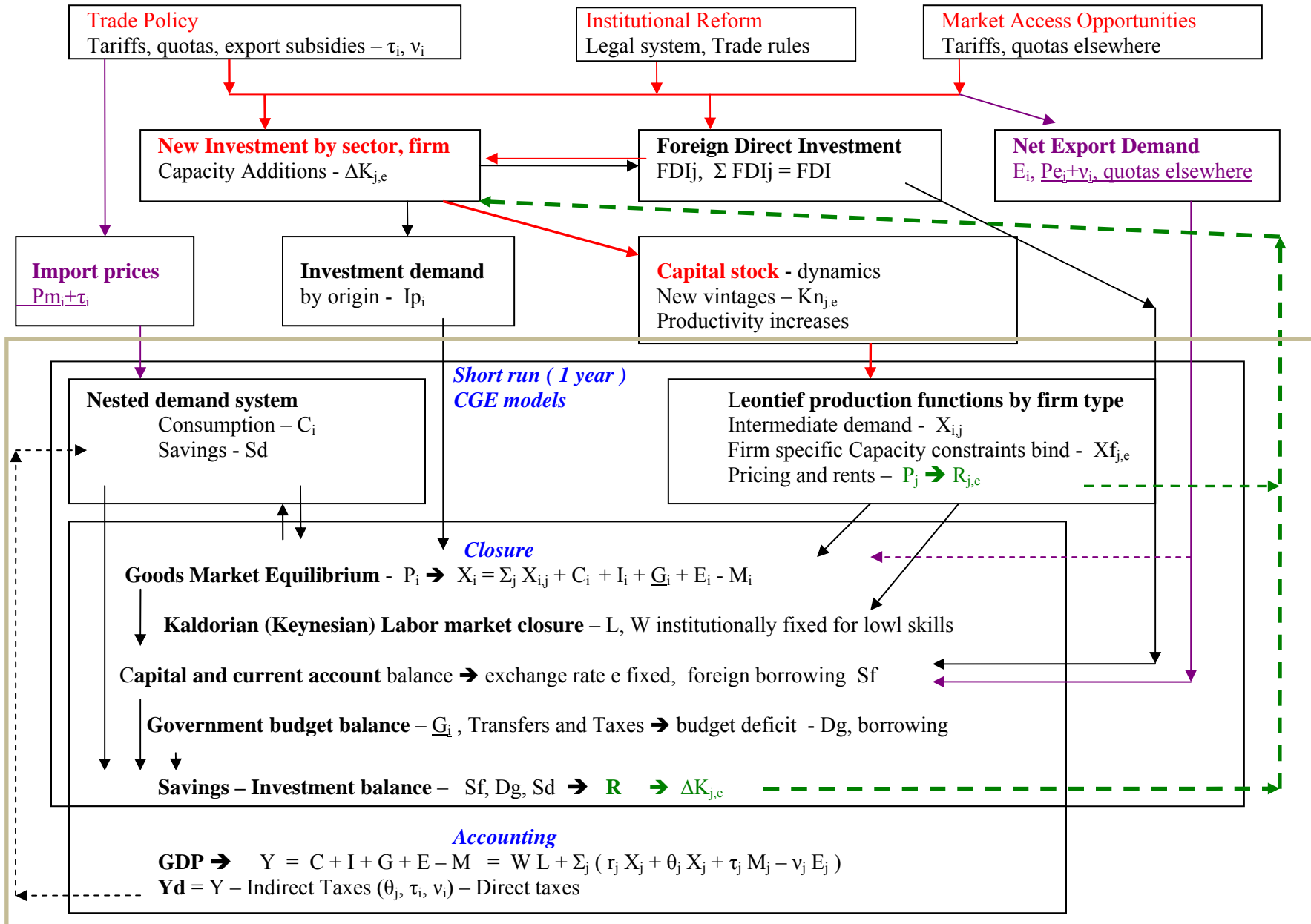


Figure 4. Macro SAM

	Goods						Aggregated Labor				Enterprises	Households		Government		ROW		Capital/ financial account	Savings Investment balance	TOTALS										
	Agr E	Agr M	Manf E	Manf M	Energy	Services	Intermediates	Educated	Technical	Unskilled		SOE FI & Priv	Rural	Urban	Budget	Public Invst	Current													
Goods																														
Agr E	Intermediate demands																													
Agr M																														
Manf E																														
Manf M																														
Energy																														
Services																														
Aggregated goods	Intermediate costs																													
Labor																														
Educated	Labor costs																													
Technical																														
Unskilled																														
Enterprises																														
Rents	Rents to capital and land				Rj,e Xj																									
Households																														
Rural	Wages																													
Urban																														
Government																														
Budget	Indirect Taxes - VAT, sales, production																													
	Tariffs																													
Public saving-investment																														
ROW																														
Current account	Imports																													
	Mj Pwmj e																													
Capital/financial account																														
Savings Investment balance -																														
Private domestic																														
TOTALS	Supply																													
	(Xj + Mj) Pj																													

	Consumption	Government Consumption	Public Investment	Exports	Investment by origin & Inventories	Demand
C	C	G	lg	E	lp + lv	
LES system	C	G	lg	E	lp + lv	

	FDI inflows	Capital payments
FDI inflows	FDI inflows	Capital payments

	Wages	Dividends	Transfers & Govt domestic int	Remittances NFP, nie	Household income
Wages	Wages	Dividends	Transfers & Govt domestic int	Remittances NFP, nie	Household income

	Enterprise income & capital taxes	Personal income taxes	Govt Foreign transfers Grants, Aid	Govt Revenue
Enterprise income & capital taxes	Enterprise income & capital taxes	Personal income taxes	Govt Foreign transfers Grants, Aid	Govt Revenue

	Public savings	Public foreign borrowing (ODA)	Public domestic borrowing	Govt Invest expenditure
Public savings	Public savings	Public foreign borrowing (ODA)	Public domestic borrowing	Govt Invest expenditure

	Repatriated earnings	Govt foreign interest	Net FX receipts
Repatriated earnings	Repatriated earnings	Govt foreign interest	Net FX receipts

	Current account deficit	Reserves increases & Short term capital	Capital account surplus
Current account deficit	Current account deficit	Reserves increases & Short term capital	Capital account surplus

	Reinvest Retained earnings & FDI inflows	Private Domestic Savings	Private foreign borrowing	Private & Enterprise savings
Reinvest Retained earnings & FDI inflows	Reinvest Retained earnings & FDI inflows	Private Domestic Savings	Private foreign borrowing	Private & Enterprise savings

	Labor expenditure	Capital income	Household income	Gov't revenue	Govt Invest expenditure	Net FX receipts	Capital account surplus	Private & Enterprise savings
Labor expenditure	Labor expenditure	Capital income	Household income	Gov't revenue	Govt Invest expenditure	Net FX receipts	Capital account surplus	Private & Enterprise savings

Figure 5. Ex-SAM Model Components

	Goods						Aggregated				
	Agr E	Agr M	Manf E	Manf M	Energy	Services					
Investment by destination - Capacity							I private				
State owned	dK j,e						I _p				
Foreign invested											
Private											
Domestic Output											
State owned	X _{f j,e}										
Foreign invested											
Private											
Total	X _j										
Prices											
Exchange rate	ex										
Border E	P _{we}										
M											
Tariff	T										
Domestic	P										
Rent	R										
Wages											
Educated	W _I										
Technical	W _{I,j}										
Unskilled											
Employment							Labor Demand & Supply			Unemployment	
Educated	B _{I,j} X _j						L _d			L _s	U
Technical											
Unskilled											

Table 1. Vietnamese Macroeconomic Indicators							
	<i>Units</i>	1986	1993	1998	2002	2004	2006
GDP	Trillion Dong		140.1	361.0	535.8	715.3	973.8
Consumption	Trillion Dong		106.4	255.9	348.7	465.5	668.5
Investment	Trillion Dong		34.0	104.9	178.0	253.7	347.9
Government Cons.	Trillion Dong		10.3	27.5	33.4	45.7	57.3
Exports	Trillion Dong		40.3	161.9	304.3	470.2	715.4
Imports	Trillion Dong		52.6	188.3	331.9	524.2	747.8
Miscellaneous Performance Indicators							
GDP Growth Rate	%/year	2.8	8.07	5.76	7.08	7.79	8.17
GDP per capita	2000 PPP \$	807	1056	1448	1780	2002	2290
Poverty	headcount %		15.0	3.7	2.0		
Trade	as % of GDP	23	66	97	115	140	150
Capital-output ratio	Real, Incremental		1.18	2.22	2.21	2.36	
Exchange Rate	Dong/\$	0.023	10.641	13.297	15.272	15.745	15.994
Population	Millions	60.5	70.5	76.5	80.9	83.1	84.2
Savings-Investment Balance			1995	1998	2002	2004	2006
Investment budgets	Trillion Dong		72	117.1	200.1	290.9	398.9
State	% of Investment budget		42%	56%	57%	48%	46%
Budget			19%	22%	25%	24%	25%
Off budget			18%	16%	17%	12%	10%
SOEs			5%	17%	15%	12%	11%
Private			58%	44%	43%	52%	54%
Foreign invested			30%	24%	25%	38%	38%
Domestic			28%	21%	17%	14%	16%
Savings							
State (on current expense)			25%	45.4%	37.7%	32.7%	29%
Private			35%	32.8%	37.4%	46.4%	53%
Household					19.2%		
Corporate					18.2%		
Foreign			41%	21.8%	24.9%	20.9%	18.0%
FDI			35%	9.1%	16.1%	10.0%	9.6%
ODA			3%	9.0%	8.5%	7.9%	5.5%
Reserves			0%	-0.2%	-9.8%	-18.8%	-17.3%
Sources: GSO website http://www.gso.gov.vn/default_en.aspx?tabid=491							
IMF, <i>International Financial Statistics</i> and IMF Country Report 07/386 for Vietnam							
Calculations using accounting identities for savings sources and capital -output ratios							
2006 data are preliminary estimates							

1

2

3 **Table 2. MODEL NOMENCLATURE**
4

<i>I. Sets</i>	
<hr/>	
i, j	Goods
im	Imported goods
ie	Exported goods
ih	Home goods
f	Enterprise (Firm) Type
SOE	State Owned Enterprise (SOE)
FI	Foreign Invested
$Priv$	Private
l	Labor Types
lu	Unskilled
lm	Semi (Medium) skilled
lh	Highly skilled
h	Household Types
RF	Rural farm
RI	Rural informal
RW	Rural wage
UF	Urban farm
UI	Urban informal
UW	Urban wage
t	Time
<hr/>	
<i>II. Endogenous Variables</i>	
<hr/>	
$BgDf_t$	Government budget deficit in time t
$Brwdg_t$	Domestic public borrowing in time t
$C_{i,t}$	Sector i levels of consumption demand in time t
$E_{i,t}$	Sector i exports in time t
$Ip_{i,t}$	Investment demand (private) for sector i products (origin) in time t
$Iv_{i,t}$	Inventories of good i in time t (home goods inventories are endogenous)
$Ld_{l,t}$	Demand of labor type l in time t
$M_{i,t}$	Sector i imports in time t
NFP_t	Net factor payments in time t
$P_{i,t}$	Domestic Price of good i in time t
$Pwe_{i,t}$	World price of exported good i in foreign currency
$Pwm_{i,t}$	World price of imported good i in foreign currency

$R_{i,t}$	Rent to capital (and land) to firm f in sector i in time t
Res_t	Reserves increases in time t
$Sc_{f,t}$	Firm (corporate) savings (retained earnings) by firm type f in time t
Sf_t	Foreign saving in time t
Sg_t	Public saving (on current spending) in time t
$Sh_{h,t}$	Domestic savings by household type h in time t
Tax_t	Tax revenue in time t
$U_{l,t}$	Unemployment rate by labor type l in time t
$X_{i,t}$	Sector i output quantity in time t
$Xf_{i,f,t}$	Firm output by firm type f in sector i in time t
$Yd_{h,t}$	Domestic disposable income in household h time t
$Yh_{h,t}$	Household income (before personal taxes) in household h in time t
$Yf_{f,t}$	Income of firm type f in time t

III. Exogenous Variables¹

$\Delta K_{i,f,t}$	Change in capital stock in sector i by firm type f in time t
$Brwfg_t$	Foreign public borrowing in time t
$Brwfp_t$	Foreign private borrowing (net) in time t
ex_t	Exchange rate in period t ; fixed exchange rate regime assumed
$Eo_{i,t}$	Exogenous exports for sector i in time t (initial year and backflows)
FDI_t	Foreign Direct Investment by sector i in time t
Fr_t	Foreign public interest payments in time t
$G_{i,t}$	Government consumption demand from sector i in time t
$Ig_{i,t}$	Public investment (infrastructure) demand for sector i (origin) in time t
Ipo_i	Initial year private investment demand for sector i
$Ivo_{i,t}$	Initial and exogenous inventories of good i in time t
$Ls_{l,t}$	Supply (endowment) of workers of skill l in time t
$Mo_{i,t}$	Exogenous imports for sector i in time t (initial year and backflows)
$OfTrn_t$	Official Foreign transfers (ODA) in time t
$Po_{ih,t}$	Home goods prices for good ih
$Pweo_{i,t}$	World price of exported good i in foreign currency
$Pwmo_{i,t}$	World price of imported good i in foreign currency
$RMT_{h,t}$	Remittances to household h in time t
$RpErn_{f,t}$	Earnings repatriated by firm f in time t
$Trn_{h,t}$	Transfer payments to household h in time t
$W_{i,l,f,t}$	Wage for labor type l in sector i by firm type f in time t

IV. Behavioral Parameters

$\alpha_{i,j}$	Input-output coefficients
$\beta_{i,l,f}$	Labor-output ratio for labor type l by sector i and firm type f
$\delta_{i,f}$	Depreciation of capital
$\kappa_{i,f}$	Incremental capital-output ratio's by sector i and enterprise type f
σh_h	Average propensity to save by households
$my_{i,h}$	Marginal budge share of good i (<i>income elasticity*budget share</i>)
$retf_f$	Retained earnings by enterprise type f
$shareL_{h,l}$	Share of labor income of skill type l accruing to household type h
$shareK_h$	Share of capital income accruing to household type h
$subs_{i,h}$	Subsistence share of good i
Tf_f	Tax rate on corporate income and factors (land and capital)
Th_h	Tax rate on household income, need corporate, factor taxes
$Tm_{i,t}$	Import tariff on sector i
Tv_i	Indirect taxes- VAT, sales tax , production tax

¹Exogenous variables are over-scored (\bar{X}) in the algebraic specification of the model.

Table 3. ALGEBRAIC SPECIFICATION OF THE MODEL

Goods Market Equilibrium

$$X_{i,t} + M_{i,t} = \sum_j (\alpha_{j,i} \cdot X_{j,t}) + C_{i,t} + (\overline{G}_{i,t} + Ip_{i,t} + Iv_{i,t} + \overline{I}g_{i,t}) / P_{i,t} + E_{i,t} \quad [1]$$

Supply-utilization equilibrium

$$X_{i,t} = \sum_f Xf_{i,f,t} \quad [2]$$

Output by firms sum to total output

$$Xf_{i,f,t} = Xf_{i,f,t-1} \cdot (1 - \delta_{i,f}) + (\overline{\Delta K}_{i,f,t-1} / \kappa_{i,f}) \quad [3]$$

Output determined by capacity additions

$$R_{i,t} = P_{i,t} - \sum_j \alpha_{j,i} \cdot P_{j,t} - \sum_f \sum_l (\overline{W}_{i,f,l,t} \cdot \beta_{i,f,l} \cdot Xf_{i,f,t} / X_{i,t}) - P_{i,t} \cdot Tv_i \quad [4]$$

Rents to firms

$$Ip_{i,t} = \left(\sum_j \sum_f \overline{\Delta K}_{j,f,t} \right) \cdot \overline{Ipo}_i / \sum_i \overline{Ipo}_i \quad [5]$$

Investment by origin determined proportionally by gross investment by destination

$$C_{i,t} = \sum_h subs_{i,h} + \sum_h my_{i,h} \cdot (Yd_{h,t} - Sh_{h,t} - \sum_j P_{j,t} \cdot subs_{j,h}) / P_{i,t} \quad [6]$$

Consumption demand; demand characterized by the standard LES system

Labor markets

$$Ld_{l,t} = \sum_i \sum_f B_{i,l,f} \cdot Xf_{i,f,t} \quad [7]$$

Labor Demand

$$U_{l,t} = 1 - Ld_{l,t} / \overline{Ls}_{l,t} \quad [8]$$

Unemployment rate

Foreign exchange market

$$\sum_i \left(\overline{ex}_t \cdot E_{i,t} \cdot Pwe_{i,t} - M_{i,t} \cdot Pwm_{i,t} \right) + NFP_t = Re s_t - \overline{FDI}_t - \overline{Brwfg}_t - \overline{Brwfp}_t \quad [9]$$

Foreign Exchange Balance

$$NFP_t = \sum_h \overline{RMT}_{h,t} + \overline{OfTrn}_t - \overline{Fr}_t - \sum_f \overline{RpErn}_{f,t} \quad [10]$$

Net Factor Payments

Government budget Balance – current expenses

$$Sg_t = Tax_t - \sum_i \overline{G}_{i,t} - \sum_h \overline{Trn}_{h,t} + \overline{OfTrn}_t - \overline{Fr}_t \quad [11]$$

Government budget

$$Tax_t = \sum_i \left((X_{i,t} + M_{i,t}) \cdot P_{i,t} \cdot Tv_i + \overline{ex}_t \cdot M_{i,t} \cdot Pwm_{i,t} \cdot Tm_{i,t} + \sum_f (Tf_f \cdot R_{i,t} \cdot Xf_{i,f,t}) \right) + \sum_h Th_h \cdot Yh_{h,t} \quad [12]$$

Tax Revenue

Agent income accounting

Households

$$Y_{h,t} = \sum_l \left(shareL_{h,l} \cdot \sum_f \bar{W}_{i,l,f,t} \cdot \beta_{i,l,f} \cdot X_{f,i,f,t} \right) + shareK_h \cdot \sum_f (Y_{f,t}^f - Sc_{f,t}) + \overline{Trn}_{h,t} + \overline{RMT}_{h,t} \quad [13]$$

Household income

$$Yd_{h,t} = Y_{h,t} \cdot (1 - Th_h) \quad [14]$$

Gross household disposable income

Firms

$$Y_{f,t}^f = \sum_i \left((1 - Tf_f) \cdot R_{i,t} \cdot X_{f,i,f,t} \right) - \overline{RpErn}_{f,t} \quad [15]$$

Net firm income

Savings-Investment balance

Public

$$\sum_i \bar{I}g_{i,t} = Sg_t + BgDf_t \quad [16]$$

Public savings investment balance.

$$BgDf_t = \overline{Brwfg}_t + Brwdg_t \quad [17]$$

Public borrowing

Private

$$\sum_i (Ip_{i,t} + Iv_{i,t}) = \sum_h Sh_{h,t} + \sum_f Sc_{f,t} + Sf_t - Brwdg_t \quad [18]$$

Private savings-investment balance. Omitted in model solution due to Walrus' Law.

$$Sf_t = \overline{FDI}_t + \overline{Brwfp}_t + Res_t \quad [19]$$

Foreign saving investment balance. Foreign saving = FDI inflows + private foreign borrowing - reserves accumulation

$$Sh_{h,t} = \sigma_h \cdot Yd_{h,t} \quad [20]$$

Household saving

$$Sc_{f,t} = (Yf_{f,t} + \overline{RpErn}_{f,t}) \cdot retf_f \quad [21]$$

Firm corporate savings

Prices

$$P_{im,t} = \overline{ex}_t \cdot \overline{Pwmo}_{i,t} \cdot (1 + Tm_{i,t}) \cdot 1 / (1 - Tv_i) \quad [22]$$

Domestic price of imported goods

$$P_{ie,t} = \overline{ex}_t \cdot \overline{Pweo}_{i,t} \quad [23]$$

Domestic price of exported goods

$$P_{ih,t} = \overline{Po}_{ih,t} = 1.0 \quad [24]$$

Domestic price of home goods

$$Pwm_{i,t} = P_{i,t} / \overline{ex}_t \cdot (1 + Tm_{i,t}) \cdot 1 / (1 - Tv_i) \quad [25]$$

Import prices for exportable and home goods are consistent with variable domestic prices

$$Pwe_{i,t} = P_{i,t} / \overline{ex}_t \quad [26]$$

Export prices for importable and home goods are consistent with variable domestic prices

Trade Flows

Tradable Goods

$$M_{ie,t} = \overline{Mo}_{ie,t} \quad [27]$$

$$E_{im,t} = \overline{Eo}_{im,t} \quad [28]$$

Backflows are exogenous

Home Goods

$$M_{ih,t} = \overline{Mo}_{ih,t} \quad [29]$$

$$E_{ih,t} = \overline{Eo}_{ih,t} \quad [30]$$

Trade in home goods is exogenous

Inventories

$$Iv_{im,t} = \overline{Ivo}_{im,t} \quad [31]$$

$$Iv_{ie,t} = \overline{Ivo}_{ie,t} \quad [32]$$

Inventories of importables and exportables are exogenous

Table 4. Aggregation Scheme and Concordance of Investment Model Economic Sectors

Investment Model Sectors			Vietnam 112 Sector Aggregation
6 Sector Aggregation	Trade Status ¹	35 Sector Aggregation	Sector Number and Description
Agriculture Export	E	1. Rice (paddy, processed)	001. Paddy (all kinds) 035. Rice, processed
	E	2. Fish, Seafood and seafood byproducts	014. Fishery 015. Fish-Farming 034. Processed seafood and by-products
	E	3. Major Export Oriented Crops	002. Raw rubber 003. Coffee beans 005. Tea 032. Tea, processed
	E	4. Processed Agricultural Exports	026. Processed and preserved fruits and vegetables 036. Other fruit manufactures 052. Processed rubber and by-products
	E	5. Other Crops	006. Other crops
Agriculture Home/Import	M	6. Sugar and Animal Feed	004. Sugarcane 030. Sugar, refined 082. Animal feeds
	M	7. Livestock and livestock products	007. Pig (all kinds) 008. Cow (all kinds) 009. Poultry 010. Other livestock and poultry 022. Processes, preserved meat and by-products
	M	8. Forestry	013. Forestry
	M	9. Processed agri-food sector products	023. Processed vegetable, and animal oils and fats
			024. Milk, butter and other dairy products 025. Cakes, jams, candy, coca, chocolate products 027. Alcohol and liquors 028. Beer 029. Non-alcohol water and soft drinks 031. Coffee, processed 033. Cigarettes and other tobacco products 080. Products of leather tanneries
Manufacturing Export	E	10. Ready made clothes; fiber, carpets	077. Ready-made clothes, sheets (all kinds) 078. Carpets 079. Weaving and embroidery of textile-based goods (excepts carpets)
	E	11. Leather goods	081. Leather goods
	E	12. Processed wood and wood products	044. Processed wood and wood products

Manufacturing Home/Import	M	13. Other (potential) manufactured export goods	037. Glass and glass products 038. Ceramics and by-products 064. Bicycles and spare parts 065. General-purpose machinery 066. Other general-purpose machinery 070. Electrical machinery 071. Other electrical machinery and equipment
	M	14. Building materials (bricks, tiles, cement etc.)	039. Bricks, tiles 040. Cement 041. Concrete, mortar and other cement products 042. Other building materials
	M	15. Pulp & Paper Products, Paper By-Products	043. Paper pulp and paper products and by-products
	M	16. Chemical Industries	045. Basic organic chemicals 046. Basic inorganic chemicals 047. Chemical fertilizer 048. Fertilizer 049. Pesticides 053. Soap, detergents 054. Perfumes and other toilet preparations 057. Paint 058. Ink, varnish and other painting materials 059. Other chemical products
	M	17. Home Appliances and Spare Parts	062. Home appliances and its spare parts
	M	18. Processed Plastic & Plastic Products	055. Plastic (including semi-plastic products) 056. Other plastic products
	M	19. Ferrous and Non-ferrous metals & metal products	073. Non-ferrous metals and products 074. Ferrous metals and products (except machinery equipment)
	M	20. Weaving of cloth (all kinds), fiber (thread)	075. Weaving of cloths (all kinds) 076. Fibber, thread (all kinds)
	M	21. Special purposes machinery and equipment	060. Health instrument and apparatus 061. Precise and optics equipment, meter (all kinds) 072. Machinery used for broadcasting, television and information Activities
	M	22. Automobiles; Motor vehicles, motorbikes, parts	063. Motor vehicles, motor bikes and spare parts 067. Other special-purpose machinery 068. Automobiles
	M	23. Other manufactured goods	050. Veterinary medicine 051. Health medicine 069. Other transport means 083. Products of printing activities 084. Products of publishing house 085. Other physical goods

Energy & Resources	M	24. Electricity, gas; (Refined) Gasoline and lubricants	086. Gasoline, lubricants (already refined) 087. Electricity, gas
	E	25. Mining and quarrying ; Water	016. Coal 017. Metallic ore 018. Stone 019. Sand, gravel 020. Other non-metallic minerals 088. Water
	E	26. Crude oil, natural gas (except exploration)	021. Crude-oil, natural gas (except exploration)
Services	H	27. Air, road, railway and water transportation	095. Transportation 096. Railway transport services 097. Water transport services 098. Air transport services 113. Domestic marketing margins
	E	28. Communication	099. Communication services
	M	29. Financial Services	101. Banking, credit, treasury 103. Insurance
	H	30. Real Estate, Real estate business and consultancy	105. Real estate 106. Real estate business and consultancy services
	H	31. Trade (Wholesale, Retail)	091. Trade 114. Export marketing margins
	H	32. Construction (Civil, Other)	089. Civil construction 090. Other construction
	M	33. Social Services and Defense	107. State management, defense and compulsory social services 108. Education and training 109. Health care, social relief 110. Culture and sport 111. Association
Services	H	34. Agricultural Services (Irrigation, Other)	011. Irrigation service 012. Other agricultural services
	E	35. Other Services	092. Repair of small transport means, motorbikes and personal household appliances 093. Hotels 094. Restaurants 100. Tourism 102. Lottery 104. Science and technology 112. Other services

Notes:

¹ Sectors are classified as being dominated by exports (E), imports (I), or home (H) goods.

Table 5. Base 2000 SAM

Macro SAM 2000	Goods						Aggregated	Labor			Enterprises	Households		Government		ROW	Capital/ financial account	Savings Investment balance	TOTALS	
	Agr E	Agr H&M	Manf E	Manf M	Energy	Services	Intermediates	Educated	Technical	Unskilled	SOE F1 & Priv	Rural	Urban	Budget	Public Invs	Current		Private domestic		
Goods	1 - 5	6 - 9	10 - 12	13 - 23	24 - 26	27 - 35														
Agr E	80,122	9,416	2,012	1,485	95	3,599	96,729					63,899	23,883	0	0	59,001		6,545	250,057	
Agr M	1,760	19,656	11,042	760	110	4,758	38,085					36,722	24,992	0	0	5,641		2,505	107,944	
Manf E	1,449	1,114	13,798	837	1,255	18,168	36,620					14,307	6,483	0	0	56,578		776	99,858	
Manf M	19,610	10,016	28,158	91,908	4,117	81,823	235,632					19,581	18,346	0	3,200	33,907		29,391	354,964	
Energy	7,991	2,799	1,851	12,135	8,512	23,989	57,277					2,870	4,349	0	0	52,970		1,233	118,698	
Services	32,773	13,047	19,135	34,134	9,953	127,485	236,527					31,160	29,773	45,567	24,533	33,798		63,295	464,654	
Aggregated goods	143,705	56,047	75,996	141,260	24,041	259,821	700,870					168,538	107,826	45,567	27,734	241,895		103,746		
Labor																				
Educated	1,169	714	441	1,413	1,913	9,072													14,722	
Technical	6,339	2,745	1,023	3,583	4,659	21,312													39,661	
Unskilled	39,593	14,711	3,456	13,616	16,818	73,196													161,390	
Enterprises																				
Rents	42,019	12,795	5,212	15,782	30,233	59,054												7,085	172,181	
Households																				
Rural								1,638	15,190	108,380	49,012									192,777
Urban								13,084	24,471	53,010	32,755				13,002		5,554		146,509	
Government																				
Budget	10,451	8,131	3,055	5,048	3,366	17,132														
Public saving-investment	450	1,057	482	6,389	5,217	0					22,370	766	1,065			1,927			86,906	
ROW																				
Current account	6,332	11,745	10,192	167,873	32,449	25,067														262,118
Capital/financial account																				
Savings Investment balance -																				
TOTALS	250,057	107,944	99,858	354,964	118,698	464,654		14,722	39,661	161,390	172,181	192,777	146,509	86,906	27,734	262,118	17,415	125,335		

Table 6. Projected 2005 SAM

Macro SAM 2005	Goods							Aggregated	Labor			Enterprises	Households		Government		ROW	Capital/ financial account	Savings Investment balance Private domestic	TOTALS
	Agr E	Agr M	Manf E	Manf M	Energy	Services	Intermediates	Educated	Technical	Unskilled	SOE Fl & Priv	Rural	Urban	Budget	Public Invs	Current				
Goods	1 - 5	6 - 9	10 - 12	13 - 23	24 - 26	27 - 35														
Agr E	134,619	18,081	4,424	3,711	235	6,496	167,567					101,202	34,493	0	0	111,440		11,004	425,706	
Agr M	3,689	47,810	36,765	1,905	319	11,981	102,468					76,600	52,033	0	0	13,126		3,419	247,646	
Manf E	2,445	1,988	29,229	1,995	2,784	33,740	72,180					24,442	10,685	0	0	140,484		1,339	221,699	
Manf M	29,622	21,486	59,439	235,692	10,254	169,481	525,975					31,334	28,619	0	14,299	87,350		159,670	874,677	
Energy	34,465	11,006	9,052	55,002	44,700	78,576	232,802					7,104	9,920	0	0	171,492		633	421,951	
Services	50,413	22,588	39,832	75,897	22,515	121,264	332,508					49,379	53,563	33,335	109,608	66,572		7,064	652,029	
Aggregated goods	255,253	122,960	178,741	374,201	80,807	421,538	1,433,499					290,061	189,314	33,335	123,907	590,463		183,128		
Labor																				
Educated	1,808	1,326	953	3,223	4,372	12,802													24,484	
Technical	9,546	4,763	2,204	8,176	10,641	29,741													65,072	
Unskilled	59,066	24,532	7,394	31,065	38,379	100,498													260,933	
Enterprises																				
Rents	59,953	103,689	-2,354	-32,688	158,314	3,749												22,621	313,284	
Households																				
Rural								2,724	24,922	175,227	65,301									331,556
Urban								21,760	40,150	85,706	43,641									257,090
Government																				
Budget	17,815	21,221	6,816	11,933	11,379	26,409					29,408	1,320	1,868							161,845
Public saving-investment	1,667	-3,636	1,178	14,292	16,536	0														
															42,149			16,088	65,671	123,907
ROW																				
Current account	20,597	-27,208	26,767	464,476	101,523	57,292					15,408				4,603					663,458
Capital/financial account																				
Savings Investment balance -																				
TOTALS	425,706	247,646	221,699	874,677	421,951	652,029		24,484	65,072	260,933	313,284	331,556	257,090	161,845	123,907	663,458	44,727	271,626		

Table 7. Base Model Macroeconomic Performance Indicators

Year		GDP	Consumption	Government Spending	Investment	Exports	Imports
2005	Actual	634,212	403,558	39,097	225,980	582,069	617,157
	Projected	766,790	479,394	33,335	307,032	590,432	643,403
	Difference (%)	20.9%	18.8%	-14.7%	35.9%	1.4%	4.3%

Table 8. Base Model 35 Sector Net Trade Projections

Brief Description	Difference between Actual and Predicted (%)					Total Across 2000-2005		
	2001	2002	2003	2004	2005	Actual	Predicted	Difference
1 Rice	8.4	36.8	32.4	-23.2	-9.2	77,032	79,918	3.7%
2 Fish & Seafood	1.0	5.8	14.2	0.8	-9.3	233,991	236,312	1.0%
3 Export Crops	-4.9	24.8	20.7	0.0	13.2	62,942	68,414	8.7%
4 Processed Exports	537.5	610.0	2004.4	65.9	386.6	8,755	37,831	332.1%
5 Other Crop	-41.5	-125.6	-208.4	-174.0	-117.6	41,911	-3,018	-107.2%
6 Sugar	-284.3	-229.1	-186.6	-144.2	-126.3	-7,429	6,291	-184.7%
7 Livestock & Meat	-538.4	-1391.4	-4651.1	-2530.3	-510.5	4,798	-34,705	-823.4%
8 Forestry	53.0	-65.5	-39.6	-23.3	-23.2	-9,425	-6,396	-32.1%
9 Processed agrifood products	6.0	-2.4	-106.0	-208.7	-318.7	-83,154	48,700	-158.6%
10 Clothes	6.2	1.6	-2.7	12.9	24.3	220,977	241,195	9.1%
11 Leather Goods	34.0	31.4	-12.7	-11.5	13.3	169,416	178,963	5.6%
12 Wood & wood products	-33.6	-51.4	-51.8	-49.6	-65.0	57,741	29,841	-48.3%
13 Other mnfg export goods	104.3	44.3	0.8	19.0	45.2	-114,664	-147,937	29.0%
14 Building materials	205.4	236.8	-293.8	-131.8	-14.8	-13,046	-9,895	-24.2%
15 Pulp & Paper	-24.9	-27.9	-45.4	-44.5	-56.3	-46,872	-28,081	-40.1%
16 Chemical Industries	11.5	-5.6	-20.4	-25.9	-45.4	-188,617	-149,878	-20.5%
17 Appliances & Parts	-55.5	-59.1	-125.2	-113.3	-90.8	-3,228	-559	-82.7%
18 Plastic & plastic prod.	-4.4	-23.1	-32.3	-43.6	-11.5	-95,580	-73,467	-23.1%
19 Metals & metal prod.	30.4	16.6	16.8	48.7	189.6	-235,316	-382,815	62.7%
20 Weaving	-4.2	-38.7	-40.4	-31.8	-44.2	-205,338	-137,590	-33.0%
21 Machinery	26.6	20.3	1.7	0.6	47.4	-220,760	-256,116	16.0%
22 Autos & Motorbikes	-23.0	-11.8	-17.9	3.1	-34.0	-106,572	-89,702	-15.8%
23 Other mnfg goods	162.5	75.3	9.8	-13.2	-21.3	-118,934	-131,800	10.8%
24 Electricity & Gasoline	3.0	-25.4	-14.6	-15.3	41.7	-236,403	-244,948	3.6%
25 Mining	-122.2	-177.4	-331.2	-142.4	1601.5	9,057	-4,319	-147.7%
26 Oil & Natural Gas	64.4	101.8	77.3	70.3	39.5	420,418	664,243	58.0%
27 Transportation	0.0	0.0	0.0	0.0	0.0	12,220	12,220	0.0%
28 Communication	-102.3	-139.8	-133.0	-12.2	72.0	14,954	8,297	-44.5%
29 Finance	-17.4	-50.1	-44.3	-47.5	-55.5	-19,555	-11,572	-40.8%
30 Real estate	0.0	0.0	0.0	0.0	0.0	-9,818	-9,818	0.0%
31 Trade	0.0	0.0	0.0	0.0	0.0	0	0	0.0%
32 Construction	0.0	0.0	0.0	0.0	0.0	0	0	0.0%
33 Social Services	52.5	82.6	116.3	114.1	139.7	-43,845	-85,589	95.2%
34 Agricultural Services	0.0	0.0	0.0	0.0	0.0	0	0	0.0%
35 Other Services	5.1	-10.6	14.5	20.7	59.4	83,941	98,650	17.5%
Correlation Across Sectors	96.8	93.2	94.0	92.7	87.6	0.0	0	95.3

Table 9. Base Model Aggregated Sector Net Trade Predictions

Brief Description	Difference between Actual and Predicted (%)					Total Across 2000-2005		
	2001	2002	2003	2004	2005	Actual	Predicted	Difference
Agricultural Exports	1.8	13.0	12.8	-17.3	-6.5	424,631	419,457	-1.2
Agricultural Imports	27.8	39.6	-60.8	-152.3	-251.3	-95,211	13,889	-114.6
Manufacturing Exports	11.1	4.0	-12.5	-3.6	7.9	448,134	449,999	0.4
Manufacturing Imports	26.3	5.9	-11.7	-3.0	15.0	-1,348,927	-1,407,839	4.4
Energy	123.2	207.9	153.6	161.7	43.1	193,073	414,975	114.9
Services	130.8	88.6	121.3	80.5	69.3	-46,042	-86,461	87.8

Table 10. Sensitivity Analysis – Summary of Sensitivity Testing Performed

Variable	Symbol	Test Number	Description of Variation
Household propensity to save	σh_h	Baseline	Estimated from baseline SAM
		1	Shock: Increase savings by 10% over base year for all h^1
Retained Earnings	$retf_{i,f}$	Baseline	Estimated from baseline SAM
		2	Shock: Increase retained earnings by 10% for all f
Marginal Budget Share	$my_{i,h}$	Baseline	Estimated using values from Huong (2000) using data from the Vietnam Living Standards Survey.
		3	Literature Based: Modification of assumptions concerning HH income elasticity of demand; use elasticities derived by Cranfield <i>et al.</i> , 2004.
Relative Wage Levels	$W_{i,l,f,t}$	Baseline	Estimated using data from the Vietnam Living Standards Survey and the baseline SAM.
		4a	Shock: Increase wages by 10% for all l
		4b	Theory based: Increase high-skilled wages (10%) relative to medium-and low-skilled wages
Depreciation of Capital	$\delta_{i,f}$	Baseline	Depreciation assumed to be 10% per annum. Depreciation rates assumed to be the same across all firm types and sectors.
		5a	Quantitative Shock: Depreciation decreased to 7.5% in all sectors across all firm types
		5b	Sector Specific: Depreciation rates adjusted by sector ² . $\delta_{Ag,f} = 5\%$; $\delta_{Mnfg,f} = \delta_{Svcs,f} = 10\%$
Incremental Capital-Output Ratios (ICOR)	$\kappa_{i,f}$	Baseline	Estimated over the baseline and projection period (2000-2005) using data from Vietnam's General Statistics Office (GSO).
		6	Estimated over the baseline and initial projection (2000-2001) using data from Vietnam's General Statistics Office (GSO).

Notes:

¹ Note: Level of HH savings rather than the direct rate of savings shocked)

² Aggregated sector categories are agriculture (Ag.), manufacturing (Mnfg.), Energy, and services (Svcs) sectors.

Table 11. Sensitivity Test Results – Macroeconomic Indicators

Measure	Test	GDP	Government		RoW	
			Revenue	Current Account	Savings	
	Baseline (BL)	3,203,701	645,034	2,317,348	1,101,773	
HH propensity to save	1	3,201,546	642,879	2,297,767	1,145,134	
	Δ from BL	0.07%	0.33%	0.84%	3.94%	
Retained Earnings	2	3,201,561	642,598	2,297,980	1,147,419	
	Δ from BL	0.07%	0.38%	0.84%	4.14%	
Marginal Budget Share	3	3,203,193	644,526	2,331,026	1,101,773	
	Δ from BL	0.016%	0.08%	0.59%	0.00%	
Wage Rate	4a	3,207,5	624,349	2,351,318	1,051,473	
	Δ from BL	0.12%	3.21%	1.47%	4.57%	
	4b	3,203,970	643,742	2,319,638	1,099,142	
	Δ from BL	0.01%	0.20%	0.10%	0.24%	
Depreciation of Capital	5a	3,286,099	659,224	2,338,503	1,123,263	
	Δ from BL	2.57%	2.20%	0.91%	1.95%	
	5b	3,289,496	657,072	2,313,356	1,127,986	
	Δ from BL	2.68%	1.87%	0.17%	2.38%	
Incremental Capital-Output Ratios (ICOR)	6	3,076,459	638,045	2,292,265	1,029,757	
	Δ from BL	3.97%	1.08%	1.08%	6.54%	

Notes: Values are denoted in billion VND. All reported results reflect the sum of that measure over the full projected period. For example, the value of ‘Baseline-GDP’ is the sum of Vietnam’s projected GDP from 2001-2005 (inclusive) under the assumptions of the baseline analysis.

Table 12. Sensitivity Test Results – Net Trade

Measure	Test	Aggregated Sector Trade												Total Net Trade Corr. (%)
		Agricultural Exports		Agricultural Imports		Manufacturing Export		Manufacturing Imports		Energy		Services		
		Level	Corr. (%)	Level	Corr. (%)	Level	Corr. (%)	Level	Corr. (%)	Level	Corr. (%)	Level	Corr. (%)	
	Baseline (BL)	419,457	95.52	13,889	-92.89	449,999	99.97	-1,407,839	88.28	414,975	99.27	12,188	96.77	95.32
HH propensity to save	1	428,114	95.66	22,068	-94.60	453,190	99.97	-1,401,479	88.15	416,224	99.26	23,685	97.54	95.32
	Δ from BL	2.06	0.142	58.90	-1.845	0.709	-0.001	0.452	-0.145	0.301	-0.011	94.326	0.795	-0.001
Retained Earnings	2	430,877	95.67	22,549	-94.64	453,728	99.97	-1,401,742	88.14	416,077	99.26	22,427	97.48	95.33
	Δ from BL	2.72	0.151	62.35	-1.884	0.829	-0.001	0.433	-0.162	0.266	-0.010	84.002	0.732	0.010
Marginal Budget Share	3	452,095	96.23	39,565	-96.74	451,333	99.97	-1,431,114	88.56	411,898	99.29	-18,168	93.37	95.55
	Δ from BL	7.78	0.741	184.87	-4.150	0.296	0.000	-1.653	0.316	-0.742	0.018	249.060	-3.514	0.235
	4a	402,937	95.25	-1,187	-88.79	443,771	99.97	-1,419,200	88.52	412,953	99.29	-3,660	95.28	95.32
	Δ from BL	-3.94	-0.290	108.55	4.415	-1.384	0.002	-0.807	0.275	-0.487	0.018	130.033	-1.534	-0.006
Wage Rate	4b	419,271	95.51	13,051	-92.67	449,760	99.97	-1,408,723	88.29	414,803	99.28	10,900	96.67	95.33
	Δ from BL	-0.04	-0.012	-6.04	0.239	-0.053	0.000	-0.063	0.013	-0.042	0.001	-10.571	-0.101	0.005
	5a	437,388	95.68	16,117	-93.32	458,120	99.95	-1,427,339	88.38	420,576	99.31	18,340	97.40	95.39
	Δ from BL	4.28	0.166	16.04	-0.464	1.805	-0.019	-1.385	0.110	1.350	0.034	50.473	0.657	0.066
Depreciation of Capital	5b	492,938	94.92	51,942	-97.51	445,211	99.97	-1,429,605	88.53	405,112	99.36	799	95.81	95.18
	Δ from BL	17.52	-0.636	273.98	-4.981	-1.064	-0.003	-1.546	0.283	-2.377	0.083	-93.445	-0.988	-0.146
Incremental Capital-Output Ratio	6	374,580	98.47	58,502	-97.60	415,078	99.83	-1,425,862	86.69	237,755	99.88	-13,292	94.52	95.61
	Δ from BL	-10.709	3.088	321.21	-5.073	-7.760	-0.141	-1.280	-1.800	-42.706	0.613	209.054	-2.325	0.301

Notes: Values are denoted in billion VND. Reported results reflect the sum of trade flows for the whole of the period under consideration (2000-2005).

'Corr.' denotes the correlation between the actual and model projected trade flows for the whole period under consideration (2000-2005).

Table 13. Sensitivity Test Results – Labor and Income Distribution

Measure	Test	Labor Demand (annual average)			Household Income (annual average)					
		High Skilled	Medium Skilled	Unskilled	Rural			Urban		
					Farm	Informal	Wage	Farm	Informal	Wage
	Baseline (BL)	2,020	7,144	43,221	183,503	55,590	33,476	20,176	105,715	83,538
HH propensity to save	1	2,020	7,144	43,221	183,503	55,590	33,476	20,176	105,715	83,538
	Δ from BL	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Retained Earnings	2	2,020	7,144	43,221	178,708	54,167	33,022	19,934	102,387	82,649
	Δ from BL	0.000%	0.000%	0.000%	-2.613%	-2.560%	-1.357%	-1.197%	-3.148%	-1.065%
Marginal Budget Share	3	2,020	7,144	43,221	183,503	55,590	33,476	20,176	105,715	83,539
	Δ from BL	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Wage Rate	4a	2,020	7,144	43,221	188,525	57,704	35,771	21,194	107,265	89,947
	Δ from BL	0.000%	0.000%	0.000%	2.737%	3.803%	6.855%	5.047%	1.466%	7.671%
	4b	2,020	7,144	43,221	183,248	55,507	33,532	20,185	105,864	84,812
	Δ from BL	0.000%	0.000%	0.000%	-0.139%	-0.150%	0.166%	0.045%	0.141%	1.525%
Depreciation of Capital	5a	2,070	7,316	44,288	187,926	57,024	34,324	20,591	108,127	85,445
	Δ from BL	2.488%	2.412%	2.468%	2.410%	2.580%	2.531%	2.059%	2.281%	2.282%
	5b	2,041	7,266	44,297	188,243	57,095	34,289	20,585	108,303	85,097
	Δ from BL	1.023%	1.715%	2.490%	2.583%	2.707%	2.429%	2.028%	2.448%	1.866%
Incremental Capital- Output Ratios (ICOR)	6	1,975	6,957	43,134	179,004	54,118	32,568	19,733	103,314	81,450
	Δ from BL	-2.213%	-2.620%	-0.200%	-2.452%	-2.649%	-2.713%	-2.194%	-2.271%	-2.500%

Notes: All reported results reflect the sum of that measure over the full projected period. For example, rural farm household income is the sum of that household's projected income from 2001-2005. Household income is reported in billion VND. Labor demand in thousands.

Table 14. Returns to Capital and Firm Type Shares of Investment by Sector

Sector Brief Description	Rents / ICOR	Investment by Firm Type		
	Average ¹	Average (%) ¹		
		Foreign Invested	State Owned	Private
1 Rice	2.271	7.08	33.28	59.64
2 Fish & Seafood	0.450	15.29	34.03	50.69
3 Export Crops	0.199	10.37	68.19	21.44
4 Processed Exports	0.214	43.82	26.54	29.64
5 Other Crop	3.098	15.48	14.42	70.09
6 Sugar	0.117	24.90	49.78	25.32
7 Livestock & Meat	0.276	8.89	31.90	59.21
8 Forestry	0.041	14.89	52.16	32.95
9 Processed agrifood products	2.966	31.57	34.06	34.37
10 Clothes	0.715	49.82	23.86	26.32
11 Leather Goods	-0.033	72.82	8.28	18.90
12 Wood & wood products	0.760	27.18	18.73	54.08
13 Other mnfg export goods	0.039	50.83	19.81	29.36
14 Building materials	0.081	28.41	52.52	19.06
15 Pulp & Paper	0.026	24.39	35.94	39.68
16 Chemical Industries	-0.048	17.19	65.94	16.87
17 Appliances & Parts	-0.166	50.95	21.79	27.25
18 Plastic & plastic prod.	0.078	47.98	16.29	35.73
19 Metals & metal prod.	0.472	31.59	41.12	27.29
20 Weaving	-0.065	36.35	41.65	22.00
21 Machinery	-0.225	68.24	15.24	16.52
22 Autos & Motorbikes	-0.427	60.91	25.27	13.83
23 Other mnfg goods	0.480	30.68	51.28	18.03
24 Electricity & Gasoline	0.156	10.57	86.03	3.41
25 Mining	0.231	2.06	64.43	33.50
26 Oil & Natural Gas	2.126	22.11	77.89	0.00
27 Transportation	0.022	41.71	0.00	58.29
28 Communication	0.377	21.42	54.83	23.75
29 Finance	0.178	23.26	43.41	33.33
30 Real estate	0.560	35.96	33.76	30.29
31 Trade	0.239	19.92	23.46	56.62
32 Construction	0.301	15.22	54.32	30.46
33 Social Services	-0.043	36.54	0.00	63.46
34 Agricultural Services	0.021	22.86	0.00	77.14
35 Other Services	0.081	5.39	25.10	69.51
Average	0.445	20.2	42.8	37.0

Note:

¹ Simple average over the period 2000-2005

Table 15. Scenarios Exploring Investment Impacts by Firm Type and Role of the State

Issue	Test	Operationalization of Test
Does the origin of investment matter?	1.1 Increased investment by FI firms	Total investment shocked by 10%. The monetary value of that shock allocated to each firm type (proportionally across sectors) through $\Delta K_{i,f,t}$
	1.2 Increased investment by SOE firms	
	1.3 Increased investment by Private firms	
	1.4 Proportional increase in investment by all firms	Total investment shocked by 10%. The monetary value of that shock allocated (proportionally across sectors and firm types) through $\Delta K_{i,f,t}$
Level of investment required to achieve the objectives of Vietnam's Five Year Plan?	2.1 Address export goals through an increase in investment in base and projection years	Investment levels in base year and projection years are increased 10%, allocated to sectors where export growth is required to achieve five-year plan goals, and allocated to each firm type through $\Delta K_{i,f,t}$

Table 16. Scenarios Exploring Investment Impacts – Macroeconomic Indicators

Measure	Test	GDP	Government	RoW	
			Revenue	Current Account	Savings
	Baseline (BL)	3,203,701	645,034	2,317,348	1,101,773
1.1 Increased investment by FI firms	Level	3,296,330	675,554	2,399,474	1,122,332
	Δ from BL	2.89%	4.73%	3.54%	1.87%
1.2 Increased investment by SOE firms	Level	3,329,979	662,536	2,388,926	1,156,236
	Δ from BL	3.94%	2.71%	3.09%	4.94%
1.3 Increased investment by Private firms	Level	3,296,959	663,569	2,408,805	1,118,355
	Δ from BL	2.91%	2.87%	3.95%	1.50%
1.4 Proportional increase in investment by all firms	Level	3,312,313	665,650	2,397,631	1,136,740
	Δ from BL	3.39%	3.20%	3.46%	3.17%
2. Increase investment in targeted sectors in all years	Level	3,515,662	704,525	2,382,970	1,196,503
	Δ from BL	9.74%	9.22%	2.83%	8.60%

Notes: Values are denoted in billion VND. All reported results reflect the sum of that measure over the full projected period. For example, the value of ‘Baseline-GDP’ is the sum of Vietnam’s projected GDP from 2001-2005 (inclusive) under the assumptions of the baseline analysis.

Table 17. Scenarios Exploring Investment Impacts – Net Trade

Test	Measure	Aggregated Sector Trade					
		Agricultural Exports	Agricultural Imports	Manufacturing Export	Manufacturing Imports	Energy	Services
	Baseline (BL)	419,457	13,889	449,999	-1,407,839	414,975	12,188
1.1 Increased investment by FI firms	Level	429,983	26,856	508,549	-1,489,920	399,760	12,756
	Δ from BL	2.51%	93.36%	13.01%	-5.83%	-3.67%	4.66%
1.2 Increased investment by SOE firms	Level	431,907	21,655	455,839	-1,481,648	468,606	8,659
	Δ from BL	2.97%	55.91%	1.30%	-5.24%	12.92%	-28.96%
1.3 Increased investment by Private firms	Level	444,212	20,446	461,291	-1,491,357	399,290	31,376
	Δ from BL	5.90%	47.21%	2.51%	-5.93%	-3.78%	157.42%
1.4 Proportional increase in investment by all firms	Level	435,823	22,379	468,573	-1,486,392	431,284	16,907
	Δ from BL	3.90%	61.12%	4.13%	-5.58%	3.93%	38.72%
2. Increased Investment in targeted sectors	Level	520,454	87,022	620,044	-1,516,858	391,717	-1,133
	Δ from BL	24.08%	526.54%	37.79%	-7.74%	-5.60%	109.30%

Notes: Values are denoted in billion VND. Reported results reflect the sum of trade flows for the whole of the period under consideration (2000-2005).

Table 18. Scenarios Exploring Investment Impacts – Labor and Income Distribution

Measure	Test	Labor Demand (annual average)			Household Income (annual average)					
		High Skilled	Medium Skilled	Unskilled	Rural			Urban		
					Farm	Informal	Wage	Farm	Informal	Wage
	Baseline (BL)	2,020	7,144	43,221	183,501	55,589	33,476	20,176	105,714	83,538
1.1	Level	2,084	7,363	44,242	187,262	56,847	34,328	20,586	107,598	85,551
Increased investment by FI firms	Δ from BL	3.17%	3.07%	2.36%	2.05%	2.26%	2.54%	2.03%	1.78%	2.41%
1.2	Level	2,070	7,337	44,131	188,590	57,251	34,489	20,670	108,445	85,853
Increased investment by SOE firms	Δ from BL	2.46%	2.71%	2.11%	2.77%	2.99%	3.03%	2.45%	2.58%	2.77%
1.3	Level	2,078	7,356	44,887	189,060	57,378	34,493	20,676	108,817	85,811
Increased investment by Private firms	Δ from BL	2.89%	2.97%	3.86%	3.03%	3.22%	3.04%	2.48%	2.94%	2.72%
1.4	Level	2,075	7,349	44,408	188,479	57,212	34,459	20,656	108,396	85,781
Proportional increase in investment by all firms	Δ from BL	2.75%	2.88%	2.75%	2.71%	2.92%	2.94%	2.38%	2.54%	2.69%
2. Increased Investment in targeted sectors	Level	2,181	7,768	47,089	198,722	60,475	36,234	21,540	114,137	89,494
	Δ from BL	7.96%	8.74%	8.95%	8.29%	8.79%	8.24%	6.76%	7.97%	7.13%

Notes: All reported results reflect the sum of that measure over the full projected period; for example, rural farm household income is the sum of that household's projected income from 2001-2005. Household income is reported in billion VND. Labor demand is in thousands.

Table 19. Tariffs and Their Impact on Sectoral Rates of Return

Sector Description	Rent/ICOR			Tariff Rate		
	2000	2001	Change (%)	2000	2015 ¹	Change (Level)
Rice	1.762	0.994	-43.61%	0.001	0.001	-0.0001
Fish & Seafood	0.409	0.630	53.99%	0.128	0.062	-0.0661
Export Crops	0.163	0.129	-21.20%	0.007	0.005	-0.0013
Processed Exports	0.224	0.236	5.02%	0.096	0.057	-0.0392
Other Crop	2.990	2.951	-1.30%	0.052	0.031	-0.0210
Sugar	0.195	0.084	-56.94%	0.339	0.229	-0.1104
Livestock & Meat	0.789	0.552	-30.02%	0.031	0.020	-0.0110
Forestry	0.121	0.080	-33.98%	0.000	0.000	0.0000
Processed agrifood products	0.431	-0.034	-107.90%	0.098	0.096	-0.0023
Clothes	0.393	0.545	38.63%	0.055	0.022	-0.0335
Leather Goods	0.251	0.585	133.32%	0.039	0.024	-0.0151
Wood & wood products	0.395	0.582	47.29%	0.031	0.012	-0.0185
Other mnfg export goods	0.119	0.159	33.44%	0.039	0.025	-0.0144
Building materials	0.267	0.216	-19.10%	0.016	0.008	-0.0076
Pulp & Paper	0.195	0.138	-29.51%	0.105	0.075	-0.0297
Chemical Industries	0.180	0.100	-44.44%	0.013	0.010	-0.0031
Appliances & Parts	0.371	0.122	-66.99%	0.145	0.074	-0.0710
Plastic & plastic prod.	0.226	0.113	-50.22%	0.029	0.018	-0.0105
Metals & metal prod.	0.066	0.025	-62.10%	0.022	0.023	0.0016
Weaving	0.150	-0.004	-102.71%	0.021	0.006	-0.0145
Machinery	0.211	0.132	-37.44%	0.025	0.005	-0.0197
Autos & Motorbikes	0.292	0.032	-88.89%	0.145	0.132	-0.0132
Other mnfg goods	0.448	0.701	56.72%	0.022	0.017	-0.0045
Electricity & Gasoline	0.113	0.141	24.33%	0.172	0.488	0.3159
Mining	0.223	0.176	-21.05%	0.009	0.008	-0.0009
Oil & Natural Gas	1.433	1.769	23.51%	0.149	0.072	-0.0767
Transportation	0.029	0.026	-10.34%	0	0	0
Communication	0.350	0.358	2.30%	0	0	0
Finance	0.351	0.301	-14.04%	0	0	0
Real estate	0.577	0.585	1.44%	0	0	0
Trade	0.205	0.227	11.06%	0	0	0
Construction	0.385	0.473	23.08%	0	0	0
Social Services	0.094	0.055	-41.88%	0	0	0
Agricultural Services	0.023	0.024	4.27%	0	0	0
Other Services	0.087	0.089	1.49%	0	0	0

¹ Tariffs committed to in the WTO accession agreement that apply from 2015 are assumed in this analysis to apply from 2001.

Table 20. Scenarios Exploring Trade Liberalization Impacts

Issue	Test	Operationalization of Test
Impact of WTO tariff reform	1. Adjust tariff levels to reflect WTO commitments	Baseline tariff levels adjusted to reflect those committed to after full implementation of the WTO agreement
Relationship between tariff reform and investment flows	2. Increase investment into sectors which generated a positive rate of return	Total investment shocked by 10% in each projected year. The monetary value of the shock allocated proportionally to the rate of return and the share of investment in that sector in the base year. Increased investment levels are allocated proportionally across firm types through $\Delta K_{i,f,t}$
	3. Increase investment into sectors which generated a positive rate of return; Tariffs also reduced as in 1.	Total investment shocked by 10% in each projected year. The monetary value of the shock allocated proportionally to the rate of return and the share of investment in that sector in the base year. Increased investment levels are allocated proportionally across firm types through $\Delta K_{i,f,t}$. Baseline tariff levels adjusted to reflect those committed to after full implementation of the WTO agreement.
Impact of WTO accession requirement to liberalize service sectors	4. Increase investment into service sectors required to liberalize as part of WTO ascension agreement	Total investment shocked by 10%. The monetary value of that shock allocated proportionally to each targeted sector (services). Investment is allocated through FI firms

Table 21. Scenarios Exploring Trade Liberalization – Macroeconomic Indicators

Test		GDP	Government	RoW	
			Revenue	Current	Savings
	Baseline (BL)	3,203,701	645,034	2,317,348	1,101,773
1. Tariff level reform	Level	3,192,638	680,559	2,312,312	1,081,142
	Δ from BL	0.35%	5.51%	0.22%	1.87%
2. Increased investment in sectors with positive return	Level	3,514,302	702,749	2,455,818	1,212,184
	Δ from BL	9.70%	8.95%	5.98%	10.02%
3. Increased investment in sectors with positive returns, and tariff reform	Level	3,502,760	743,647	2,450,275	1,187,779
	Δ from BL	9.33%	15.29%	5.74%	7.81%
4. Increased investment in WTO liberalized sectors (services)	Level	3,284,801	672,489	2,449,009	1,117,521
	Δ from BL	2.51%	4.26%	5.68%	1.43%

Notes: Values are denoted in billion VND. All reported results reflect the sum of that measure over the full projected period (2001-2005).

Table 22. Scenarios Exploring Trade Liberalization – Net Trade

Test	Measure	Aggregated Sector Trade					
		Agricultural Exports	Agricultural Imports	Manufacturing Export	Manufacturing Imports	Energy	Services
	Baseline (BL)	419,457	13,889	449,999	-1,407,839	414,975	12,188
1. Tariff level reform	Level	423,872	16,372	449,900	-1,415,696	423,065	18,821
	Δ from BL	1.05%	17.87%	-0.02%	-0.56%	1.95%	54.41%
2. Increased investment in sectors with positive return	Level	531,103	40,672	481,600	-1,536,783	513,582	-18,060
	Δ from BL	26.62%	192.83%	7.02%	-9.16%	23.76%	248.17%
3. Increased investment in sectors with positive return, and tariff reform	Level	536,041	43,267	481,672	-1,545,147	522,411	-10,958
	Δ from BL	27.79%	211.52%	7.04%	-9.75%	25.89%	189.90%
4. Increased investment in WTO liberalized sectors (services)	Level	409,391	4,929	442,766	-1,526,222	400,295	31,674
	Δ from BL	-2.40%	-64.51%	-1.61%	-8.41%	-3.54%	159.87%

Notes: Values are denoted in billion VND. Reported results reflect the sum of trade flows for the whole of the period under consideration (2000-2005).

Measure	Test	Labor Demand (annual average)			Household Income (annual average)					
		High Skilled	Medium Skilled	Unskilled	Rural			Urban		
					Farm	Informal	Wage	Farm	Informal	Wage
	Baseline (BL)	2,020	7,144	43,221	183,501	55,589	33,476	20,176	105,714	83,538
1. Tariff level reform	Level	2,020	7,144	43,221	180,759	54,775	33,216	20,037	103,810	83,029
	Δ from BL	0.00%	0.00%	0.00%	-1.49%	-1.46%	-0.78%	-0.68%	-1.80%	-0.61%
2. Increased investment in sectors with positive return	Level	2,098	7,484	45,958	197,377	60,023	35,923	21,392	113,440	88,702
	Δ from BL	3.89%	4.76%	6.33%	7.56%	7.97%	7.31%	6.03%	7.31%	6.18%
3. Increased investment in sectors with positive return, and tariff reform	Level	2,098	7,484	45,958	194,413	59,143	35,642	21,242	111,383	88,152
	Δ from BL	3.89%	4.76%	6.33%	5.95%	6.39%	6.47%	5.29%	5.36%	5.52%
4. Increased investment in WTO liberalized sectors (services)	Level	2,088	7,336	43,949	186,844	56,717	34,258	20,549	107,418	85,507
	Δ from BL	3.38%	2.70%	1.68%	1.82%	2.03%	2.34%	1.85%	1.61%	2.36%

Notes: All reported results reflect the sum of that measure over the full projected period; for example, rural farm household income is the sum of that household's projected income from 2001-2005. Household income is reported in billion VND. Labor demand is in thousands.

Table 23. Scenarios Exploring Trade Liberalization – Labor and Income Distribution

APPENDIX A

DATA DOCUMENTATION

Implementation of this model has been enabled through the availability of several key and unique data sources. Essential among these is an investment dataset provided by the General Statistics Office (GSO) in Vietnam. This data provided information on investment by sector of destination by firm type for 112 economic sectors, from 2000 to 2005 (GSO, 2007a). In addition, the GSO also provided data on trade, trade prices and tariffs for the 112 sectors of the 2000 IO table. This is the primary source of information used to generate the data inputs required for this analysis.

Other central data sources include the 2000 and 2003 Vietnam SAMs which are documented by Jensen et al. (2003), and Jensen and Tarp (2007), respectively. Data available through the GSO publications¹¹ and IMF Vietnam Country Reports provided a majority of the required domestic and foreign macroeconomic information. The Vietnam (Household) Living Standards Survey (VLSS) and to a limited extent, the Vietnam Enterprise Survey¹² were used to determine behavioural parameters that could not be estimated from other sources.

Not surprisingly, these numerous data sources provided overlapping and sometimes inconsistent data concerning a particular variable. In these cases, a general rule concerning the prioritized source of data was applied. Among the primary sources, the Vietnam SAMs and GSO investment data were used first. Following this, GSO macroeconomic data (available through the organization's website) and IMF reports were turned to.

The following discussion begins with a description of model aggregation. Following this, data and calculations required to generate the endogenous and exogenous variables and behavioural parameters required for this analysis are provided. For a majority of these data, multiple data sources and/or calculation steps were required to derive these estimates. In these cases, it is only the final variable estimates which were introduced into the model which are presented.

Model Aggregation

The success of this study was enabled through the important contributions of several earlier studies focused on Vietnam's economy. Key among these were the 2000 and 2003 Vietnam SAMs generated by Jensen et al. (2004), and Jensen and Tarp (2007). As these sources include less detail concerning several macroeconomic issues which are

¹¹ These sources included information available through the GSO website and other GSO publications such as annual *Statistical Yearbooks*.

¹² Attempts to base production parameters on the enterprise survey data led to unacceptable inconsistencies. It is for this reason that disaggregation of most parameters by firm type has been abandoned in this analysis.

required for this study, neither could directly be employed as the baseline SAM. It was decided that to the extent possible, the structure of these SAMs would be updated to incorporate more macroeconomic information. To this end, the aggregation of this model is based upon sectors which were included in these earlier analyses.

The 2000 and 2003 Vietnam SAMs used a much more disaggregated structure of economic sectors, households, factors of production and taxes than that which is used in this analysis. Table A.1 presents the general concordance between the number of sectors in these models.

Table A.1. Comparison of Aggregation in Source SAMs with SAM Used in this Analysis

Aggregation of:	Social Accounting Matrix (SAM) Aggregation:	
	2000 ¹ and 2003 ²	This Study
Economic Sectors	112	35
Factors of Production	14	7
Household Types	15	6
Taxes and Tariffs	7	4

Notes:

¹ Documented in Jensen et al., 2004.

² Documented in Jensen and Tarp, 2007.

As the documentation that accompanies the 2000 SAM provides a good description of these sectors, this information will not be repeated here. Instead, the following series of tables map the concordance between the sectors used in these earlier studies and those employed in the current analysis.

The aggregation of economic sectors is particularly important to the results of this analysis. Considerable care was paid to aggregate sectors in a manner that, to the extent possible, was sensible from the perspectives of trade status, production output, intermediate and consumption demand, and policy treatment. Among these, trade considerations were the most important and required that aggregated sectors of goods be identified as predominantly imported, exported or home goods based on an assessment of relative production levels and trade flows. Details of the specific aggregations used in this analysis are presented in Table A.2. This table demonstrates how the 2000 112-sector SAM maps into this 35-sector SAM, and indicates the trade status of these aggregated sectors. A six-sector aggregation of the model, which is used for convenience in discussion purposes only, is also presented.

Home/Import categories represent goods either produced and consumed domestically, or imported for domestic consumption. Export goods are those which are produced specifically to satisfy foreign consumer product preferences, and they are consumed domestically when the price falls to the domestic price level. For agricultural goods it is assumed that the food processing required to satisfy domestic and foreign consumer preferences is the same.

Capacities used for processing of agricultural commodities in a particular aggregate sector¹³ are assumed be perfectly substitutable. For manufactured products, in sectors for which goods are produced for the domestic and export markets, these goods are assumed to be perfect substitutes.

Table A.2. Concordance of Investment Model Economic Sectors

Investment Model Sectors			Vietnam 112 Sector Aggregation
6 Sector Aggregation	Trade Status ¹	35 Sector Aggregation	Sector Number and Description
Agriculture Export	E	1. Rice (paddy, processed)	001. Paddy (all kinds) 035. Rice, processed
	E	2. Fish, Seafood and seafood byproducts	014. Fishery 015. Fish-Farming 034. Processed seafood and by-products
	E	3. Major Export Oriented Crops	002. Raw rubber 003. Coffee beans 005. Tea 032. Tea, processed
	E	4. Processed Agricultural Exports	026. Processed and preserved fruits and vegetables 036. Other fruit manufactures 052. Processed rubber and by-products
	E	5. Other Crops	006. Other crops
Agriculture Home/Import	M	6. Sugar and Animal Feed	004. Sugarcane 030. Sugar, refined 082. Animal feeds
	M	7. Livestock and livestock products	007. Pig (all kinds) 008. Cow (all kinds) 009. Poultry 010. Other livestock and poultry 022. Processes, preserved meat and by-products
	M	8. Forestry	013. Forestry
	M	9. Processed agri-food sector products	023. Processed vegetable, and animal oils and fats
			024. Milk, butter and other dairy products 025. Cakes, jams, candy, coca, chocolate products 027. Alcohol and liquors 028. Beer 029. Non-alcohol water and soft drinks 031. Coffee, processed 033. Cigarettes and other tobacco products 080. Products of leather tanneries
Manufacturing Export	E	10. Ready- made clothes; fiber, carpets	077. Ready-made clothes, sheets (all kinds) 078. Carpets 079. Weaving and embroidery of textile-based goods (excepts carpets)
	E	11. Leather goods	081. Leather goods

¹³ For example, facilities are assumed to be equally efficient at processing fish sourced from fisheries and through fish-farming (both in Sector 2).

Investment Model Sectors			Vietnam 112 Sector Aggregation Sector Number and Description
6 Sector Aggregation	Trade Status ¹	35 Sector Aggregation	
Manufacturing Home/Import	E	12. Processed wood and wood products	044. Processed wood and wood products
	M	13. Other (potential) manufactured export goods	037. Glass and glass products 038. Ceramics and by-products 064. Bicycles and spare parts 065. General-purpose machinery 066. Other general-purpose machinery 070. Electrical machinery 071. Other electrical machinery and equipment
	M	14. Building materials (bricks, tiles, cement etc.)	039. Bricks, tiles 040. Cement 041. Concrete, mortar and other cement products 042. Other building materials
	M	15. Pulp & Paper Products, Paper By-Products	043. Paper pulp and paper products and by- products
	M	16. Chemical Industries	045. Basic organic chemicals 046. Basic inorganic chemicals 047. Chemical fertilizer 048. Fertilizer 049. Pesticides 053. Soap, detergents 054. Perfumes and other toilet preparations 057. Paint 058. Ink, varnish and other painting materials 059. Other chemical products
	M	17. Home Appliances and Spare Parts	062. Home appliances and its spare parts
	M	18. Processed Plastic & Plastic Products	055. Plastic (including semi-plastic products) 056. Other plastic products
	M	19. Ferrous and Non-ferrous metals & metal products	073. Non-ferrous metals and products 074. Ferrous metals and products (except machinery equipment)
	M	20. Weaving of cloth (all kinds), fiber (thread)	075. Weaving of cloths (all kinds) 076. Fibber, thread (all kinds)
	M	21. Special purposes machinery and equipment	060. Health instrument and apparatus 061. Precise and optics equipment, meter (all kinds) 072. Machinery used for broadcasting, television and information activities
	M	22. Automobiles; Motor vehicles, motorbikes, parts	063. Motor vehicles, motor bikes and spare parts 067. Other special-purpose machinery 068. Automobiles

Investment Model Sectors			Vietnam 112 Sector Aggregation Sector Number and Description
6 Sector Aggregation	Trade Status ¹	35 Sector Aggregation	
Energy & Resources	M	23. Other manufactured goods	050. Veterinary medicine 051. Health medicine 069. Other transport means 083. Products of printing activities 084. Products of publishing house 085. Other physical goods
	M	24. Electricity, gas; (Refined) Gasoline and lubricants	086. Gasoline, lubricants (already refined) 087. Electricity, gas
	E	25. Mining and quarrying ; Water	016. Coal 017. Metallic ore 018. Stone 019. Sand, gravel 020. Other non-metallic minerals 088. Water
	E	26. Crude oil, natural gas (except exploration)	021. Crude-oil, natural gas (except exploration)
Services	H	27. Air, road, railway and water transportation	095. Transportation 096. Railway transport services 097. Water transport services 098. Air transport services 113. Domestic marketing margins
	E	28. Communication	099. Communication services
	M	29. Financial Services	101. Banking, credit, treasury 103. Insurance
	H	30. Real Estate, Real estate business and consultancy	105. Real estate 106. Real estate business and consultancy services
	H	31. Trade (Wholesale, Retail)	091. Trade 114. Export marketing margins
	H	32. Construction (Civil, Other)	089. Civil construction 090. Other construction
	M	33. Social Services and Defense	107. State management, defense and compulsory social services 108. Education and training 109. Health care, social relief 110. Culture and sport 111. Association
Services	H	34. Agricultural Services (Irrigation, Other)	011. Irrigation service 012. Other agricultural services
	E	35. Other Services	092. Repair of small transport means, motorbikes and personal household appliances 093. Hotels 094. Restaurants 100. Tourism 102. Lottery 104. Science and technology 112. Other services

Notes:

¹ Sectors are classified as being dominated by exports (E), imports (I), or home (H) goods.

Tables A.3 and A.4 map household-types and factors of production in the SAM generated for this analysis to that used in the 2000 SAM. As gender considerations were not of primary interest in this study, household and production factor aggregations based on this measure were not retained. Regional (urban/rural) aggregations were retained to improve welfare analysis.

Table A.3. Concordance of Model Households Groups

Investment Model Household Aggregation	Vietnam 112-Sector SAM Household Aggregation ¹
HH1. Rural Farm HH	H01. Rural male self-employed farmer household H05. Rural female self-employed farmer household
HH2. Rural Informal HH	H02. Rural male self-employed non-farmer household H04. Rural male non-employed household H06. Rural female self-employed non-farmer household H08. Rural female non-employed household
HH3. Rural Wage HH	H03. Rural male wage-earner household H07. Rural female wage-earner household
HH4. Urban Farm HH	H09. Urban male self-employed farmer household H13. Urban female self-employed farmer household
HH5. Urban Informal HH	H10. Urban male self-employed non-farmer household H12. Urban male non-employed household H14. Urban female self-employed non-farmer household H16. Urban female non-employed household
HH6. Urban Wage HH	H11. Urban male wage-earner household H15. Urban female wage-earner household

Notes:
¹ Documented by Jensen *et al.*, 2004.

Table A.4. Concordance of Model Factor Groups

Investment Model Factor Aggregation	Vietnam 112-Sector SAM Factor Aggregation ¹
FA1. Rural unskilled labor	F01. Rural male unskilled labor F04. Rural female unskilled labor
FA2. Rural medium-skilled labor	F02. Rural male medium-skilled labor F05. Rural female medium-skilled labor
FA3. Rural high-skilled labor	F03. Rural male high-skilled labor F06. Rural female high-skilled labor
FA4. Urban unskilled labor	F07. Urban male unskilled labor F10. Urban female unskilled labor
FA5. Urban medium-skilled labor	F08. Urban male medium-skilled labor F11. Urban female medium-skilled labor
FA6. Urban High-skilled labor	F09. Urban male high-skilled labor

	F12. Urban female high-skilled labor
FA7. Capital	F13. Land
	F14. Capital

Notes:

¹ Documented by Jensen *et al.*, 2004.

Table A.5 presents the mapping of taxes and tariffs between the aggregation used in the 2000 SAM and that used in this analysis. This tax aggregation simplifies the tax structure to the application of a single tax category per economic agent.

Table A.5. Concordance of Model Tax Groups

Investment Model Tax Aggregation	Vietnam 112-Sector SAM Tax Aggregation ¹
TA1. Indirect Taxes	T01. Value added tax T02. Production tax T03. Special consumption sales tax
TA2. Import Tariffs	T04. Import tariff
TA3. Corporate Income and Factor Taxes	T05. Factor taxes T06. Enterprise taxes
TA4. Personal Taxes	T07. Household taxes

Notes:

¹ Documented by Jensen *et al.*, 2004.

Endogenous Variables

As endogenous variables are calculated within the context of the model, estimates of only some of the list of endogenous variables (previously presented in Table A.2) are required to benchmark the model (year 2000) or to ensure market clearing in subsequent years (2001-2005). In addition, several other variables included on this list as being endogenous are for some sectors, in fact, treated exogenously. The following discussion outlines the data requirements for both of these types of variables and provides details concerning their calculation.

Exports - $E_{i,t}$

Imports - $M_{i,t}$

Calibration of model requires trade levels for each year of analysis. The 2000 SAM (Jensen *et al.*, 2003) provide 112-sector estimates of the import and export levels. This information was aggregated according the sector mapping provided in Table A.2.

While during the projection years this model treats major trade flow endogenously, trade backflows (i.e. exports in an import dominated sector), are treated exogenously. As such, estimates of import and export levels are required across time.

The value of exports and imports, by sector and across time, were obtained from the GSO (2007b). Data from this source was used to estimate annual average changes in trade (by sector, flow direction). To remain consistent with the trade data from the 2000 SAM,

these annual changes were then applied to the baseline 2000 data to project the value of import and export flows for 2001 through 2005. Final estimates of these export and import trade series are provided in Tables A.6 and A.7, respectively.

Table A.6. Value of Exports

35-Sector Description	Year					
	2000	2001	2002	2003	2004	2005
1 Rice	12079.6	8209.4	11042.5	12211.1	18510.2	16174.2
2 Fish & Seafood	24453.2	34620.1	34727.0	39106.0	50303.0	63136.5
3 Export Crops	10108.0	9867.3	8760.1	11535.5	13196.7	13572.9
4 Processed Exports	2271.2	3995.3	5454.3	6001.0	11807.6	11045.1
5 Other Crop	10089.0	9671.0	9059.0	9718.9	14457.5	13857.2
6 Sugar & Animal Feed	635.3	568.2	149.2	470.0	589.6	775.6
7 Livestock & Meat	1382.0	985.2	1162.8	851.1	1089.5	3042.0
8 Forestry	729.0	812.7	89.1	109.3	144.6	174.6
9 Processed Agrifood Prod.	2894.4	4652.6	7371.6	6272.0	7391.4	9134.0
10 Clothes	27320.1	31307.6	35734.9	51110.6	58762.0	65342.5
11 Leather Goods	23407.4	24155.1	27656.5	36129.9	46298.9	45133.6
12 Wood & wood products	5850.5	8554.6	12936.3	14893.9	17373.7	21659.3
13 Other Mnfg Exports	5620.5	8464.5	11724.7	13797.3	18876.1	21345.0
14 Building materials	101.1	121.3	246.4	303.1	893.2	1321.7
15 Pulp & Paper	830.6	1041.2	976.5	1431.3	1770.6	2361.5
16 Chemical Industries	1036.0	1709.4	1756.7	2625.0	3728.0	4331.0

17	Appliances & Parts	0.0	0.0	0.0	0.0	0.0	0.0
18	Plastic & plastic prod.	528.1	2095.5	2575.7	3325.9	5005.3	5487.4
19	Metals & metal prod.	2394.9	3108.7	3584.6	6170.4	15031.8	15940.2
20	Weaving	3070.6	3052.2	3272.2	4258.2	5711.4	3166.5
21	Machinery	13106.7	12937.0	15909.4	18568.6	23321.9	25405.3
22	Autos & Motorbikes	96.5	361.7	638.8	830.3	2719.4	3001.2
23	Other mnfg goods	7122.2	4692.6	7535.6	6496.7	8426.2	4990.0
24	Electricity & Gasoline	1499.5	1755.5	2182.0	2307.2	2943.4	674.3
25	Mining	1840.8	3319.9	4100.5	5307.7	8914.0	5797.7
26	Oil & Natural Gas	49629.3	48978.7	53711.8	66721.6	86279.2	115936.8
27	Transportation	7109.1	7056.2	7341.1	8127.4	8558.8	8655.3
28	Communication	2292.7	2665.0	2635.7	2716.5	2928.0	3902.5
29	Finance	4922.0	4864.8	5174.7	5547.6	5443.0	5412.7
30	Real estate	322.7	176.8	437.6	453.2	499.5	982.7
31	Trade	0.0	0.0	0.0	0.0	0.0	0.0
32	Construction	0.0	0.0	0.0	0.0	0.0	0.0
33	Social Services	2276.4	1760.3	2690.0	3055.2	3371.3	5742.7
34	Agricultural Services	0.0	0.0	0.0	0.0	0.0	0.0
35	Other Services	16875.3	18322.4	22931.0	23044.7	26047.2	28993.4

Note: Values denoted in billion Vietnamese dong (VND).

Table A.7. Value of Imports

35-Sector Description	Year					
	2000	2001	2002	2003	2004	2005
1 Rice	199.5	197.8	150.8	139.0	223.6	284.4
2 Fish & Seafood	546.6	859.2	1764.8	2290.1	3232.8	3661.3
3 Export Crops	655.0	147.9	409.5	643.7	925.6	1316.8
4 Processed Exports	2725.5	3365.3	4376.8	5606.6	6735.7	9009.5
5 Other Crop	2205.2	2761.4	3518.1	4483.6	5648.1	6325.4
6 Sugar & Animal Feed	134.3	1266.3	1423.8	2093.0	2336.4	3363.5
7 Livestock & Meat	326.9	289.3	558.7	661.4	741.5	1137.1
8 Forestry	1090.8	837.3	1569.2	2039.3	2619.7	3327.6
9 Processed Agrifood Prod.	10192.9	12764.7	16114.4	21914.0	27969.0	31915.1
10 Clothes	5678.1	8375.5	6651.5	7390.0	8971.5	11534.3
11 Leather Goods	3371.6	5743.3	5231.2	5225.0	5398.1	8396.4
12 Wood & wood products	1142.7	1644.0	3133.5	4254.0	6516.8	6836.0
13 Other Mnfg Exports	19266.1	18304.8	27226.3	39827.7	43725.8	46141.2
14 Building materials	3689.1	1302.8	1804.5	2462.6	2817.1	3957.3
15 Pulp & Paper	4350.5	6476.3	7453.9	9699.8	11716.3	15587.1
16 Chemical Industries	22147.5	21939.8	27181.4	34029.4	43821.2	54683.6
17 Appliances & Parts	348.8	348.8	483.7	535.4	650.8	860.3
18 Plastic & plastic prod.	10663.0	12177.6	15804.1	20340.3	29736.2	25877.1
19 Metals & metal prod.	19534.6	26563.8	37168.4	52257.2	79677.3	66344.8
20 Weaving	20214.6	20799.5	33621.4	40213.1	48399.7	64620.5
21 Machinery	32636.4	41542.7	49714.4	63642.6	75381.2	67092.1
22 Autos & Motorbikes	16689.6	17117.3	16532.3	18392.7	17584.4	27903.8
23 Other mnfg goods	18333.1	13467.7	18521.9	28168.6	37493.8	42211.8
24 Electricity & Gasoline	30089.9	27178.2	29930.6	37234.3	55539.3	67792.2
25 Mining	2183.7	2544.6	2050.0	3670.5	4186.5	5587.7

26	Oil & Natural Gas	175.7	225.5	120.0	72.1	136.6	109.7
27	Transportation	4335.3	4696.4	5967.0	6134.1	6301.1	7193.5
28	Communication	318.1	323.9	342.2	312.8	390.8	498.2
29	Finance	7027.1	7141.9	8030.3	8706.3	9528.4	10486.0
30	Real estate	311.5	919.9	2773.3	2854.9	3255.9	2574.7
31	Trade	0.0	0.0	0.0	0.0	0.0	0.0
32	Construction	0.0	0.0	0.0	0.0	0.0	0.0
33	Social Services	6890.4	7125.0	9832.5	10753.8	13137.9	15000.9
34	Agricultural Services	0.0	0.0	0.0	0.0	0.0	0.0
35	Other Services	6184.7	6282.2	8517.0	9109.2	10740.5	11439.3

Note: Values denoted in billion VND.

World Price of Exported Goods - $Pwe_{i,t}$

World Price of Imported Goods - $Pwm_{i,t}$

Indices of export and import prices were provided by the GSO (GSO, 2007a). For export prices these indices were calculated using FOB prices (export tax inclusive), while import price indices were based on CIF prices. Both of these annual series were based on a 112-sector aggregation of the economy. To be used in this analysis, these indices were trade weighted using data for the relevant year and direction of flow (GSO, 2007a), and aggregated according to the 35-sector aggregation detailed in Table A.2. As tariffs are directly specified in the model, for the import price index calculation an intermediate step was required to remove the impact of tariffs from these prices, so they are relative to domestic prices (set to one in the base year).

Sector Output - $X_{i,t}$

As several of the components of domestic demand differed (slightly) from those in the 2000 SAM, the vector of domestic output was adjusted to satisfy these demand requirements. Specifically, this variable was calculated to satisfy the following formula:

$$X_{i,t} + M_{i,t} = \sum_j (\alpha_{j,i} \cdot X_{j,t}) + C_{i,t} + (\bar{G}_{i,t} + Ip_{i,t} + Iv_{i,t} + \bar{I}g_{i,t}) / P_{i,t} + E_{i,t}$$

[A.1]

Table A.8 presents the vector of sector output for the baseline year.

Table A.8. Baseline Level of Output

35-Sector Description	Output $X_{i,t}$	35-Sector Description	Output $X_{i,t}$	35-Sector Description	Output $X_{i,t}$
1 Rice	115967	10 Clothes	36885	24 Electricity & Gasoline	18382
2 Fish & Seafood	54135	11 Leather Goods	38795	25 Mining	9690
3 Export Crops	11674	12 Wood & wood products	13163	26 Oil & Natural Gas	52280
4 Processed Exports	22932	13 Other Mnfg Exports	17712	27 Transportation	88925
5 Other Crop	38214	14 Building materials	26412	28 Communication	10962
6 Sugar	15809	15 Pulp & Paper	9123	29 Finance	7975
7 Livestock & Meat	32872	16 Chemical Industries	17340	30 Real estate	28677
8 Forestry	9026	17 Appliances & Parts	1329	31 Trade	97354
9 Processed Agrifood Prod.	35944	18 Plastic & plastic prod.	10797	32 Construction	87828
		19 Metals & metal prod.	22893	33 Social Services	57789
		20 Weaving	16182	34 Agricultural Services	6243
		21 Machinery	11642	35 Other Services	53205
		22 Autos & Motorbikes	20530		
		23 Other mnfg goods	24569		

35-Sector Description	Output $X_{i,t}$	35-Sector Description	Output $X_{i,t}$	35-Sector Description	Output $X_{i,t}$
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Note: Output levels are denoted in billion VND.

Firm output - $X_{i,f,t}$

To accurately assess the impact of investment and capital accumulation, it is necessary to determine the relative levels of output by state-owned enterprises (SOE), foreign invested (FI), and private (Priv) firms. For the sectors of interest, however, these relative output shares are not available from a single source. Vietnam's General Statistics Office (GSO) does conduct enterprise surveys and does publish firm output figures for a number of highly aggregated sectors; to the extent possible, this data and these figures were used in this calculation. For the remaining sectors, studies which examined individual industries or informed assumptions were used to allocate output across firms.¹⁴ Further explanation regarding the approach used for agricultural and manufacturing output is provided in the following discussion; estimates of the share of output by firm type are provided in Table A.9 below.

Agricultural Output

Allocating agricultural production across firm types proved to be the most difficult of the broad categories examined and deserves special note. The agricultural sector aggregation combines both production and relevant processing activities. While processing activities were broadly captured under firm-level manufacturing data available through the GSO, no equivalent coverage of production activities was available.¹⁵ As no alternative sources of firm-type production information were available, (and no evidence could be found to the contrary), it was assumed that all primary agricultural production and fishing activities were done by private firms. For a given sector then, firm-type shares were calculated using a weighted average of the value of production across composite sub-sectors. In the case of forestry, although individuals are permitted to own forests, only the state has the right to exploit forests (Hieu, 2004). As such it was assumed that SOE firms are the only producers of forest output.

Manufacturing, Energy & Services Output

¹⁴ The input-output (IO) table used as a basis of this analysis does not distinguish production by firm type. As such, these shares are not available through this more direct (potential) estimation method.

¹⁵ Dependent upon the sector similarity, the firm output shares of for the manufacture of either 'food products and beverages' or 'tobacco products' were used to allocate processed agricultural sector outputs by firm type. These firm output shares were calculated from data provided by GSO, 2008a; GSO, 2008b; GSO, 2008c.

The GSO conducts an annual survey of registered enterprises that captures, among much other information, details concerning the type of enterprise (firm type), and the level of output¹⁶ (Enterprise Survey, 2002-2004). While this survey is purported to sample all registered firms, this data yielded considerable year-to-year variation in firm-type shares of output. As such, it was decided to base this estimate on the share of output by firm-type over the full period of data used from this source in this analysis (2002-2004 inclusive).

¹⁶ Ideally this data source would have also been used for agricultural firms. This survey, however, excludes household enterprises (which provide much agricultural output) and concentrates its coverage upon manufacturing sectors. As such, it was not deemed appropriate to use this source in the agricultural sector calculations.

Table A.9. Share of Output by Firm Type

35-Sector Description	Share of Output			Source
	SOE	FI	Priv	
1 Rice	0.359	0.002	0.639	Assumption; GSO, 2008x
2 Fish & Seafood	0.303	0.002	0.695	Assumption; GSO, 2008x
3 Export Crops	0.044	0.022	0.933	Assumption; GSO, 2008x
4 Processed Exports	0.662	0.028	0.310	Assumption; GSO, 2008x
5 Other Crops ^a	0.000	0.000	1.000	Assumption; GSO, 2008x
6 Sugar & Animal Feed	0.220	0.111	0.670	Assumption; GSO, 2008x
7 Livestock & Meat	0.044	0.022	0.934	Assumption; GSO, 2008x
8 Forestry ^a	1.000	0.000	0.000	Hieu, 2004
9 Processed Agrifood Prod.	0.524	0.150	0.326	Assumption; GSO, 2008x
10 Clothes	0.230	0.654	0.115	Enterprise Survey, 2002-2004
11 Leather Goods	0.051	0.889	0.059	Enterprise Survey, 2002-2004
12 Wood & wood products	0.193	0.451	0.356	Enterprise Survey, 2002-2004
13 Other Mnfg Exports	0.225	0.552	0.223	Enterprise Survey, 2002-2004
14 Building materials	0.548	0.195	0.256	Enterprise Survey, 2002-2004
15 Pulp & Paper	0.264	0.550	0.186	Enterprise Survey, 2002-2004
16 Chemical Industries	0.299	0.374	0.327	Enterprise Survey, 2002-2004
17 Appliances & Parts	0.048	0.660	0.291	Enterprise Survey, 2002-2004
18 Plastic & plastic prod.	0.120	0.700	0.180	Enterprise Survey, 2002-2004
19 Metals & metal prod.	0.208	0.435	0.356	Enterprise Survey, 2002-2004
20 Weaving	0.429	0.455	0.117	Enterprise Survey, 2002-2004
21 Machinery	0.193	0.414	0.393	Enterprise Survey, 2002-2004
22 Autos & Motorbikes	0.124	0.220	0.656	Enterprise Survey, 2002-2004
23 Other mnfg goods	0.773	0.144	0.083	Enterprise Survey, 2002-2004
24 Electricity & Gasoline	0.874	0.091	0.035	Enterprise Survey, 2002-2004
25 Mining	0.661	0.167	0.173	Enterprise Survey, 2002-2004

26	Oil & Natural Gas	0.143	0.014	0.843	Enterprise Survey, 2004
27	Transportation	0.510	0.246	0.245	Enterprise Survey, 2002-2004
28	Communication	0.955	0.015	0.030	Enterprise Survey, 2002-2004
29	Finance	0.726	0.219	0.055	Enterprise Survey, 2002-2004
30	Real estate	0.220	0.208	0.572	Enterprise Survey, 2002-2004
31	Trade	0.459	0.259	0.282	Enterprise Survey, 2002-2004
32	Construction	0.513	0.229	0.258	Enterprise Survey, 2002-2004
33	Social Services	0.421	0.189	0.390	Enterprise Survey, 2002-2004
34	Agricultural Services	0.679	0.252	0.070	Enterprise Survey, 2002-2004
35	Other Services	0.248	0.427	0.325	Enterprise Survey, 2002-2004

Notes:

Firms are classified as State-owned enterprises (SOE), Foreign Invested (FI), and Private (Priv) firms. GSO, 2008x refers to the following sources: GSO, 2008a; GSO, 2008b; GSO, 2008c.

^a Due to the lack of output in some firms in this sector, the model did not perform well. In practice then, it was assumed that firms not engaged in this sector actually produced one unit of output each; total production by the active firm type was reduced by these two units of production to accommodate this adjustment.

Exogenous Variables

The following discussion outlines the construction of exogenous variables used in this analysis.

Change in Capital Stock - $\Delta K_{i,f,t}$

This analysis assumes that increases in investment directly translate into positive changes in capital stock. Investment figures, disaggregated by sector, firm type, and across time, available from the GSO (2007a) are used in this analysis.

Foreign Public Borrowing - $Brwfg_t$

Information required to calculate foreign public borrowing are reported in the Balance of Payments information available in the IMF country reports (Table 23). Data for 2000-2001 was obtained from IMF 2006a, and for 2002-2005 from IMF 2007.

The level of foreign public borrowing was calculated as the reported level of ‘Overseas Development Assistance (ODA) Loans’, less the loan amortization relevant to this loan amount¹⁷. It was then required that the units of measure of this borrowing be adjusted (scale, currency) to accommodate its inclusion in the model. Final estimates of foreign public borrowing are reported in Table A.10.

Foreign Private Borrowing - $Brwfp_t$

Information required to calculate foreign private borrowing is reported in the Balance of Payments information available in the IMF country reports (Table 23). Data for 2000-2001 was obtained from IMF 2006a, and for 2002-2005 from IMF 2006b.

Estimates of foreign private borrowing were calculated in a similar manner to those of foreign public borrowing. In this instance the level of ‘Commercial Loans’ was reduced by the relevant amount of loan amortization¹⁸ and then unit adjusted. This analysis assumes that Vietnamese households do not directly make loans to foreign firms.¹⁹ Estimates of foreign private borrowing are reported in Table A.10.

Table A.10. Foreign Public & Private Borrowing

Year	2000	2001	2002	2003	2004	2005
Foreign Public Borrowing	9963.88	5060.97	6798.02	12320.42	15929.27	16087.63

¹⁷ The IMF reports provide a single measure of the amount of loan amortization which applies to both public and private loans. To estimate the amount of amortization which was due to public borrowing, the principal owed on public and private loans was used to proportionately allocate the amount of loan amortization to each of these sources. This method inherently assumes that the rates of loan amortization are the same for all public and private loan sources.

¹⁸ For an explanation, see Footnote 4.

¹⁹ If households do make loans to foreign firms it is assumed that they channel funds through public banks.

Foreign Private Borrowing	366.05	158.49	216.15	3191.10	6494.51	6018.11
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Note: Values denoted in billion VND.

Exchange Rate - ex_t

Vietnam's exchange rates were drawn from a series of International Monetary Fund (IMF) country reports. As estimates for a particular year are frequently updated in subsequent future reports, rates from most recent report that provided coverage of the particular year in question were used. Table A.11 provides a summary of this information.

Table A.11. Exchange Rates

Year	Exchange Rate (Dong/USD)	Normalized Exchange Rate	Source
2000	14 170	1.000	IMF, 2003
2001	14 786	1.043	IMF, 2006b
2002	15 244	1.076	IMF, 2007
2003	15 479	1.092	IMF, 2007
2004	15 705	1.108	IMF, 2007
2005	15 819	1.116	IMF, 2007

Foreign Direct Investment - FDI_t

Levels of foreign direct investment were obtained from the GSO (2007a). This data source disaggregates investment by firm type for each of the baseline and projected years. This analysis treats all investment by foreign invested (FI) firms as FDI, and assumes that no investment by state owned enterprises (SOE) or private (Priv) firms are FDI.

Foreign Public Interest Payments - Fr_t

Vietnam's foreign public interest payments are reported in the 'External Debt and Debt Service' information available in the IMF country reports. Measures of 'Total External Debt Service' for 2000-2001 were obtained from IMF 2006a (Table 30) and for 2002-2005 from IMF 2007 (Table 29). Unit adjusted values (scaled, currency) of these interest payments are presented in Table A.12.

Table A.12. Foreign Public Interest Payments

Year	2000	2001	2002	2003	2004	2005
Foreign Public Interest Payments	4,293.5	4,066.2	3,170.7	3,250.6	5,088.4	4,603.3

Note: Values denoted in billion VND.

Government Consumption - $G_{i,t}$

Sector disaggregated government consumption estimates for 2000 and 2003 are available from the Vietnam SAMs for these years (respectfully documented in Jensen et al., 2004, and Jensen and Tarp, 2007). On the basis of the assumption that government spending increased according to the average growth rate of a geometric series, estimates were

made of government spending for the remaining projection years. In practice government consumption was concentrated in a few sectors; Table A.13 summarizes government spending estimates.

Table A.13. Government Spending

Aggregate Category	Sector(s)	2000	2001	2002	2003	2004	2005
Agriculture	1-9	0	0	0	0	0	0
Manufacturing	10-23	0	0	0	0	0	0
Energy	24-26	0	0	0	0	0	0
	27-32, 34	0	0	0	0	0	0
Services	Social Services (33)	41598	37328	33496	30057	26971	24202

Other Services (35)	3969	4689	5539	6544	7730	9133
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Note: Values denoted in billion VND.

Inventories - $Iv_{i,t}$

While acknowledged to potentially be relevant to some agricultural commodities, this analysis does not incorporate an endogenous stock accumulation mechanism. Inventories are treated as exogenous except for selected services which are treated as home goods. In those cases inventories adjust to equilibrate those sectors, as we expect that capacity constraints may not bind there. But in the cases of tradable goods, inventories are exogenous and generally small. This analysis then requires direct measures of inventories, which are disaggregated by sector and available across time. While such information is not directly available, in combining information from several sources, estimates of inventories can be derived.

Annual estimates of Vietnam's aggregate change in stocks are available through the IMF Country Reports (2000-2001, IMF, 2006a; 2002-2005, IMF 2006b). To disaggregate these to sector-levels estimates of inventory holding several steps were required. Due to differences in the manner in which stockpiling decisions are made across agricultural, manufacturing, and service sectors, different approaches were used in the inventory calculations for these broad sectors.

The 2000 Vietnam SAM contained an investment vector which reflected gross asset accumulation; this measure includes capital formation and inventory changes for the relevant year. As capital formation in the agricultural sector is rarely (accurately) valued, it is assumed that these inventories reflect changes in agricultural stocks. As such, in 2000 for all sectors focussed upon agricultural production (Sectors 1-3, 5-8), inventory levels are drawn from the 2000 SAM.

The difference between the change in stocks reported by the IMF and the agricultural sector inventories was assumed to be due to changes in manufacturing and service sector inventories. This aggregate level is proportioned across sectors on the basis of the sector shares of inventory levels self-reported by firms in Vietnam's annual Enterprise survey²⁰.

To project these inventory estimates forward, it is assumed that the relative share of year 2000 inventories which are attributed to agricultural goods and manufacturing goods remains

²⁰ As this survey does not capture agricultural sector firms, this approach could not be applied to all sectors.

constant remains constant over time. Aggregate annual changes in stock reported by the IMF are allocated first into these broad goods categories and then allocated across sectors. Within the agricultural production sectors, the relative shares of inventories are assumed to be equal to those in 2000. For manufacturing sectors, the allocation of inventories across sectors is varied annually in proportion to the inventory levels calculated from the Enterprise Survey data. It is worth noting that this approach permits negative changes in inventories. In such instances it is assumed that this reflects a drawdown of stocks accrued in previous periods. Final estimates of annual inventory changes are reported in Table A.14.

Table A.14. Change in Inventories

35-Sector Description	Inventory Change					
	2000	2001	2002	2003	2004	2005
1 Rice	3965.5	4029.3	4618.4	5310.3	6549.0	9399.2
2 Fish & Seafood	201.5	204.7	234.6	269.8	332.7	477.5
3 Export Crops	15.4	15.7	17.9	20.6	25.4	36.5
4 Processed Exports	2608.3	42.8	160.2	120.5	259.3	372.2
5 Other Crop	-245.2	307.9	353.0	405.8	500.5	718.3
6 Sugar & Animal Feed	789.8	802.5	919.8	1057.6	1304.4	1872.0
7 Livestock & Meat	508.6	516.8	592.3	681.1	839.9	1205.5
8 Forestry	0.0	0.0	0.0	0.0	0.0	0.0
9 Processed Agrifood Prod.	1207.0	55.4	332.9	97.2	237.9	341.4
10 Clothes	604.7	102.8	158.8	30.0	82.7	118.7
11 Leather Goods	50.2	13.2	55.2	18.0	30.3	43.5
12 Wood & wood products	-194.3	48.8	101.5	13.4	172.8	248.0
13 Other Mnfg Exports	-2034.6	165.6	208.2	101.9	274.6	394.1
14 Building materials	-39.5	362.4	199.8	105.7	140.1	201.1
15 Pulp & Paper	148.6	304.0	404.3	-249.8	733.0	1052.0
16 Chemical Industries	233.6	100.7	158.1	74.1	935.8	1343.0
17 Appliances & Parts	124.9	44.8	250.3	68.8	273.5	392.6
18 Plastic & plastic prod.	87.6	1.7	0.0	47.0	267.2	383.5

19	Metals & metal prod.	-6164.4	318.7	385.1	105.5	798.6	1146.1
20	Weaving	349.2	319.2	607.7	-44.5	325.7	467.5
21	Machinery	-9468.8	69.4	128.7	94.4	184.6	265.0
22	Autos & Motorbikes	4624.0	286.4	819.0	123.9	-147.4	-211.5
23	Other mnfg goods	-10778.7	50.5	67.0	30.1	82.6	118.6
24	Electricity & Gasoline	526.1	125.9	-3075.1	2037.8	403.8	579.5
25	Mining	706.9	25.9	100.7	56.4	37.1	53.2
26	Oil & Natural Gas	0.0	0.0	0.0	0.0	0.0	0.0
27	Transportation	0.0	30.2	-2.7	43.5	99.8	143.2
28	Communication	0.0	1380.4	2357.2	1349.2	181.8	260.9
29	Finance	0.0	35.3	201.8	27.1	94.4	135.5
30	Real estate	0.0	161.8	428.9	753.1	413.7	593.8
31	Trade	0.0	-244.0	140.5	33.6	224.7	322.6
32	Construction	20843.7	0.0	0.0	0.0	0.0	0.0
33	Social Services	0.0	1.3	23.8	8.7	15.9	22.8
34	Agricultural Services	0.0	0.5	55.9	11.0	52.6	75.5
35	Other Services	0.0	51.2	151.0	24.1	90.7	130.2

Public Investment (Infrastructure) - $Ig_{i,t}$

Private Investment - Ipo_i

Although captured by a single vector, investment reported in the 2000 SAM in reality reflect the sum of stock changes (Iv_i), public investment (Ig_i), and private investment demand (Ipo_i). The manner in which stock changes were determined was described in the previous discussion. In the baseline year, total investment from the 2000 SAM, less investment allocated to stock changes, reflects the aggregated total of public and private investment. In forecasted years, private investment is determined endogenously while public investment is set exogenously. During this period (2001-2005), the total value of public investment was obtained from the GSO²¹ and reflects the annual sum of the state budget and state loans.

²¹ This information was obtained from the GSO website from the table titled 'State investment by investment source'. Available at: http://www.gso.gov.vn/default_en.aspx?tabid=471&idmid=3&ItemID=6236

This model requires that these aggregated measure of public and private investment be disaggregated by source and sector of origin. Source and sector-level disaggregation, while not available annually, has been estimated for a single year in the 2003 Vietnam SAM (Jensen and Tarp, 2007). On the basis of this information, the allocation of investment across public and private sources was determined and the relative distribution of investment across sectors was calculated. These shares were then used to proportionately allocate the remaining aggregate investment across sources and sectors. This method implicitly assumes that the distribution of public investment across sectors remains the same in each year of analysis. Private investment is used to calibrate the base year model and then determined endogenously in projection years. Table A.15 presents the final estimates of the public and private investment levels.

Table A.15. Public and Private Investment

35-Sector Description	Level of Investment							
	Private	Public						
	2000	2000	2001	2002	2003	2004	2005	
1	Rice	0	0	0	0	0	0	0
2	Fish & Seafood	0	0	0	0	0	0	0
3	Export Crops	0	0	0	0	0	0	0
4	Processed Exports	0	0	0	0	0	0	0
5	Other Crop	0	0	0	0	0	0	0
6	Sugar & Animal Feed	0	0	0	0	0	0	0
7	Livestock & Meat	0	0	0	0	0	0	0
8	Forestry	0	0	0	0	0	0	0
9	Processed Agrifood Prod.	0	0	0	0	0	0	0
10	Clothes	0	0	0	0	0	0	0
11	Leather Goods	0	0	0	0	0	0	0
12	Wood & wood products	315.2	0	0	0	0	0	0
13	Other Mnfg Exports	12627.5	933.6	2501.7	2866.2	3230.9	3529.2	4171.0
14	Building materials	0	0	0	0	0	0	0
15	Pulp & Paper	0	0	0	0	0	0	0
16	Chemical Industries	0	0	0	0	0	0	0
17	Appliances & Parts	0	0	0	0	0	0	0
18	Plastic & plastic prod.	0	0	0	0	0	0	0
19	Metals & metal prod.	7993.8	1452.0	3890.8	4457.8	5025.0	5488.9	6487.1
20	Weaving	0	0	0	0	0	0	0
21	Machinery	15874.9	420.6	1127.2	1291.5	1455.8	1590.2	1879.3
22	Autos & Motorbikes	3106.4	0	0	0	0	0	0
23	Other mnfg goods	12706.5	394.2	1056.4	1210.3	1364.3	1490.2	1761.3
24	Electricity & Gasoline	0	0	0	0	0	0	0
25	Mining	0	0	0	0	0	0	0

26	Oil & Natural Gas	0	0	0	0	0	0	0
27	Transportation	0	0	0	0	0	0	0
28	Communication	0	0	0	0	0	0	0
29	Finance	0	0	0	0	0	0	0
30	Real estate	0	0	0	0	0	0	0
31	Trade	0	0	0	0	0	0	0
32	Construction	42451.6	24533.1	65740.9	75321.2	84904.1	92742.5	109608.3
33	Social Services	0	0	0	0	0	0	0
34	Agricultural Services	0	0	0	0	0	0	0
35	Other Services	0	0	0	0	0	0	0

Note: Values denoted in billion VND.

Supply (Endowment) of Workers - $LS_{t,t}$

Basic labour supply estimates are generated by Vietnam's Ministry of Labour (GSO, 2004). This source provides estimates of the number of individuals in the workforce disaggregated into three broad skill categories over the period of 1996 through 2003. Estimates of unskilled labour supply from 2000-2003 were obtained from this source; estimates for 2004 and 2005 were projected using the annual rate of unskilled labour supply change from 1996-2003.

An alternative approach was required to determine the supply of high and medium skilled workers. While this data source does disaggregate labour into 'unskilled', 'medium skilled' and 'high skilled' individuals, the manner in which medium and high skill categories were defined is not the same as that used in the SAM. To obtain comparative estimates of the supply of labour in these skill categories, the following calculation was used:

$$\text{Number of Workers}_{sl} = \frac{\text{Wage Bill}_{sl}}{\text{Average Wage}_{sl}} \cdot (1 - U) \quad [\text{A.2}]$$

Where:

sl = Skilled labour. Included in this set are high and medium skill labour categories.

- $Wage\ Bill_{sl}$ = the sum of the wage bill for skill type sl as calculated from the 2000 SAM (Jensen et al., 2000)
- $Average\ Wage_{sl}$ = the average wage reportedly earned by individuals of skill type sl . These wage levels were estimated from data collected through Vietnam's Living Standards Survey (VLSS).
- U = Unemployment rate. The national rate of unemployment as reported by the GSO (GSO, 2008). Available unemployment rates are not disaggregated by skill type and are reported only for urban areas. This national rate of unemployment in 2000 (6.42%²²) was assumed to apply equally to all skill categories.

This procedure was used to estimate levels of labour supply in 2000. The annual change in the availability of medium skilled labour (as calculated from the Ministry of Labour estimates (GSO, 2004)) was used to project the availability of both medium and high skilled labour in 2001 through 2005.²³ Final estimates of the labour supply are provided in Table A.16.

Table A.16. Labour Supply

Skill Level	2000	2001	2002	2003	2004	2005
Unskilled	32680	32871	33091	32576	32589	32602
Medium Skilled	5995	6574	7592	8656	8763	8871
High Skilled	1741	1909	2205	2514	2545	2577

Note: Labour supply denoted in thousands of workers.

Official Foreign Transfers - $OfTrn_t$

²² This information is available through the GSO website on a table titled 'Unemployment rate of labour force of working age in urban area by region'. This site is available at:

http://www.gso.gov.vn/default_en.aspx?tabid=471&idmid=3&ItemID=6236. Statistics concerning unemployment rates in rural areas are not gathered. Reflecting the ability of rural (agriculture) dominated production in developing nations to absorb surplus labour, rural underemployment rates are estimated instead. These rates are not reflected in this calculation.

²³ The measure of medium skilled labor in the Ministry of Labour source (GSO, 2003) captures those who are categorized as medium skilled, and many of those who are considered high-skilled elsewhere in this analysis. Thus, as this data is available annually and spans both of these labour categories, it was decided to use this single source to estimate supply growth rates.

Official foreign transfers are reported in the Balance of Payments information available in the IMF country reports (Table 23). Data for 2000-2001 was obtained from IMF 2003, and for 2002-2005 from IMF 2007. These values were scaled and currency adjusted to permit their inclusion in the model; final values used in this analysis are presented in Table A.17.

Table A.17. Official Foreign Transfers

Year	2000	2001	2002	2003	2004	2005
Foreign Transfers	1,927	2,218	2,348	2,152	2,748	3,638

Note: Values denoted in billion VND.

Remittances by Households - $RMT_{h,t}$

At present there is not public record of the number of Vietnamese who work abroad, their income, or the amount of that income which is returned to Vietnam. Funds returned to Vietnam through formal channels (banks, transfer companies, postal and customs offices) are tracked. A substantial portion of remitted earnings, however, are transferred through informal channels through which they are unable to be tracked or measured (IMF, 2006c). In addition, efforts to measure remitted earnings are complicated by the lack of sound estimates of the number of Vietnamese individuals who, temporarily or permanently, have sought work abroad. At present then, estimates of migrant remittances are largely based on incomplete information and anecdotal evidence gathered by official, observers and those who participate in the cross-border transfer of these workers (IMF, 2006c).

Estimates of total annual remittances were obtained from the IMF (IMF, 2006c). For inclusion in the model it is required that these values be scale and currency adjusted. It is also necessary to allocate remittances across household types. The 2000 Vietnam SAM (Jensen et al., 2003), distributed the estimated remittances for that year to the 16 household types used in that analysis. Aggregating across these household types (Table A.3), the share of remittances destined for each type of household was determined. These shares were then used to proportionately allocate remittances across households for each year of this analysis. Final estimates of household disaggregated remittances are provided in Table A.18.

Table A.18. Remittances to Households

Household Type	2000	2001	2002	2003	2004	2005	
Rural	Farm	3389	2903	4808	5802	8183	8471
	Informal	1867	1599	2649	3196	4508	4666

	Wage	298	255	423	510	719	745
	Farm	335	287	475	573	809	837
Urban	Informal	8656	7415	12279	14818	20898	21634
	Wage	4443	3805	6302	7606	10726	11104

Note: Values denoted in billion VND.

Repatriated Earnings - $RpErn_{f,t}$

Information required to calculate the level of repatriated earnings are reported in the Balance of Payments information available in the IMF country reports (Table 23). Data for 2000-2001 was obtained from IMF 2003, and for 2002-2005 from IMF 2007. During this period, measures of investment income indicate that Vietnam experienced a net outward flow of income. The reported level of net investment flow, less the amount of interest paid on foreign public loans, was deemed to be the amount of investment earnings which were repatriated.

While this source provides a good aggregate estimate of repatriated earnings, this analysis requires that this measure be disaggregated across firms. The relative share of repatriated earnings by firms in the 2000 Vietnam SAM (Jensen et al., 2003) was used for this purpose. The 2000 SAM reported that no earnings of SOEs or Private firms were sent abroad; as a result then, it was assumed that foreign invested firms were the source of all outward-bound income flows. These final estimates were scale and currency adjusted and are presented in Table A.19.

Table A.19. Repatriated Earnings

Firm Type	2000	2001	2002	2003	2004	2005
State Owned Enterprises	0	0	0	0	0	0
Foreign Invested	4,166	5,323	8,887	9,597	9,360	15,408
Private	0	0	0	0	0	0

Note: Values denoted in billion VND.

Transfer Payments to Households - $Trn_{h,t}$

Estimates of transfer payments to households for 2000 and 2003 were obtained from the Vietnam SAMs for these years (respectfully documented in Jensen et al., 2004, and Jensen and Tarp, 2007). On the basis of the increase in transfer payments between 2000 and 2003, payments for the remaining years were estimated assuming an average growth rate of a geometric series. The complete series of transfer payments are provided in Table A.20.

Table A.20. Transfer Payments to Households

Household Type	2000	2001	2002	2003	2004	2005
Farm	10513	13766	18027	23606	30912	40480
Rural Informal	1187	1532	1978	2554	3297	4256
Wage	1302	1687	2187	2835	3674	4762
Urban Farm	2305	2919	3698	4684	5934	7517
Urban Informal	4035	5062	6351	7968	9996	12541
Wage	3416	4406	5683	7331	9457	12198

Note: Values denoted in billion VND.

Institutional Wages - $W_{i,l,f,t}$

This analysis estimates an institutional wage for high, medium and low skilled workers which reflects both the sector and the type of firm in which they are employed. Total wage earnings by households are assumed to be equal to those reported in the 2000 Vietnam SAM (Jensen et al., 2003). From these total measures, institutional wages rates were determined. The Vietnam Living Standards Survey (VLSS) collects information about surveyed household employers (sector, type of firm), and household income. Using this information, average wages by sector and firm type for each skill level were determined. To ensure that inter-year changes in skill definitions do not cloud these calculations, a single year of the VLSS data (2004) was used in this calculation.

Several important adjustment steps were required in these wage calculations. Internal consistency between these wage estimates, the wage bill provided in the SAM, and labour demand is necessary. As information concerning the supply of unskilled labour is deemed to be the most reliable²⁴, dividing the total wage bill by the labour demand²⁵, permitted a SAM based average wage for unskilled labour to be determined. The relative values of wages for unskilled, medium and high skilled workers across sectors and firm types was then determined relative to the average wage of unskilled labour calculated using the VLSS data. Finally, replacing the average survey based wage with average SAM based wage, and using the relative values of

²⁴ See discussion related to this variable.

²⁵ The labor demand was assumed to be equal to the labor supply less the number of unemployed.

wages across skill, sector and firm types, permits the estimation of SAM consistent disaggregated institutional wages.

As an additional consideration in several sectors, there were no or limited observations for wages paid by certain firm types. This is particularly true for medium and high skilled wage categories which, compared to the unskilled wage category, have relatively few workers. Due to the limited number of observations in these categories, a sector average wage was calculated and applied to all firm types. Given that the labour markets (in terms of wages and associated benefits) appear to function much more competitively for higher skill work categories this adjustment is reasonable. Wages were estimated separately by sector and firm type for unskilled workers.

Also worth noting are the wage estimates for the agricultural sectors (sectors 1-9). As the VLSS collected information only on agricultural workers and did not distinguish between sectors, it was possible to only estimate average wages within each skill-type for that broad industry.

Institutional wages estimated through this process are displayed in Table A.21. These wages were assumed to remain constant throughout the period of analysis.

Table A.21. Institutional Wages

35-Sector Disaggregation		High Skilled	Medium Skilled	Unskilled		
		All Firms	All Firms	SOEs	FI	Private
1	Rice	7.88	6.51	5.84	3.79	3.77
2	Fish & Seafood	7.88	6.51	5.84	3.79	3.77
3	Export Crops	7.88	6.51	5.84	3.79	3.77
4	Processed Exports	7.88	6.51	5.84	3.79	3.77
5	Other Crop	7.88	6.51	5.84	3.79	3.77
6	Sugar & Animal Feed	7.88	6.51	5.84	3.79	3.77
7	Livestock & Meat	7.88	6.51	5.84	3.79	3.77
8	Forestry	7.86	4.56	9.04	6.59	3.65
9	Processed Agrifood Prod.	9.42	6.73	4.71	4.36	3.70
10	Clothes	8.29	4.93	4.19	4.17	3.40
11	Leather Goods	4.19	5.40	5.43	5.33	4.23
12	Wood & wood products	6.58	6.08	2.59	4.81	2.67
13	Other Mnfg Exports	14.58	7.09	8.59	8.43	7.53
14	Building materials	8.56	5.54	5.46	5.41	3.35
15	Pulp & Paper	9.89	6.51	4.08	3.85	3.81
16	Chemical Industries	8.56	5.54	5.63	5.57	3.45
17	Appliances & Parts	8.56	5.54	5.63	5.57	3.45
18	Plastic & plastic prod.	7.33	5.90	3.27	5.65	3.60
19	Metals & metal prod.	12.48	7.41	5.23	5.31	3.42
20	Weaving	10.22	4.02	9.95	3.22	2.63
21	Machinery	8.57	7.67	9.48	9.31	3.18
22	Autos & Motorbikes	11.31	6.10	7.21	9.08	2.77
23	Other mnfg goods	11.86	5.51	6.56	5.96	5.36
24	Electricity & Gasoline	11.50	5.27	7.04	3.90	3.26
25	Mining	7.76	8.71	8.82	10.36	4.79

26	Oil & Natural Gas	32.56	26.59	8.42	8.27	5.11
27	Transportation	11.26	7.51	5.34	6.28	2.28
28	Communication	9.07	10.87	5.42	11.47	4.20
29	Finance	12.04	4.26	4.89	3.59	3.54
30	Real estate	8.44	8.33	7.69	6.55	3.54
31	Trade	13.39	10.53	5.01	5.49	2.04
32	Construction	11.31	9.21	7.83	11.16	3.50
33	Social Services	5.50	5.94	6.65	5.84	3.11
34	Agricultural Services	7.24	5.09	5.01	5.49	2.04
35	Other Services	8.50	5.92	7.83	11.16	3.50

Note: Values denoted in annual income per thousand workers in billion VND.

Behavioural Parameters

The following discussion provided details concerning the estimation of behavioural parameters used in this analysis.

Input-output coefficients - $\alpha_{i,j}$

Input-output coefficients used in this analysis were computed using the input-output (IO) table from the 2000 SAM (Jensen, et al., 2003), and the level of domestic output calculated by this analysis.²⁶

Due to the innovative construction of the 2000 Vietnam SAM, a few additional considerations were required to derive these coefficients. In addition to a matrix of intermediate consumption, this SAM also separately estimates domestic and export marketing margins. This analysis treats these margins as an intermediate factor of production and adjusts the IO table accordingly. To accommodate the model specification, this matrix was then aggregated from 112 sectors to 35 sectors according to the sector aggregation described in Table A.2. Input-output parameters are presented in Tables A22a-b.

²⁶ Is it worth reemphasizing that this IO table does not distinguish production by type of firm. It is for this reason that the method outlined under the description for the variable $X_{i,f,t}^f$ was used.

Table A.22a. Input-Output Coefficients – Part I

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	0.445	0.008	0.000	0.050	0.000	0.040	0.026	0.000	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.285	0.000	0.012	0.000	0.026	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	0.001	0.055	0.015	0.000	0.000	0.000	0.000	0.005	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000
4	0.000	0.007	0.000	0.127	0.000	0.035	0.002	0.001	0.030	0.010	0.033	0.002	0.005	0.001	0.001	0.002	0.001
5	0.000	0.004	0.000	0.211	0.047	0.053	0.068	0.000	0.037	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.001	0.000	0.247	0.156	0.000	0.034	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
7	0.000	0.004	0.000	0.032	0.000	0.005	0.114	0.000	0.017	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	0.000	0.005	0.000	0.003	0.003	0.003	0.004	0.060	0.000	0.000	0.000	0.410	0.002	0.001	0.049	0.001	0.001
9	0.000	0.001	0.000	0.010	0.000	0.001	0.000	0.000	0.118	0.001	0.144	0.000	0.000	0.000	0.000	0.005	0.000
10	0.000	0.001	0.001	0.003	0.000	0.000	0.000	0.001	0.000	0.099	0.003	0.001	0.000	0.000	0.001	0.000	0.001
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.247	0.000	0.000	0.000	0.000	0.000	0.000
12	0.001	0.009	0.001	0.001	0.004	0.003	0.009	0.011	0.002	0.002	0.000	0.027	0.001	0.001	0.023	0.006	0.002
13	0.002	0.003	0.002	0.004	0.002	0.000	0.000	0.003	0.015	0.003	0.002	0.006	0.168	0.009	0.004	0.011	0.066
14	0.001	0.001	0.000	0.004	0.002	0.005	0.004	0.003	0.000	0.016	0.000	0.005	0.005	0.261	0.007	0.004	0.001
15	0.000	0.004	0.002	0.012	0.001	0.001	0.001	0.006	0.063	0.005	0.005	0.018	0.011	0.026	0.297	0.013	0.020
16	0.062	0.005	0.191	0.031	0.076	0.020	0.001	0.028	0.031	0.014	0.034	0.026	0.035	0.017	0.034	0.323	0.005
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.190
18	0.001	0.016	0.002	0.025	0.001	0.006	0.006	0.001	0.022	0.012	0.024	0.008	0.054	0.052	0.026	0.038	0.025

19	0.000	0.018	0.001	0.009	0.001	0.031	0.002	0.002	0.020	0.014	0.010	0.008	0.129	0.020	0.008	0.048	0.130
20	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.009	0.455	0.088	0.001	0.001	0.000	0.009	0.000	0.000
21	0.005	0.001	0.002	0.002	0.000	0.000	0.001	0.003	0.010	0.002	0.001	0.002	0.120	0.003	0.001	0.001	0.085
22	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.001	0.002	0.000	0.000	0.000	0.001
23	0.000	0.029	0.004	0.004	0.001	0.027	0.017	0.004	0.042	0.025	0.011	0.017	0.032	0.016	0.016	0.007	0.007
24	0.006	0.084	0.022	0.045	0.012	0.035	0.009	0.030	0.022	0.017	0.011	0.040	0.031	0.101	0.080	0.033	0.019
25	0.000	0.002	0.002	0.007	0.001	0.006	0.001	0.001	0.002	0.005	0.001	0.002	0.024	0.094	0.006	0.028	0.005
26	0.000	0.000	0.000	0.026	0.000	0.000	0.000	0.000	0.020	0.000	0.000	0.000	0.001	0.004	0.000	0.006	0.000
27	0.080	0.081	0.026	0.140	0.063	0.133	0.122	0.140	0.110	0.065	0.121	0.133	0.160	0.139	0.252	0.199	0.120
28	0.000	0.003	0.001	0.002	0.010	0.002	0.002	0.012	0.002	0.003	0.003	0.003	0.002	0.003	0.002	0.002	0.003
29	0.000	0.007	0.000	0.001	0.000	0.001	0.000	0.001	0.001	0.005	0.004	0.002	0.002	0.001	0.000	0.002	0.001
30	0.000	0.003	0.000	0.005	0.000	0.000	0.000	0.003	0.013	0.004	0.004	0.002	0.002	0.001	0.001	0.001	0.015
31	0.013	0.052	0.079	0.011	0.016	0.004	0.004	0.012	0.004	0.087	0.125	0.078	0.016	0.000	0.002	0.003	0.000
32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
33	0.001	0.001	0.002	0.000	0.001	0.001	0.000	0.002	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000
34	0.041	0.003	0.008	0.000	0.008	0.002	0.001	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
35	0.000	0.003	0.004	0.002	0.000	0.002	0.000	0.005	0.004	0.003	0.002	0.003	0.002	0.002	0.001	0.002	0.003

Table A.22b. Input-Output Coefficients – Part II

Sector	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.014	0.007
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.022
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001
4	0.001	0.001	0.000	0.003	0.007	0.018	0.000	0.004	0.000	0.002	0.001	0.000	0.001	0.003	0.002	0.001	0.004	0.015
5	0.000	0.000	0.038	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002
6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018	0.005
7	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.032
8	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.008	0.000	0.000	0.000	0.000	0.001	0.003	0.002	0.000	0.008	0.003
9	0.000	0.000	0.001	0.000	0.000	0.002	0.001	0.000	0.000	0.002	0.001	0.001	0.001	0.005	0.001	0.004	0.000	0.018
10	0.001	0.000	0.002	0.000	0.000	0.001	0.006	0.001	0.001	0.000	0.003	0.000	0.001	0.001	0.001	0.002	0.001	0.005
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.000	0.000	0.000
12	0.001	0.001	0.005	0.001	0.000	0.009	0.000	0.007	0.000	0.000	0.001	0.002	0.010	0.003	0.028	0.007	0.001	0.006
13	0.001	0.008	0.007	0.028	0.003	0.010	0.039	0.021	0.002	0.001	0.014	0.002	0.006	0.017	0.102	0.013	0.015	0.016
14	0.003	0.017	0.041	0.008	0.000	0.003	0.001	0.039	0.000	0.000	0.007	0.000	0.044	0.007	0.195	0.005	0.022	0.013
15	0.004	0.001	0.005	0.007	0.001	0.046	0.000	0.001	0.000	0.000	0.013	0.011	0.008	0.011	0.002	0.009	0.002	0.006
16	0.033	0.005	0.029	0.005	0.006	0.053	0.001	0.020	0.007	0.000	0.001	0.000	0.011	0.005	0.036	0.010	0.074	0.013
17	0.000	0.002	0.000	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.002	0.000	0.003
18	0.424	0.001	0.028	0.013	0.003	0.019	0.002	0.004	0.000	0.001	0.004	0.000	0.009	0.010	0.071	0.001	0.007	0.005
19	0.006	0.458	0.030	0.088	0.126	0.040	0.017	0.033	0.001	0.004	0.006	0.001	0.028	0.007	0.120	0.002	0.020	0.014

20	0.001	0.000	0.366	0.000	0.000	0.014	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.001
21	0.001	0.071	0.001	0.384	0.004	0.011	0.032	0.012	0.022	0.001	0.074	0.023	0.005	0.009	0.055	0.043	0.000	0.019
22	0.000	0.028	0.000	0.033	0.469	0.006	0.000	0.007	0.000	0.002	0.002	0.001	0.013	0.104	0.002	0.007	0.002	0.008
23	0.008	0.031	0.025	0.023	0.010	0.263	0.010	0.015	0.002	0.010	0.018	0.034	0.021	0.012	0.009	0.067	0.010	0.020
24	0.027	0.049	0.044	0.014	0.010	0.039	0.184	0.065	0.060	0.046	0.017	0.033	0.032	0.028	0.037	0.059	0.104	0.082
25	0.002	0.005	0.010	0.001	0.001	0.004	0.009	0.111	0.001	0.001	0.002	0.001	0.006	0.002	0.024	0.002	0.010	0.004
26	0.000	0.000	0.002	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.016	0.001	0.005	0.000	0.000	0.004
27	0.247	0.171	0.172	0.162	0.140	0.194	0.010	0.092	0.005	0.075	0.001	0.007	0.010	0.018	0.002	0.010	0.002	0.004
28	0.002	0.002	0.002	0.003	0.002	0.003	0.002	0.002	0.049	0.001	0.009	0.035	0.008	0.001	0.004	0.015	0.005	0.020
29	0.002	0.003	0.003	0.004	0.001	0.001	0.001	0.002	0.000	0.000	0.092	0.150	0.014	0.024	0.001	0.019	0.003	0.016
30	0.003	0.003	0.002	0.008	0.001	0.003	0.001	0.009	0.093	0.018	0.001	0.021	0.050	0.109	0.006	0.014	0.002	0.022
31	0.001	0.005	0.007	0.006	0.000	0.014	0.000	0.027	0.000	0.730	0.000	0.000	0.000	0.160	0.000	0.000	0.000	0.000
32	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
33	0.000	0.000	0.002	0.001	0.000	0.001	0.001	0.002	0.001	0.001	0.002	0.004	0.009	0.001	0.001	0.052	0.002	0.002
34	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.132	0.000
35	0.002	0.001	0.003	0.005	0.001	0.003	0.001	0.008	0.010	0.001	0.007	0.014	0.027	0.010	0.006	0.041	0.004	0.023

Labour-output ratio - $\beta_{i,l,f}$

Labour-output ratios generated for this analysis reflect the conversion of labour into firm output within a given sector. These parameters were calculated according to the following formula:

$$\beta_{i,l,f} = \frac{Wage\ Bill_{i,l}}{X_{i,f,2000} \cdot W_{i,l,f,2000}} \quad [A.3]$$

Where:

$Wage\ Bill_{i,l}$ = expenditure for the use of labour type l in sector i . This data was obtained from the 2000 Vietnam SAM (Jensen et al., 2003).

$X_{i,f,2000}$ = sector i output by firm type f in 2000.²⁷

$W_{i,l,f,2000}$ = the average wage paid to labour of skill l employed in sector i by firm type f in 2000.¹⁰

As described in the discussion concerning calculation of institutional wage levels

($W_{i,l,f,t}$), these estimates are assumed to be the same across firm types for medium and high-skilled labour. As a consequence of this, $\beta_{i,l,f}$ values are also the same across firms for these labour categories.

Labour-output ratios are calculated using base-year data and are assumed to remain constant throughout the period of analysis. These parameters are presented in Table A.23.

²⁷ A description of the derivation of this variable is provided earlier in this discussion.

Table A.23: Labour-Output Ratios

Sector	High Skilled			Medium Skilled			Unskilled		
	SOE	FI	Private	SOE	FI	Private	SOE	FI	Private
1	0.0006	0.0006	0.0006	0.0037	0.0037	0.0037	0.0256	0.0395	0.0397
2	0.0006	0.0006	0.0006	0.0043	0.0043	0.0043	0.0301	0.0464	0.0467
3	0.0006	0.0006	0.0006	0.0044	0.0044	0.0044	0.0314	0.0484	0.0487
4	0.0008	0.0008	0.0008	0.0025	0.0025	0.0025	0.0111	0.0171	0.0172
5	0.0006	0.0006	0.0006	0.0054	0.0054	0.0054	0.0407	0.0626	0.0629
6	0.0007	0.0007	0.0007	0.0031	0.0031	0.0031	0.0183	0.0282	0.0284
7	0.0006	0.0006	0.0006	0.0046	0.0046	0.0046	0.0334	0.0514	0.0516
8	0.0008	0.0008	0.0008	0.0092	0.0092	0.0092	0.0312	0.0428	0.0773
9	0.0012	0.0012	0.0012	0.0044	0.0044	0.0044	0.0241	0.0260	0.0306
10	0.0006	0.0006	0.0006	0.0024	0.0024	0.0024	0.0092	0.0092	0.0113
11	0.0011	0.0011	0.0011	0.0020	0.0020	0.0020	0.0065	0.0066	0.0083
12	0.0008	0.0008	0.0008	0.0022	0.0022	0.0022	0.0197	0.0106	0.0190
13	0.0007	0.0007	0.0007	0.0033	0.0033	0.0033	0.0086	0.0088	0.0098
14	0.0007	0.0007	0.0007	0.0029	0.0029	0.0029	0.0112	0.0113	0.0182
15	0.0005	0.0005	0.0005	0.0019	0.0019	0.0019	0.0118	0.0125	0.0126
16	0.0011	0.0011	0.0011	0.0047	0.0047	0.0047	0.0186	0.0188	0.0304
17	0.0011	0.0011	0.0011	0.0048	0.0048	0.0048	0.0190	0.0192	0.0310
18	0.0011	0.0011	0.0011	0.0037	0.0037	0.0037	0.0270	0.0156	0.0245
19	0.0004	0.0004	0.0004	0.0018	0.0018	0.0018	0.0104	0.0103	0.0159
20	0.0009	0.0009	0.0009	0.0050	0.0050	0.0050	0.0066	0.0204	0.0249
21	0.0011	0.0011	0.0011	0.0029	0.0029	0.0029	0.0079	0.0081	0.0237
22	0.0007	0.0007	0.0007	0.0034	0.0034	0.0034	0.0119	0.0094	0.0309
23	0.0008	0.0008	0.0008	0.0044	0.0044	0.0044	0.0149	0.0164	0.0182
24	0.0028	0.0028	0.0028	0.0137	0.0137	0.0137	0.0321	0.0580	0.0694
25	0.0027	0.0027	0.0027	0.0060	0.0060	0.0060	0.0219	0.0186	0.0403

26	0.0007	0.0007	0.0007	0.0020	0.0020	0.0020	0.0245	0.0249	0.0404
27	0.0005	0.0005	0.0005	0.0015	0.0015	0.0015	0.0062	0.0053	0.0146
28	0.0035	0.0035	0.0035	0.0063	0.0063	0.0063	0.0378	0.0178	0.0487
29	0.0034	0.0034	0.0034	0.0204	0.0204	0.0204	0.0511	0.0697	0.0706
30	0.0039	0.0039	0.0039	0.0084	0.0084	0.0084	0.0261	0.0307	0.0567
31	0.0015	0.0015	0.0015	0.0045	0.0045	0.0045	0.0318	0.0290	0.0779
32	0.0007	0.0007	0.0007	0.0025	0.0025	0.0025	0.0128	0.0090	0.0288
33	0.0070	0.0070	0.0070	0.0163	0.0163	0.0163	0.0550	0.0626	0.1175
34	0.0010	0.0010	0.0010	0.0100	0.0100	0.0100	0.0684	0.0624	0.1676
35	0.0045	0.0045	0.0045	0.0137	0.0137	0.0137	0.0303	0.0213	0.0678

Depreciation of Capital - $\delta_{i,f}$

Even in the best of circumstances, the depreciation rates of capital are notoriously hard to estimate. In the case of Vietnam, the lack of information about the stock of capital has been noted by other authors (IDCJ, 2003). As no data based measure of depreciation was available, this assumes that capital depreciates at a rate of 10% annually. This rate has been used in other analysis for similar purposes (e.g. Baxter and King, 1993).

Incremental capital-output ratio - $\kappa_{i,f}$

Incremental capital-output ratios (ICOR) were calculated using investment (I) and gross output (GO) estimates provided by the GSO (GSO, 2007a). These ratios were calculated according to the following formula:

$$ICOR_i = \frac{\sum_{i=2000}^{2004} I_i \cdot (1 - \delta_i)}{GO_{i,2005} - GO_{i,2000} \cdot (1 - \delta_i)} \quad [A.4]$$

Estimates of investment reflected the sum of investment directed toward a particular sector by all firm types. It was assumed that the stock of investment depreciates over time at the rate previously described for that variable; as such, in this calculation, investment levels were annually downward adjusted to accommodate this capital loss. ICOR ratios were assumed to be the same across firm types and were assumed to remain constant over the full period of this analysis. Incremental capital-output ratios used in this analysis are presented in Table A.24.

Table A.24. Incremental Capital-Output Ratios

35-Sector Description	ICOR	35-Sector Description	ICOR	35-Sector Description	ICOR
1 Rice	0.074	10 Clothes	0.155	24 Electricity & Gasoline	2.886
2 Fish & Seafood	0.262	11 Leather Goods	0.176	25 Mining	0.906
3 Export Crops	1.884	12 Wood & wood products	0.240	26 Oil & Natural Gas	0.297
4 Processed Exports	0.316	13 Other Mnfg Exports	0.600	27 Transportation	1.238
5 Other Crop	0.139	14 Building materials	0.473	28 Communication	1.063
6 Sugar	0.660	15 Pulp & Paper	0.471	29 Finance	0.756
7 Livestock & Meat	0.232	16 Chemical Industries	0.603	30 Real estate	0.436
8 Forestry	1.846	17 Appliances & Parts	0.366	31 Trade	0.819
9 Processed Agrifood Prod.	0.177	18 Plastic & plastic prod.	0.447	32 Construction	0.288
		19 Metals & metal prod.	0.741	33 Social Services	1.040
		20 Weaving	0.439	34 Agricultural Services	4.347
		21 Machinery	0.381	35 Other Services	2.173
		22 Autos & Motorbikes	0.285		
		23 Other mnfg goods	0.213		

Average propensity to save - σh_h

Estimates of the average propensity to save are primarily based on Vietnam’s 2000 SAM (Jensen et al., 2003). Baseline levels of household savings are adopted from this SAM. To these savings levels are added an adjustment that reflects the difference between remittance levels which were reported in this SAM and the IMF report sourced remittance levels used in this analysis.²⁸ The sum of the 2000 SAM savings and remittance adjustment was then divided by household disposable income to provide an estimate of household average propensity to save. The results of this calculation are presented in Table A.25 below. It is assumed that these savings propensities remain the same throughout the period of analysis.

Table A.25. Average propensity to save

Household Type		Propensity to Save
	Farm	0.1079
Rural	Informal	0.1711
	Wage	0.1169
	Farm	0.2599
Urban	Informal	0.2798
	Wage	0.2316

Marginal budget share - $my_{i,h}$

Household consumption is based on a linear expenditure system (LES). In this demand system, it is assumed that income is dedicated first to satisfying basic subsistence consumption needs, and then any remaining income is allocated in proportion to its marginal budget share.

The marginal budget share is calculated according to the following formula:

$$my_{i,h} = \eta_{i,h} \cdot \theta_{i,h} \quad [A.5]^{29}$$

²⁸ While not a large, it is necessary that the slightly increased remittances reported by the IMF be captured in household accounting. This step implicitly assumes, however, that households save the total of the difference in these remittances.

²⁹ Although widely available, this particular specification of the LES is adopted from Taylor (1979), pp. 219-223.

Where:

- $my_{i,h}$ = marginal budget share for good i by household h
- $\eta_{i,h}$ = is the Engle elasticity (income elasticity of demand) for sector i goods by household h
- $\theta_{i,h}$ = the average budget share of commodity i in household h .

Income elasticities of demand used in this analysis were estimated by Huong (2000) based on the 1992-93 Vietnam's Living Standards Survey (VLSS). This source provides income elasticity of demand estimates for ten sectors. While these sectors are generally consistent with those used in this model, due to the difference in the relative number of sectors there is, of course, an imperfect correspondence between these aggregations. The first two columns of Table A.26 present a mapping between the 35-Sector model and the sector aggregation used by Huong³⁰. Estimates of the average budget share are obtained from the 2000 Vietnam SAM (Jensen et al., 2003).

In computing the marginal budget shares, attention must be paid to one additional consideration before final estimates can be obtained. As several of the Huong elasticities of demand are applied to multiple sectors, when combined with the budget shares ($\theta_{i,h}$), the marginal budget shares which are generated violate the Engle aggregation restriction. (The sum of these marginal budget shares is greater than one.) This violation was corrected by rescaling the relative budget shares within each household type. Final estimates of the household-disaggregated marginal budget shares are provided in Table A.26.

³⁰ For the purposes of this analysis, two small changes to the Engle elasticities estimated by Huong (2000) were required. For both urban informal and urban wage households, Huong reported the Engle elasticities to be 0; both of these were adjusted to be equal to 0.0001.

Table A.26. Marginal Budget Shares of Household Demand

35-Sector Model Aggregation	Huong (2000) aggregation	Rural			Urban		
		Farm	Informal	Wage	Farm	Informal	Wage
1 Rice	Rice	0.1595	0.0801	0.0366	0.0455	0.0000	0.0000
2 Fish & Seafood	Meat	0.0468	0.0454	0.0704	0.0493	0.0383	0.0332
3 Export Crops	Other foods	0.0034	0.0030	0.0026	0.0041	0.0015	0.0012
4 Processed Exports	Other foods	0.0479	0.0539	0.0487	0.0643	0.0394	0.0301
5 Other Crop	Other foods	0.0853	0.0713	0.0728	0.0883	0.0529	0.0439
6 Sugar & Animal Feed	Other foods	0.0184	0.0173	0.0176	0.0178	0.0097	0.0073
7 Livestock & Meat	Meat	0.0888	0.0803	0.1069	0.1119	0.0751	0.0770
8 Forestry	Other foods	0.0091	0.0066	0.0070	0.0103	0.0029	0.0017
9 Processed Agrifood Prod.	Tobacco & Beverages	0.1178	0.1198	0.1406	0.0905	0.1027	0.1509
10 Clothes	Textiles & garments	0.0491	0.0440	0.0491	0.0417	0.0228	0.0330
11 Leather Goods	Textiles & garments	0.0388	0.0346	0.0374	0.0339	0.0212	0.0286
12 Wood & wood products	Durables	0.0118	0.0093	0.0097	0.0133	0.0054	0.0062
13 Other Mnfg Exports	Durables	0.0059	0.0059	0.0060	0.0063	0.0040	0.0049
14 Building materials	Others	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15 Pulp & Paper	Durables	0.0009	0.0022	0.0030	0.0039	0.0156	0.0213
16 Chemical Industries	Others	0.0206	0.0224	0.0192	0.0252	0.0184	0.0218
17 Appliances & Parts	Others	0.0004	0.0017	0.0009	0.0033	0.0043	0.0057
18 Plastic & plastic prod.	Durables	0.0004	0.0004	0.0004	0.0005	0.0002	0.0003
19 Metals & metal prod.	Others	0.0009	0.0009	0.0006	0.0009	0.0003	0.0004
20 Weaving	Textiles & garments	0.0300	0.0295	0.0334	0.0255	0.0122	0.0199
21 Machinery	Durables	0.0108	0.0102	0.0078	0.0132	0.0151	0.0242

	Autos &							
22	Motorbikes	Durables	0.0238	0.0440	0.0381	0.0209	0.0503	0.0835
23	Other mnfg goods	Others	0.0332	0.0407	0.0310	0.0325	0.0279	0.0344
	Electricity &							
24	Gasoline	Fuel	0.0173	0.0317	0.0328	0.0251	0.0379	0.0390
25	Mining	Others	0.0009	0.0012	0.0007	0.0025	0.0029	0.0029
26	Oil & Natural Gas	Fuel	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
27	Transportation	Transport	0.0217	0.0424	0.0174	0.0141	0.0115	0.0276
28	Communication	Services	0.0012	0.0035	0.0020	0.0044	0.0219	0.0150
29	Finance	Services	0.0046	0.0073	0.0065	0.0201	0.0114	0.0123
30	Real estate	Services	0.0160	0.0218	0.0234	0.0301	0.0237	0.0441
31	Trade	Services	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32	Construction	Services	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
33	Social Services	Services	0.0538	0.0585	0.0595	0.0820	0.1139	0.0741
	Agricultural							
34	Services	Services	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
35	Other Services	Services	0.0809	0.1102	0.1178	0.1185	0.2565	0.1555

Subsistence Level of Consumption - $subs_{i,h}$

Subsistence consumption levels describe the absolute minimum level of consumption of commodity i which is required by household h . This parameter is the second component of the linear expenditure system, and is calculated according to the following formula:

$$subs_{i,h} = \left(\frac{D_h}{P_i} \right) \cdot \left(\theta_{i,h} + my_{i,h} \left(\frac{1}{\beta_h} \right) \right) \quad [A.7]^{31}$$

³¹ Although widely available, this particular specification of the LES is adopted from Taylor (1979), pp. 219-223.

Where:

$subs_{i,h}$ = marginal budget share for good i by household h

D_h = total expenditure by household h

P_i = price of commodity i

$\theta_{i,h}$ = average budget share of commodity i in household h .

$my_{i,h}$ = marginal budget share for good i by household h

β_h = Frisch parameter for household h

This calculation benchmarks a household LES demand function to initial consumption at net expenditure levels in the 2000 Vietnam SAM. Estimates of total household expenditure (D_h), and average budget shares ($\theta_{i,h}$) were calculated from this source. The estimation steps to determine the marginal budget shares ($my_{i,h}$) were previously described. In 2000, the year to which this system is benchmarked, domestic prices were assumed to equal 1.0 for all sectors. Estimates of the Frisch parameter were drawn from Huong (2000) and are based on the 1992-93 Vietnam Living Standards Survey (VLSS). While these parameters are based upon a slightly different household aggregation³² there is a sufficiently strong correlation between these aggregations and that these parameters are appropriate for use in this analysis. Frisch parameters used in this calculation, and the final subsistence levels of consumption are provided in Table A.27.

³² The household aggregation used in Huong (2000) is 'rich', 'middle', and 'low' income households in both rural and urban areas.

Table A.27. Subsistence Level of Consumption

35-Sector Model Aggregation		Rural			Urban		
		Farm	Informal	Wage	Farm	Informal	Wage
1	Rice	19961	4612	3574	1380	3824	2951
2	Fish & Seafood	3919	894	251	302	1321	653
3	Export Crops	222	43	19	21	55	38
4	Processed Exports	3108	781	352	331	1413	963
5	Other Crop	5534	1033	527	455	1898	1403
6	Sugar & Animal Feed	1192	251	128	92	349	234
7	Livestock & Meat	7427	1581	381	686	2588	1514
8	Forestry	589	95	51	53	103	54
9	Processed Agrifood Prod.	7218	2044	605	904	5002	1707
10	Clothes	3238	646	204	252	992	313
11	Leather Goods	2556	507	155	204	918	272
12	Wood & wood products	726	113	54	71	134	23
13	Other Mnfg Exports	364	72	33	34	98	18
14	Building materials	0	0	0	0	0	0
15	Pulp & Paper	55	26	17	21	385	78
16	Chemical Industries	1294	271	176	162	976	597
17	Appliances & Parts	23	21	8	21	228	157
18	Plastic & plastic prod.	24	4	2	3	4	1
19	Metals & metal prod.	57	11	5	6	15	11
20	Weaving	1980	433	138	154	529	189
21	Machinery	666	124	43	71	372	88
22	Autos & Motorbikes	1466	534	213	112	1238	305
23	Other mnfg goods	2081	490	284	208	1480	944
24	Electricity & Gasoline	1013	243	-19	140	1263	498
25	Mining	56	14	7	16	154	81

26	Oil & Natural Gas	0	0	0	0	0	0
27	Transportation	733	106	84	81	330	-52
28	Communication	90	65	16	20	196	211
29	Finance	354	136	52	91	102	173
30	Real estate	1227	405	185	136	212	622
31	Trade	0	0	0	0	0	0
32	Construction	0	0	0	0	0	0
33	Social Services	4118	1089	471	369	1018	1044
34	Agricultural Services	0	0	0	0	0	0
35	Other Services	6191	2051	932	533	2291	2191
	Frisch Parameter	-3.12	-2.28	-1.73	-3.23	-2.25	-1.63

Note: Consumption values reflect total annual value consumption for goods in each sector by household type. Values are denoted in billion VND.

Retained earnings - $retf_{i,f}$

Consistent and comprehensive information is not available on the extent to which profits are retained by firms for internal investment.³³ As such, an aggregate measure of retained earnings is determined residually through the following calculation:

$$\sum_i \sum_f retf_{i,f} = \sum_f \left(Yf_{f,2000} - RpErn_{f,2000} - Yf_{f,2000} \cdot Tf_f - \sum_h Divd_{h,f,2000} \right) \quad [A.8]$$

Where:

$Yf_{f,t}$ = Income of firm type f in time t .³⁴

$RpErn_{f,t}$ = earnings repatriated by firm f in time t .¹²

³³ An estimate of retained earnings is provided in the 2000 SAM but this value is determined as a residual calculation.

³⁴ A description of the derivation of this variable is provided earlier in this discussion.

Tf_f = tax rate on corporate income and factors (land and capital)¹²

$Divd_{h,f,t}$ = profits and social security distributed to household h by firm f in time t . This information is available in the 2000 Vietnam SAM (Jensen et al., 2003).

This calculation yields an aggregate measure of retained earnings of 56,793 billion VND in 2000.

For this analysis, estimates of retained earnings are required at the firm level. The careful estimation of earnings retained by SOEs provided in the 2000 SAM is adopted in this analysis. The level of earnings retained by foreign invested firms was calculated in a manner similar to the aggregate residual calculation³⁵:

$$\sum_i retf_{i,FI} = Yf_{FI,2000} - RpErn_{FI,2000} - Yf_{FI,2000} \cdot Tf_{FI} \quad [A.9]$$

Private firms are assumed to provide the balance of the aggregate level of retained earnings.

For the purposes of this analysis, retained earnings estimates are required as a share of after-tax corporate income. It is assumed that, within each firm type, these shares are constant both across sectors and time. Table A.28 summarizes the level and share estimates of this parameter. Retained earnings shares vary considerably across firm types with privately owned firms retaining the lowest proportion of their income. This outcome is expected given the significant portion of profits that these firms return to their owners.

Table A.28. Retained Earnings

	Type of Firm		
	State Owned Enterprise	Foreign Invested	Private
Amount Retained	36 884	9743	10 156
Proportion of Earnings Retained	0.7115	0.7007	0.1320

³⁵ It is assumed that FI firms repatriate earnings rather than provide dividends to domestic households or partners.

Share of Labour Income by Skill Type - $shareL_{h,l}$

Information from the 2000 Vietnam SAM was used to estimate this parameter. This source quantifies the amount of income that each type of labour provides to each category of household. As might be assumed, this data exhibits strong correlation between households that earn a majority of their income from wage sources and those with high-skilled expertise. Similarly labour deemed as ‘unskilled’ provides a majority of the income to farming households. Table A.29 provides these estimates.

Table A.29. Share of Labour Income by Skill Type

Household Type		Share of Labour Income		
		Unskilled	Medium Skilled	High Skilled
Rural	Farm	0.4353	0.2066	0.0539
	Informal	0.1404	0.1002	0.0122
	Wage	0.0958	0.0762	0.0452
Urban	Farm	0.0498	0.0249	0.0137
	Informal	0.1541	0.2338	0.2011
	Wage	0.1245	0.3583	0.6739

Share of Capital Income Accruing to Households - $shareK_h$

Data available in the aggregated 2000 SAM was used to calculate the share of capital rents which were accrued to each household type. This capital income is generated through income paid to households as returns for the use of factors of production (land, capital), and profits returned to households from privately owned firms (dividends). Capital income from these sources is summed and the relative proportion of capital income accrued to each household type was determined; these shares are presented in Table A.30. As with other behavioural parameter estimates, it is assumed that these shares remain fixed over the period of analysis.

Table A.30. Share of Capital Income by Household Type

Household Type		Share of Capital Income
Rural	Farm	0.4353
	Informal	0.1404
	Wage	0.0958
Urban	Farm	0.0498
	Informal	0.1541
	Wage	0.1245

Tax Rate on Corporate Income and Factors - Tf_f

The 2000 Vietnam SAM is used as the basis for the calculation of corporate tax rates. These tax rates are determined on the basis of the following formula:

$$Tf_f = \frac{\text{Corporate Tax Bill}_f - \text{Enterprise Subsidies}_f}{\text{Gross Total Income}_f} \quad [\text{A.10}]$$

Corporate tax rates are presented in Table A.31. For the purpose of this analysis, these rates are introduced to the model as ratios. It is assumed that these tax rates are constant through the duration of the period of analysis.

Table A.31. Taxes on Corporate Income

	Firm Type		
	State Owned Enterprise	Foreign Invested Firms	Private Firms
Tax Ratio	0.0669	0.4636	0.0793

Tax Rate on Household Income - Th_h

The income tax rates are calculated on a household basis by dividing the total private tax bill by the total income for each household type. The total private tax bill was calculated using the 2000 SAM. Total household income was calculated by adding the household income from 2000 SAM to the increase in household income due to the required remittance adjustment³⁶.

Household tax rates are presented in Table A.32. For the purpose of this analysis, these rates are introduced to the model as ratios; it is assumed that these tax rates are constant through the duration of the period of analysis.

Table A.32: Taxes on Household Income

	Rural			Urban		
	Farm	Informal	Wage	Farm	Informal	Wage
Tax Ratio	0.0042	0.0036	0.0031	0.0064	0.0073	0.0074

Import Tariff - $Tm_{i,t}$

Import tariff rates are determined by dividing tariff revenue by the value of imports measured at world prices. This calculation is benchmarked in 2000 and the needed data is drawn from the 2000 Vietnam SAM. Import tariff rates are presented in Table A.33. These rates are assumed to be constant through the duration of the period of analysis.

Indirect Taxes - Tv_i

Indirect taxes are collected on goods which are sold domestically³⁷ and valued at domestic prices. This parameter is calculated based upon the 2000 Vietnam SAM according to the following formula:

³⁶ The need for this adjustment is described in the discussion concerning the 'Average Propensity to Save'.

³⁷ This includes both domestically produced and imported goods.

$$Tv_i = \frac{Indirect\ Tax\ Bill_{i,2000}}{\left(X_{i,2000} + \frac{M_{i,2000}}{ex_{2000} \cdot Pwm_{i,2000}} \right)} \quad [A.11]$$

Where:

$Indirect\ Tax\ Bill_{i,t}$ = marginal budget share for good i by household h

$X_{i,t}$ = sector i output quantity in time t

$M_{i,t}$ = sector i importvalues in time t

ex_t = exchange rate in period t

$Pwm_{i,t}$ = world price of imported good i in foreign currency

The total amount of indirect taxes which are collected were obtained from the SAM; to obtain this amount, vectors of tax income were aggregated across both sectors and tax types according to Tables A.2 and A.5, respectively. Other variables used in this calculation have been described earlier in this discussion. Indirect tax rates are presented in Table A.33. These rates are assumed to be constant through the duration of the period of analysis.

Table A.33 Tariff and Indirect Tax Rates

35-Sector Model Aggregation	Tariff	Indirect Tax
1 Rice	0.001	0.034
2 Fish & Seafood	0.128	0.042
3 Export Crops	0.007	0.068
4 Processed Exports	0.096	0.042
5 Other Crop	0.052	0.057
6 Sugar & Animal Feed	0.339	0.045
7 Livestock & Meat	0.031	0.033
8 Forestry	0.000	0.111
9 Processed Agrifood Prod.	0.098	0.106
10 Clothes	0.055	0.032
11 Leather Goods	0.039	0.026
12 Wood & wood products	0.031	0.039
13 Other Mnfg Exports	0.039	0.014
14 Building materials	0.016	0.034
15 Pulp & Paper	0.105	0.022
16 Chemical Industries	0.013	0.011
17 Appliances & Parts	0.145	0.018
18 Plastic & plastic prod.	0.029	0.011
19 Metals & metal prod.	0.022	0.013
20 Weaving	0.021	0.012
21 Machinery	0.025	0.006
22 Autos & Motorbikes	0.145	0.015
23 Other mnfg goods	0.022	0.012
24 Electricity & Gasoline	0.172	0.017
25 Mining	0.009	0.035

26	Oil & Natural Gas	0.149	0.039
27	Transportation	0	0.015
28	Communication	0	0.047
29	Finance	0	0.016
30	Real estate	0	0.113
31	Trade	0	0.051
32	Construction	0	0.032
33	Social Services	0	0.015
34	Agricultural Services	0	0.037
35	Other Services	0	0.045

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