The 2003 Merged Model for Vietnam

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Abstract: This monograph documents the 2003 Merged Model for Vietnam. The initialization and calibration of the model is based on a financial 2003 SAM framework and an auxiliary 2002-3 data set. The recursive nature of the solution of the Merged Model is discussed with reference to the four main sectors of the model, including (i) the goods market and private sector budget, (ii) the government budget, (iii) the money market, and (iv) the balance of payments, and the initialization and solution of individual (exogenous and endogenous) variables is outlined. In addition, the calibration of parameter values is presented and the validity of the calibrated model parameters for the creation of future economic projections is discussed with reference to historical time series data. Similarly, benchmark growth paths for the four (intermediate target) focal variables, including real government consumption, government domestic credit, private domestic credit, and private net foreign debt, are discussed with reference to historical time series data. Accordingly, the current monograph facilitates the future implementation of the Merged Model for Vietnam by going through the main considerations necessary for the implementation of the projection tool, and the subsequent evaluation of the economic projections on the basis of the focal variable growth paths.

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1. Introduction

The 2003 Vietnam Merged Model (VMM) was constructed on the basis of the Merged Model established in Brixen and Tarp (1996) and further developed in Jensen and Tarp (2002, 2006). The Merged Model framework is a needs-based macroeconomic planning tool. The origins of the model framework can be traced back to the Revised Minimum Standards Model (RMSM) framework of the World Bank, and the Financial Programming (FP) approach of the IMF. As such, it retains the growth programming ideas from the RMSM model, and the balance of payments/government resource use focus from the FP approach. The Merged Model is fundamentally a medium-term planning tool, which takes a requirement approach rather than an availabilities approach to policy formulation. Nevertheless, the framework is typically used in an iterative fashion, which supposedly makes it more suitable for making projections. Thus, endogenously determined (focal) variables are used as indicators of the relevance of the assumptions about the exogenous variables, e.g. economic growth. The Merged Model framework can therefore be used both for (i) the development of new internally consistent economic scenarios, and (ii) the evaluation and identification of internal inconsistencies in existing economic plans.

The current 2003 VMM model framework was developed as part of a lecture series focussing on SAM-based analytical methods at the Central Institute for Economic Management (CIEM) at the Ministry of Planning and Investment in Ha Noi during 2006. To increase the accessibility of the modelling tool, the 2003 VMM model was implemented using the Excel spreadsheet programme platform (Jensen & Tarp; 2007a).[2] The current monograph documents the 2003 VMM model. Furthermore, it seeks to provide sufficient background knowledge to allow for a smooth application of the model framework by Vietnamese economic analysts. In particular, the monograph seeks to provide an understanding of (i) the basic structure and recursive nature of the Merged Model framework, (ii) basic model initialization and parameter calibration procedures, and (iii) Vietnamese benchmark growth paths for calibrated parameters and (intermediate target) focal variables. A basic understanding of (historical) benchmark growth paths is essential for the development of future macroeconomic scenarios. An application of the 2003 VMM model framework to evaluate the internal consistency of the 2006-2010 Socio-Economic Development Plan for Vietnam is contained in Jensen & Tarp (2007b).

The rest of the monograph is structured as follows. The background for the construction of the Merged Model, including the RMSM and FP modelling approaches, is discussed in Chapter 2. This chapter also contains an outline of the 2003 VMM model equations. Subsequently, the model closure and the recursive solution structure of the Merged Model are discussed in Chapter 3. The (recursive) solution of each individual (endogenous) variable is put forward with reference to the main sectors of the model, including the '*goods market and private sector budget*', '*government sector budget*', '*money market*', and '*balance of payments*'. Similarly, the four focal variables (intermediate targets) of the model, including *real government consumption*, *government domestic credit*, *private domestic credit*, and *private net foreign debt*, are presented as a set of diagnostic tools to target problematic assumptions and internal inconsistencies in the development of Merged Model projections. Chapter 4 contains a discussion of the initialization of the Merged Model

2 Previous Merged Model applications, e.g. Jensen & Tarp (2002; 2006), were implemented using the less accessible GAMS software. The Excel-based Merged Model software is available upon request.

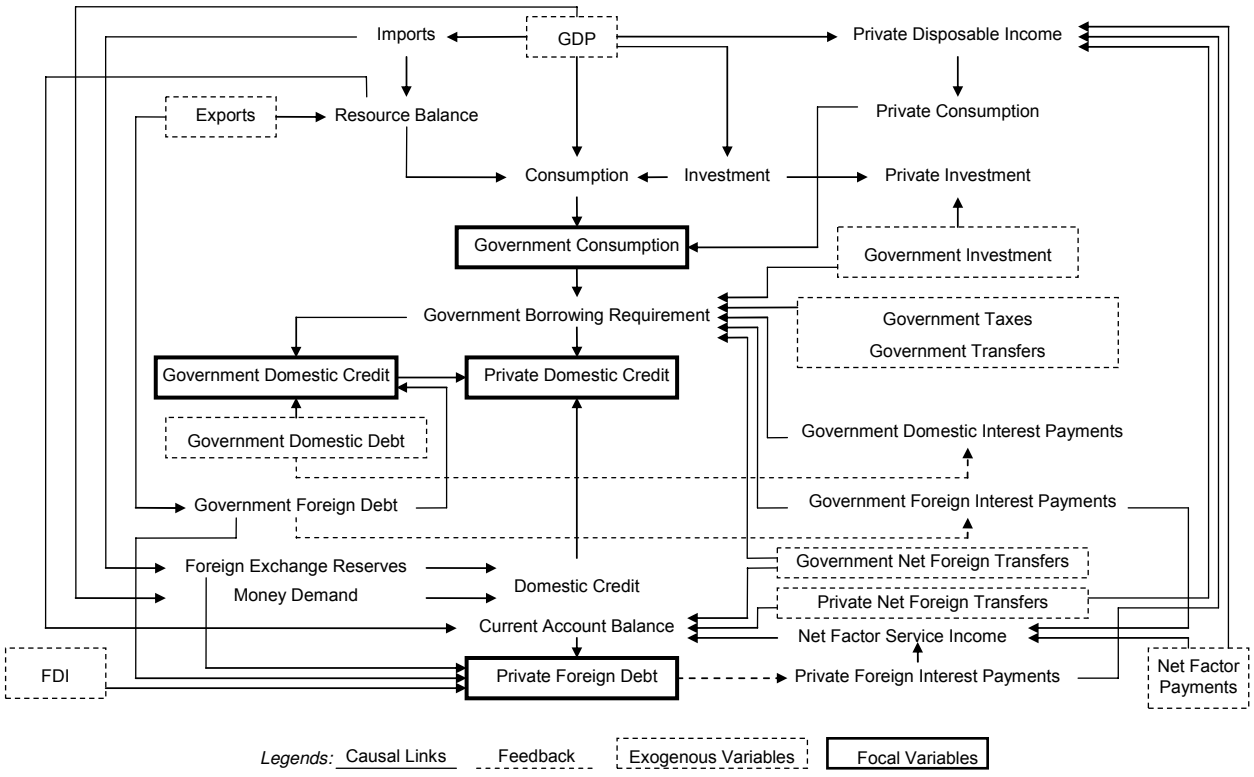
variables and the calibration of the Merged Model parameters. In particular, the chapter contains a discussion (validation) of the calibrated model parameters with reference to the medium term nature of the projection framework. Chapter 5 contains a discussion of the role of the four focal variables in the evaluation of Merged Model projections. In particular, historical time series evidence on the focal variables is presented and the implications for the expected future development of the focal variables (benchmark growth paths) are discussed. Chapter 6 concludes.

2. The Merged Model Framework

2.1. Background

The 2003 Vietnam Merged Model (VMM) was constructed on the basis of the Merged Model established in Brixen and Tarp (1996) and further developed in Jensen and Tarp (2002, 2006). The Merged Model was first developed as an attempt to unite the Revised Minimum Standard Model (RMSM) of the World Bank (Addison; 1989), and the Financial Programming (FP) modelling approach (IMF; 1987) into a common modelling framework. As such, it was meant to provide a formalized macroeconomic framework, which could be used to evaluate the combined impact of the stabilization and development strategies of the IMF and the World Bank. The 2003 VMM model builds on the model developed by Jensen and Tarp (2002), and a flow diagram of the model is presented in Figure 1. The equations of model framework are presented in appendix A.

Figure 1. Merged Model Flow Diagram



The Revised Minimum Standard Model (RMSM) is the traditional stylized framework, which the World Bank has used for decades to establish consistent long-term economy-wide growth projections for member countries. The World Bank approach takes an exogenously specified growth path of GDP as starting point in the tradition of Domar (1946), and the supply side is accounted for through a Harrod-Domar type specification of required investment demand. In addition, it includes a balance of payments section, used to derive the implied need for foreign long-

term borrowing. Addison (1989) provides an authoritative statement of the RMSM modelling framework.

The application of the model relies on a closure, which makes the model solve sequentially. First, the 'final demand' variables are determined. An exogenously specified growth path for GDP, determines import and investment demand, an exogenously specified export growth path determines the trade balance, and the material balance accounting identity determines consumption residually. Subsequently, the 'balance of payments' variables are determined. The trade balance, together with predetermined foreign interest payments and exogenous growth paths for net factor payments and net transfers from abroad, determine the current account of the balance of payments. Moreover, the accumulation of foreign exchange reserves are determined by a 'capacity to import' equation. The model is closed, by allowing the capital account to adjust through changes in long-term net foreign borrowing.[3]

Financial programming (FP) has been the traditional methodology used by the IMF to establish short-term stabilization programs for member countries with balance of payments problems. The methodology, in the tradition of Polak (1957), integrates the monetary sector within the analysis of income and balance of payments developments. The formalized FP modelling framework is based on an exogenously specified GDP growth path, and includes the monetary sector, government accounts and the balance of payments. IMF (1987) presents a formalization of the IMF methodology for assessing the causes and cures of balance of payments problems.

The application of the FP model relies on a highly stylized closure. An exogenously specified GDP growth path determines money demand through a quantity theory specification. Moreover, a given government borrowing requirement and a fixed supply of long-term borrowing determines the demand for government domestic credit. With a given demand for private domestic credit, this will determine total demand for domestic credit and – given the previously determined money demand – the demand for foreign exchange reserves. On the other hand, a given level of export earnings and fixed supplies of private and government long-term borrowing makes the supply of foreign exchange reserves a function of import expenditures. An 'import demand' specification, which acts as a check on the consistency of the demand for foreign exchange reserves, closes the model.

From the above discussion, it follows that the RMSM model is solved sequentially with foreign long-term borrowing as the intermediate target variable (or focal variable). The FP model is, on the other hand solved simultaneously with government domestic credit as intermediate target variable. In merging these two models, Brixen and Tarp (1996) and Jensen and Tarp (2002) kept the sequential nature of the RMSM model. Accordingly, the merged model solves for final demand and private sector budget variables, before solving for government budget, money market and balance of payments variables. Moreover, government domestic credit and private foreign borrowing were maintained as intermediate target (or focal) variables of the merged model (in addition to real government consumption and private domestic credit). The currently used version of the merged model, which is described below, makes use of the same closure rules.

[3] The RMSM model is fundamentally a planning tool, which takes a requirement approach rather than an availabilities approach to policy formulation. Nevertheless, the framework is typically used in an iterative fashion, which supposedly makes it more suitable for making projections. Thus, endogenously determined variables are used as indicators of the relevance of the assumptions about the exogenous variables, e.g. economic growth.

2.2. The Merged Model Equations

This section presents the equations of the 2003 Merged Model for Vietnam. The equations are presented with reference to four separate economic sectors including (i) Goods Market and Private Sector Budget, (ii) Government Budget, (iii) Money Market, and (iv) Balance of Payments. The distinction between these four fundamental sectors of the economy is maintained, since the model solves recursively for sector-specific variables within and between periods. A detailed discussion of the recursive nature of the model solution is included in Section 4. In the following, the equations of the Merged Model are briefly presented with reference to the four fundamental sectors of the model. Variables are indexed over time (t) and economic sectors (s) including agriculture, industry and service sectors.

2.2.1. Goods Market and Private Sector Budget Equations

This section presents the first set of equations in the Merged model (Eqs. (1)-(13) in Appendix A). These equations include national accounting identities (e.g. the material balance) and behavioural relationships (e.g. investment demand and import demand specifications). The structure of the equations clearly demonstrates how the Merged Model is a needs-based macro-economic planning tool. It specifies exogenous aggregate GDP and export growth paths for the economy, and calculates the associated needs in terms of imports and capital accumulation.

Equation (1): Sectoral GDP

The first equation defines sectoral GDP ($GDPS_{s,t}$):

(1) $GDPS_{s,t} = (1+\gamma_{s,t})*GDPS_{s,t-1}$.

Sectoral GDP is defined over time (t) three sectors (s) including agriculture, industry, services, and the sectoral GDP growth paths are determined by exogenous growth rates ($\gamma_{s,t}$).

Equation (2): Aggregate GDP

The second equation defines aggregate GDP (GDP_t):

(2) $GDP_t = \Sigma_s GDPS_{s,t}$.

The aggregate GDP growth path is defined as the sum of the sectoral GDP growth paths.

Equation (3): Sectoral Exports

The third equation defines sectoral exports ($XS_{s,t}$):

(3) $XS_{s,t} = (1+\lambda_{s,t})*XS_{s,t-1}$.

Sectoral exports is also defined over time (t) and three sectors (s) including agriculture, industry, services, and the sectoral export growth paths are determined by exogenous growth rates ($\lambda_{s,t}$).

Equation (4): Aggregate Exports

The fourth equation defines aggregate exports (X_t):

(4) $X_t = \Sigma_s XS_{s,t}$.

The aggregate export growth path is defined as the sum of the sectoral export growth paths.

Equation (5): Investment Demand

The fifth equation is a behavioural relationship which defines aggregate investment demand (IV_t):

(5) $IV_t = k_{0,t}GDP_{t-1} + k_{1,t}\Delta GDP_t$.

Investment demand is a linear function of lagged GDP and current GDP growth. The specification is a needs-based specification, which can be derived from a capital accumulation equation with depreciation rate (δ_t) and an incremental capital-output ratio (κ_t). The investment demand coefficients are defined as $k_{0,t} = \delta_t*\kappa_t$ and $k_{1,t} = \kappa_t$. The derivation of this result relies on a fixed capital-output ratio (κ):

$$K_t = \kappa GDP_t$$

and a capital accumulation relationship with a fixed depreciation rate (δ):

$$\begin{aligned} IV_t &= \delta K_{t-1} + \Delta K_t \\ &= \delta\kappa GDP_{t-1} + \kappa\Delta GDP_t \\ &= k_0 GDP_{t-1} + k_1 \Delta GDP_t. \end{aligned}$$

Equation (6): Import Demand

The sixth equation is a behavioural relationship which defines aggregate import demand (M_t):

(6) $\log(M_t) = m_{0,t}+m_{1,t}\log(GDP_t)+m_{2,t}\log(E_t*MPI_t/PD_t)$.

Import demand is an exponential function of (i) real GDP and (ii) relative import prices, defined as the product of world market import prices (MPI_t) and the exchange rate (E_t) divided by the GDP price deflator (PD_t). The import demand specification may be given the interpretation of a needs-based specification. E.g. a needs-based specification with $m_{2,t} = 0$ would leave import demand as an exponential function of GDP growth. On the other hand, the specification also allows for a demand-

based interpretation. E.g. a demand-based specification with $m_{2,t} = 1$ and $m_{2,t} = -\sigma$ would be equivalent to the first order condition for cost-minimization based on a Constant Elasticity of Substitution (CES) specification with substitution elasticity σ.

Equation (7): Aggregate Consumption

The seventh equation defines aggregate consumption (C_t):

(7) $C_t = CP_t + CG_t$

Aggregate consumption is defined as the sum of private consumption (CP_t) and government consumption (CG_t).

Equation (8): Aggregate Investment

The eighth equation defines aggregate investment (IV_t):

(8) $IV_t = IVP_t + IVG_t$

Aggregate investment is defined as the sum of private investment (IVP_t) and government investment (IVG_t).

Equation (9): Private Consumption

The ninth equation is a behavioural equation which defines nominal private consumption expenditures (P_t*CP_t):

(9) $P_t*CP_t = (1-b_t)*GDY_t$

Private consumption expenditures are defined as the product of the absorption price deflator (P_t) and real private consumption (CP_t). Moreover, it is determined on the basis of an exogenous average private savings propensity (b_t) and private disposable income (GDY_t).

Equation (10): Material Balance

The tenth equation is a national accounting identity (material balance) which defines nominal GDP (PD_t*GDP_t):

(10) $PD_t*GDP_t = P_t*(C_t+IV_t) + E_t*(XPI_t*X_t–MPI_t*M_t)$

The material balance accounting identity specifies that nominal GDP (PD_t*GDP_t) is equal to the sum of nominal absorption ($P_t*(C_t+IV_t)$) and the resource balance ($E_t*(XPI_t*X_t–MPI_t*M_t)$). Nominal GDP is defined as the product of the GDP price deflator (PD_t) and real GDP (GDP_t). Nominal absorption is defined as the product of the absorption price deflator (P_t) and the sum of

real consumption and real investment (C_t+IV_t). Finally, the resource balance is defined as the difference between export earnings (E_t*XPI_t*X_t) and import expenditures (E_t*MPI_t*M_t). Export earnings are defined as the product of the exchange rate (E_t), the world market export price deflator (XPI_t) and real exports (X_t), while import expenditures are defined as the product of the exchange rate (E_t), the world market import price deflator (MPI_t) and real imports (M_t).

Equation (11): Real GDP

The eleventh equation is a national accounting identity which defines real GDP (GDP_t):

(11) $PD_{2003}*GDP_t = P_{2003}*(C_t+IV_t) + E_{1995}*(MPI_{12003}*M_t-XPI_{2003}*X_t)$,

The accounting identity specifies that real GDP evaluated at base year prices ($PD_{2003}*GDP_t$) is equal to the sum of real absorption evaluated at base year prices ($P_{2003}*(C_t+IV_t)$) and the real resource balance evaluated at base year prices ($E_{2003}*(XPI_{2003}*X_t–MPI_{2003}*M_t)$).

Equation (12): Private Disposable Income

The twelfth equation is an accounting identity which measures private disposable income (GDY_t):

(12) $GDY_t = PD_t*GDP_t+E_t*NFP_t+E_t*NTRP_t+INDG_t+(GT_t-TG_t)-E_t*INFP_t$,

Private sector disposable income is defined as gross national income ($PD_t*GDP_t + E_t*(NFP_t – INFG_t – INFP_t) + E_t*(NTRP_t + NTRG_t)$) net of government (net) domestic revenues ($GT_t – TG_t – INDG_t$) and government (net) foreign revenues ($NTRG_t – INFG_t$). Private sector income items include nominal GDP (PD_t*GDP_t), net factor payments (E_t*NFP_t), net private foreign transfers (E_t*NTRP_t), government domestic interest payments ($INDG_t$), and government transfers (GT_t). Private sector 'fixed' expenditure items include government domestic revenues (TG_t) and private foreign interest payments (E_t*INFP_t).

Equation (13): Gross Domestic Savings

The thirteenth equation defines gross domestic savings (GDS_t):

(13) $GDS_t = PD_t*GDP_t+E_t*(NFP_t-INFG_t-INFP_t)+E_t*(NTRP_t+NTRG_t)-P_t*C_t$.

Gross domestic savings is defined as the difference between gross national income ($PD_t*GDP_t + E_t*(NFP_t – INFG_t – INFP_t) + E_t*(NTRP_t + NTRG_t)$) and aggregate nominal consumption P_t*C_t. Gross national income is defined as the sum of nominal GDP (PD_t*GDP_t), net factor service income from abroad ($E_t*(NFP_t – INFG_t – INFP_t)$), unrequited private net foreign transfers (E_t*NTRP_t), and unrequited government net foreign transfers (E_t*NTRG_t).

2.2.2. Government Budget Equations

The second set of equations in the Merged Model (Eqs. (14)-(16) in Appendix A) describes the government sector budget accounts.

Equation (14): Government Borrowing Requirement

The fourteenth equation summarizes all current transactions of the government institutional account and defines the origin of the government borrowing requirement (BRG_t):

(14) $BRG_t = P_t*(CG_t+IVG_t)+(GT_t-TG_t)+ INDG_t +E_t*(INFG_t-NTRG_t)$.

The government borrowing requirement is defined as the difference between government current expenditure and income. Current expenditure items include government consumption (P_t*CG_t), government investment (P_t*IVG_t), government current transfers to the private non-government sector (GT_t), government domestic interest payments ($INDG_t$), and government foreign interest payments (E_t*INFG_t). Current income items include government domestic revenues (TG_t) and unrequited government foreign transfers (E_t*NTRG_t).

Equation (15): Government Financing

The fifteenth equation summarizes all capital transactions of the government institutional budget and defines the financing of the government borrowing requirement (BRG_t):

(15) $BRG_t = E_t*\Delta NFDG_t+ \Delta NDDG_t+\Delta DCG_t$.

The government borrowing requirement is financed from foreign and domestic financial sources. The foreign financing sources include accumulation of net government foreign debt ($NFDG_t$), while domestic financing sources include accumulation of net government domestic debt ($NDDG_t$) and government domestic credit (DCG_t).

Equation (16): Government Net Foreign Debt

The sixteenth equation is a behavioural relationship which defines the stock of government net foreign debt ($NFDG_t$):

(16) $NFDG_t = g_t*XPI_t*X_t$.

Government net foreign debt is defined as an exogenous share (g_t) of foreign currency export earnings (XPI_t*X_t). The specification may be given an ability-based interpretation. If the foreign currency constraint is binding, the ability to increase foreign borrowing depends on the ability to increase export earnings. Otherwise, the debt-to-export ratio may also be set according to political priorities (below the ability to borrow). The determination of the stock of government net foreign debt implicitly determines the governments' ability/priority to borrow from abroad at any given point in time.

2.2.3. Money Market Equations

The third set of equations in the Merged Model (Eqs. (17)-(22) in Appendix A) describes the money market accounts.

Equation (17): Nominal GDP

The seventeenth equation defines nominal GDP ($GDPN_t$):

(17) $GDPN_t = PD_t*GDP_t$.

Nominal GDP is defined as the product of real GDP (GDP_t) and the GDP deflator (PD_t).

Equation (18): Money Demand

The eighteenth equation is a behavioural relationship which defines the demand for money (MD_t):

(18) $MD_t = (1/v_t)*GDPN_t$.

The money demand specification is a quantity specification, and it defines private non-government sector money demand as the ratio between nominal GDP ($GDPN_t$) and the velocity of circulation parameter (v_t).

Equation (19): Money Supply

The nineteenth equation is an accounting relationship which summarizes the sources of money supply growth (ΔMS_t):

(19) $\Delta MS_t = \Delta(E_t*R_t)+\Delta DC_t$

The accumulation of money balances is defined as the sum of money creation from foreign and domestic sources. Foreign sources of money creation include current foreign exchange reserve accumulation ($\Delta(E_t*R_t)$), while domestic sources of money creation include current domestic credit expansion (ΔDC_t).[4]

Equation (20): Foreign Exchange Reserve Accumulation

The twentieth equation is a behavioural relationship which defines the accumulation of foreign exchange reserves (ΔR_t):

[4] It may be noted that this accounting convention for money creation means that revaluation gains from foreign exchange reserve holdings (ΔE_t*R_{t-1}) will automatically add to the outstanding stock of money.

(20) $\Delta R_t = d_t(MPI_t*M_t-MPI_{t-1}*M_{t-1})$.

The accumulation of foreign exchange reserves is defined as an exogenous share (d_t) of the increase in foreign currency import expenditures ($MPI_t*M_t-MPI_{t-1}*M_{t-1}$). This specification is designed to mirror the long-run desire of policy makers, to ensure that sufficient foreign exchange reserves are available to finance a given number of weeks of import expenditures.[5] Since the relationship is specified in differences, the level of foreign exchange reserves (R_t) will converge asymptotically to the desired level of foreign exchange reserves as foreign currency import expenditures grow over time.

Equation (21): Domestic Credit

The twenty-first equation defines total domestic credit (DC_t):

(21) $DC_t = DCG_t+DCP_t$,

Total domestic credit is defined as the sum of government domestic credit (DCG_t) and private domestic credit (DCP_t).

Equation (22): Money Market Equilibrium

The twenty-second equation is a money market equilibrium condition:

(22) $MS_t = MD_t$.

The money market equilibrium equation ensures that money supply (MS_t) is equal to money demand (MD_t) at any given point in time.

2.2.4. The Balance of Payments Equations

The fourth set of equations in the Merged Model (Eqs. (23)-(26) in Appendix A) describes the balance of payments accounts.

Equation (23): Resource Balance

The twenty-third equation defines the resource balance ($RESBAL_t$):

(23) $RESBAL_t = (XPI_t*X_t-MPI_t*M_t)$.

[5] E.g. policy makers may desire to maintain sufficient foreign exchange reserves to finance ten weeks of additional imports. In this case, the parameter (d_t) would amount to 10/52.

The resource balance is defined as the difference between foreign currency export earnings (XPI_t*X_t) and foreign currency import earnings (MPI_t*M_t).

Equation (24): Net Factor Service Income

The twenty-fourth equation defines net factor service income ($NETFSY_t$):

(24) $NETFSY_t = NFP_t-INFG_t-INFP_t$.

Net factor service income is defined as the difference between net factor payments (NFP_t) and foreign interest payments ($INFG_t$ and $INFP_t$).

Equation (25): Current Account Balance

The twenty-fifth equation defines the current account balance ($CURBAL_t$):

(25) $CURBAL_t = RESBAL_t+NETFSY_t+NTRG_t+NTRP_t$.

The current account balance (of the balance of payments) is defined as the sum of the resource balance ($RESBAL_t$), net factor service income ($NETFSY_t$), unrequited government foreign transfers ($NTRG_t$) and unrequited private foreign transfers ($NTRP_t$).

Equation (26): Balance of Payments

The twenty-sixth equation is an accounting identity (the balance of payments), which summarizes the sources of foreign exchange reserve accumulation (ΔR_t):

(26) $\Delta R_t = CURBAL_t +\Delta NFDG_t+\Delta NFDP_t+FDI_t$

The accumulation of foreign exchange reserves is defined as the sum of the current account balance ($CURBAL_t$) and the capital account balance ($\Delta NFDG_t + \Delta NFDP_t + FDI_t$). The capital account balance is defined as the sum of government net foreign borrowing ($\Delta NFDG_t$), private net foreign borrowing ($\Delta NFDP_t$), and foreign direct investment inflows (FDI_t).

2.2.5. Interest Payments Equations

The fifth set of equations in the Merged Model (Eqs. (27)-(29) in Appendix A) describes domestic and foreign interest payments.

Equation (27): Government Domestic Interest Payments

The twenty-seventh equation defines government domestic interest payments ($INDG_t$):

(27) $INDG_t = IRDG_t * NDDG_{t-1}$.

Domestic interest payments are defined on the basis of an exogenous domestic interest rate ($IRDG_t$) and the lagged domestic debt stock ($NDDG_{t-1}$). It follows that **government domestic interest payments** are **pre-determined** at any given point in time, i.e. they provide **feedback** between time periods (see fig. 1).

Equation (28): Government Foreign Interest Payments

The twenty-eighth equation defines government foreign interest payments ($INFG_t$):

(28) $INFG_t = IRFG_t * NFDG_{t-1}$

Foreign interest payments are defined on the basis of an exogenous foreign interest rate ($IRFG_t$) and the lagged foreign debt stock ($NFDG_{t-1}$). It follows that **government foreign interest payments** are **pre-determined** at any given point in time, i.e. they provide **feedback** between time periods (see fig. 1).

Equation (29): Private Foreign Interest Payments

The twenty-ninth equation defines private foreign interest payments ($INFP_t$):

(29) $INFP_t = IRFP_t * NFDP_{t-1}$.

Private foreign interest payments are defined on the basis of an exogenous foreign interest rate ($IRFP_t$) and a lagged foreign debt stock ($NFDP_{t-1}$). It follows that the **private foreign interest payments** are **pre-determined** at any given point in time, i.e. they provide **feedback** between time periods (see fig. 1).

2.2.6. Excluded Equation (Walras' Law)

The thirtieth and final equation of the closed system underlying the Merged Model is excluded from the model due to Walras' Law. The excluded equation is the private sector budget constraint.

Excluded Equation: Private Sector Budget Constraint

The Merged Model is a general equilibrium model which satisfies all the fundamental accounting identities, including market equilibrium conditions and institutional budget constraints.[6] Accordingly, the model is a closed square system which satisfies Walras' law. In relation to the solution of the model, this implies that one equation must be dropped from the system to avoid

[6] The model explicitly includes equilibrium conditions for the goods market (the material balance), the domestic currency market (money market balance) and the foreign currency market (the balance of payments), as well as a government sector budget constraint.

singularity in the solution procedure.[7] The private sector budget constraint has therefore been left out of the Merged Model equations.

Nevertheless, the private sector budget constraint remains satisfied as part of the model solution. Accordingly, substituting equations (7), (8), (12), (14), (15), (21), (23), (24), (27), (28) and (29) into the material balance equation (10) and moving terms around, yields the private sector budget constraint (*):

$$(*) \quad P_t*(CP_t+IVP_t) + \Delta NDDG_t + \Delta MD_t = GDY_t + E_t*(\Delta NFDP_t+FDI_t) + \Delta E_t*R_{t-1}.$$

On the expenditure (asset) side of the budget, we find private sector consumption (P_t*CP_t), private sector investment (P_t*IVP_t), direct domestic lending to the government ($\Delta NDDG_t$) and money stock accumulation (ΔMD_t). On the income (liability) side of the budget, we find private disposable income (GDY_t), foreign capital inflows in the form of private net foreign borrowing ($\Delta NFDP_t$), foreign direct investment inflows (FDI_t), and revaluation gains from foreign exchange reserves (ΔE_t*R_{t-1}).[8]

[7] Walras' law: If n-1 equations are satisfied in a closed system of n equations, the final nth equation must also be satisfied by definition. It follows that one equation should be eliminated from the system to avoid singularity problems in the solution procedure. Alternatively, an additional variable ("walras") may be included in the nth accounting identity. This variable must (by definition) attain the value "0". Accordingly, the latter option can be used as a specification check on the model implementation.

[8] It may be noted that the current model specification implicitly assumes that revaluation gains from foreign exchange reserve holdings falls into the hands of the private sector.

3. Model Closure and Recursive Model Solution

The Merged Model is a dynamically recursive framework in the sense that it is solved period-by-period. Accordingly, the model is recursive between periods. In addition, the model is recursive within a given period. Accordingly, the model solves first for "Goods Market and Private Sector Budget" variables, second for "Government Budget" variables, and third for "Money Market" variables and "Balance of Payments" variables. Each of these sectors of the model solves for a residual (intermediate target) variable – a so-called *focal variable*. These variables adjust residually to maintain consistency with fundamental accounting identities. The four focal variables include (i) Government Consumption (goods market and private sector budget residual), (ii) Government Domestic Credit (government budget residual), (iii) Private Domestic Credit (money market residual), and (iv) Private Net Foreign Debt (balance of payments residual).

In the following, the recursive solution of Merged Model variables is discussed with reference to each of these four fundamental sectors of the model. The prior specification of growth paths for exogenous variables is discussed in Section 3.1, while the determination of pre-determined (interest payment) variables is discussed in Section 3.2. Subsequently, the recursive within-period determination of endogenous variables (including the determination of focal variables) is outlined in Section 3.3, while the general within- and between-period recursive nature of the model solution is discussed in Section 3.4. Finally, an overview of the model closure and the role of the (intermediate target) focal variables are provided in Section 3.5.

3.1. Exogenous Variables

3.1.1. Exogenous Flow Variables

Exogenous (Flow) Variable: Foreign Direct Investment (FDI_t)

The model closure of the Merged Model specifies an exogenous growth path for the foreign currency value of Foreign Direct Investment inflows (USD).

Exogenous (Flow) Variable: Government Transfers (GT_t)

The model closure of the Merged Model specifies an exogenous growth path for nominal value of Government Transfers to the private non-government sector.

Exogenous (Flow) Variable: Government Investment (GT_t)

The model closure of the Merged Model specifies an exogenous growth path for real Government Investment.

Exogenous (Flow) Variable: Net Factor Payments (NFP_t)

The model closure of the Merged Model specifies an exogenous growth path for the foreign currency value of Net Factor Payments from abroad (USD).

Exogenous (Flow) Variable: Government Net Foreign Transfers ($NTRG_t$)

The model closure of the Merged Model specifies an exogenous growth path for the foreign currency value of Government Net Foreign Transfers from abroad (USD).

Exogenous (Flow) Variable: Private Net Foreign Transfers ($NTRP_t$)

The model closure of the Merged Model specifies an exogenous growth path for the foreign currency value of Private Net Foreign Transfers from abroad (USD).

Exogenous (Flow) Variable: Government Domestic Revenues (TG_t)

The model closure of the Merged Model specifies an exogenous growth path for the nominal value of Government Domestic Revenues.

3.1.2. Exogenous Stock Variables

Exogenous (Stock) Variable: Government Net Domestic Debt ($NDDG_t$)

The model closure of the Merged Model specifies an exogenous growth path for the Government Net Domestic Debt stock. This implies that government domestic debt financing ($\Delta NDDG_t$) is exogenously given at any given point in time. Instead, the government budget constraint is satisfied by flexible government domestic credit taking (see below).

3.1.3. Exogenous Price Variables

Exogenous (Price) Variable: Exchange Rate (E_t)

The model closure of the Merged Model specifies an exogenous growth path for the Exchange Rate (VND/USD). Instead, balance of payments equilibrium is ensured by flexible (private sector) foreign borrowing (see below).

Exogenous (Price) Variable: World Market Import Price (MPI_t)

The model closure of the Merged Model specifies an exogenous growth path for the level of World Market Import Prices. This is a standard assumption in single-country small-economy models.

Exogenous (Price) Variable: GDP Deflator (PD_t)

The model closure of the Merged Model specifies an exogenous (numeraire) growth path for the GDP deflator. Consistency of aggregate price levels, including the exchange rate, the GDP deflator and world market prices, is ensured by a flexible absorption price deflator (see below).

Exogenous (Price) Variable: World Market Export Price (XPI_t)

The model closure of the Merged Model specifies an exogenous growth path for the level of World Market Export Prices. This is a standard assumption in single-country small-economy models.

3.2. Pre-determined Variables

The model closure of the Merged Model specifies a class of variables as pre-determined. Accordingly, the set of pre-determined variables is characterised as interest payments by domestic institutions, and includes government domestic interest payments, government foreign interest payments, and private foreign interest payments.

Pre-determined Variable: Government Domestic Interest Payments ($INDG_t$)

Government domestic interest payments are determined by equation (27):

(27) $INDG_t = irdg_t * NDDG_{t-1}$.

Government domestic interest payments are defined on the basis of an exogenous government domestic interest rate and the lagged government domestic debt stock. It follows that **government domestic interest payments** are **pre-determined** at any given point in time.

Pre-determined Variable: Government Foreign Interest Payments ($INFG_t$)

Government foreign interest payments are determined by equation (28):

(28) $INFG_t = irfg_t * NFDG_{t-1}$

Government foreign interest payments are defined on the basis of an exogenous government foreign interest rate and the lagged government foreign debt stock. It follows that **government foreign interest payments** are **pre-determined** at any given point in time.

Pre-determined Variable: Private Domestic Interest Payments ($INFP_t$)

Private foreign interest payments are determined by equation (29):

(29) $INFP_t = irfp_t * NFDP_{t-1}$

Private foreign interest payments are defined on the basis of an exogenous private foreign interest rate and the lagged private foreign debt stock. It follows that **private foreign interest payments** are **pre-determined** at any given point in time.

3.3. Endogenous Variables

Endogenous variables are determined recursively within a given time period as well as between time periods. The within-period recursive nature of the Merged Model is discussed in this section. In particular, it is demonstrated how Goods Market and Private Sector Budget variables (Section 3.3.1) are determined in step one, and Government Budget variables (Section 3.3.2) are determined in step two, while Money Market variables (Section 3.3.3) and Balance of Payments variables (Section 3.3.4) are determined in step three of the solution procedure. The between-period recursive nature of the Merged Model is discussed in Section 3.4.

3.3.1. Endogenous Variables: Goods Market and Private Sector Budget

The first set of equations in the Merged Model (Eqs. (1)-(13) in Appendix A) describes the Goods Market and Private Sector Budget accounts. This sub-section describes how these 13 equations are solved recursively for the 13 endogenous variables, which are associated with these accounts (see Appendix B).

Endogenous (Flow) Variable: Real Sectoral GDP ($GDPS_{s,t}$)

The growth path for real sectoral GDP is determined by equation (1):

(1) $GDPS_{s,t} = (1+\gamma_{s,t})*GDPS_{s,t-1}$,

Real sectoral GDP is determined from exogenous sectoral GDP growth rates ($\gamma_{s,t}$) and lagged sectoral GDP at any given point in time. Accordingly, equation (1) sets out a set of fundamental (exogenous) growth paths for sector level GDP.

Endogenous (Flow) Variable: Real GDP (GDP_t)

The growth path for real GDP is determined by equation (2):

(2) $GDP_t = \Sigma_s GDPS_{s,t}$.

Real GDP is determined as the sum of real sectoral GDP at any given point in time. Accordingly, equation (2) sets out a fundamental (exogenous) growth path for aggregate GDP, which the Merged Model takes as the point of departure for the construction of consistent macroeconomic projections.

Endogenous (Flow) Variables: Real sectoral exports ($XS_{s,t}$)

The growth path for real sectoral Exports is determined by equation (1):

(3) $XS_{s,t} = (1+\lambda_{s,t})*XS_{s,t-1}$,

Real sectoral exports are determined from exogenous sectoral export growth rates ($\lambda_{s,t}$) and lagged sectoral exports at any given point in time. Accordingly, equation (3) sets out a set of fundamental (exogenous) growth paths for sector level exports.

Endogenous (Flow) Variable: Real exports (X_t)

The growth path for real exports is determined by equation (4):

(4) $X_t = \Sigma_s XS_{s,t}$.

Real exports are determined as the sum of real sectoral exports at any given point in time. Accordingly, equation (2) sets out a fundamental (exogenous) growth path for aggregate exports, which the Merged Model takes as the point of departure for the construction of consistent macro projections.

Endogenous (Flow) Variable: Aggregate real investment (IV_t)

The growth path for real investment is determined by equation (5):

(5) $IV_t = k_{0,t}GDP_{t-1} + k_{1,t}\Delta GDP_t$,

Real investment is determined from a behavioural specification, which estimates the need for investment to sustain the (exogenous) GDP growth path. Accordingly, aggregate investment is determined on the basis of the GDP growth path which was derived above.

Endogenous (Flow) Variable: Real imports (M_t)

The growth path for real imports is determined by equation (6):

(6) $\log(M_t) = m_{0,t}+m_{1,t}\log(GDP_t)+m_{2,t}\log(E_t*MPI_t/PD_t)$.

Real imports are determined from a behavioural specification, which estimates the need for imports to sustain the (exogenous) GDP growth path. Accordingly, import demand is determined from the GDP growth path which was derived above, and from exogenous relative import prices.

Endogenous (Flow) Variable: Private real investment (IVP_t)

The growth path for private real investment is determined by equation (8):

(8') $IVP_t = IV_t - IVG_t$.

Private real investment is determined as the residual investment need, over an above (exogenous) government real investment, to sustain the (exogenous) GDP growth path. Accordingly, private real investment demand is determined as the difference between aggregate real investment demand, which was derived above, and (exogenous) government real investment demand.

Endogenous (Flow) Variable: Aggregate real consumption (C_t)

The growth path for aggregate real consumption is determined by equation (11):

(11') $C_t = P_{2003}*GDP_t - (P_{2003}*IV_t + E_{1995}*(XPI_{2003}*X_t - MPI_{2003}*M_t))/P_{2003,}$

Equation (11) defines real GDP. Aggregate real consumption is therefore determined as the residual resources, which are left over after (net) trade flows and real investment needs to sustain the (exogenous) GDP growth path have been satisfied. Accordingly, aggregate real consumption is determined as the difference between real GDP (evaluated at base year prices) on the one hand, and aggregate real investment and the external trade surplus (evaluated at base year prices) on the other hand. All of the right-hand side variables were derived above.

Endogenous (Price) Variable: Absorption Price Deflator (P_t)

The growth path for the absorption price deflator is determined by equation (10):

(10') $P_t = (PD_t*GDP_t - E_t*(MPI_t*M_t-XPI_t*X_t))/(C_t+IV_t)$.

Equation (10) is the material balance accounting identity. The model closure specifies exogenous growth paths for all price indices (see above), except the absorption price deflator. Moreover, growth paths for real GDP and aggregate final demand components including aggregate real consumption, aggregate real investment, real exports and real imports, were derived above. Accordingly, the absorption deflator is determined as the ratio between nominal absorption defined as the difference between nominal GDP and the nominal external trade surplus on the one hand, and real absorption defined as the sum of aggregate real consumption and aggregate real investment on the other hand.

Endogenous (Flow) Variable: Private disposable income (GDY_t)

The growth path for private disposable income is determined by equation (12):

(12) $GDY_t = PD_t*GDP_t+E_t*NFP_t+E_t*NTRP_t+INDG_t+(GT_t-TG_t)-E_t*INFP_t$.

Private disposable income is defined as the difference between (i) gross national income, i.e. the sum of nominal GDP (PD_t*GDP_t), net factor service income ($E_t*NFP_t-E_t*INFG_t-E_t*INFP_t$), and unrequited net foreign transfers from abroad ($E_t*NTRG_t + E_t*NTRP_t$), and (ii) government net revenues, i.e. the sum of government net domestic revenues ($GT_t – TG_t – INDG_t$) and government net foreign revenues ($E_t*NTRG_t-E_t*INFG_t$). Accordingly, private disposable income is determined by equation (12) since growth paths for all right-hand variables were already derived above, including five exogenous variables (exchange rate, GDP price deflator, government domestic revenues, government transfers, and net factor payments from abroad), two pre-determined variables (government domestic interest payments, and private foreign interest payments), and one endogenous variable (real GDP).

Endogenous (Flow) Variable: Private real consumption (CP_t)

The growth path for private real consumption is determined by equation (9):

(9') $CP_t = (1-b_t)*GDY_t/P_t$.

Private real consumption is determined from a behavioural specification, which determines private nominal consumption as a simple linear function of private disposable income. Accordingly, private real consumption is determined as the ratio between (i) private nominal consumption defined as the average (exogenous) private propensity to consume out of disposable income multiplied by private disposable income, and (ii) the absorption price deflator.

Endogenous (Flow) Variable: Government real consumption (CG_t)

The growth path for government real consumption is determined by equation (7):

(7') $CG_t = C_t - CP_t$,

Government real consumption is determined as the residual consumption component. Accordingly, government consumption is determined as the difference between aggregate real consumption and private real consumption. Both of these real aggregates were derived above.

Since aggregate real consumption is defined residually (from equation (10)) as the remaining resources which are left after resource needs to sustain the (exogenous) GDP growth path have been satisfied, it follows that government real consumption constitutes the overall residual use of resources among the Goods Market and Private Sector Budget variables.

Endogenous (Flow) Variable: Gross Domestic Savings (GDS_t)

The growth path for gross domestic savings is determined by equation (13):

$$(13)\quad GDS_t = PD_t*GDP_t+E_t*(NFP_t-INFG_t-INFP_t)+E_t*(NTRP_t+NTRG_t)-P_t*C_t.$$

Gross domestic savings is defined as the difference between (i) gross national income, i.e. the sum of nominal GDP (PD_t*GDP_t), net factor service income ($E_t*NFP_t-E_t*INFG_t-E_t*INFP_t$), and unrequited net foreign transfers from abroad ($E_t*NTRG_t + E_t*NTRP_t$), and (ii) aggregate nominal consumption (P_t*C_t). Accordingly, gross domestic savings is determined by equation (13) since growth paths for all right-hand variables were already derived above, including five exogenous variables (exchange rate, GDP price deflator, net factor payments from abroad, government net foreign transfers from abroad, and private net foreign transfers from abroad), two pre-determined variables (government foreign interest payments, and private foreign interest payments), and three endogenous variables (real GDP, aggregate real consumption, and absorption price deflator).

Focal Variable No. 1: Government real consumption (CG_t)

From the above derivation, it can be seen that the solution of (the goods market and private sector budget equations of) the Merged Model is recursive within the given period. Moreover, the residual variable in this section of the model (equations (1)-(13)) is **government consumption** (CG_t). Accordingly, if there are consistency problems between (i) the assumed (exogenous) GDP growth path and the resources needed to sustain the GDP growth path, and (ii) the resource demands from the private sector of the economy and the rest of the world, this will give rise to an unreasonable growth path for government consumption. Accordingly, government real consumption is the **first focal variable** in the Merged Model.

3.3.2. Endogenous Variables: Government Budget

The second set of equations in the Merged Model (Eqs. (14)-(16) in Appendix A) describes the government sector budget accounts. Moreover, these three equations are solved for the three endogenous variables which are associated with these accounts (see Appendix B).

Endogenous (Flow) Variable: Government Borrowing Requirement (BRG_t)

The growth path for the government borrowing requirement is determined by equation (14):

$$(14)\quad BRG_t = P_t*(CG_t+IVG_t)+(GT_t-TG_t)+ INDG_t +E_t*(INFG_t-NTRG_t).$$

Equation (14) establishes the current balance of the government institutional budget account. Accordingly, the government borrowing requirement is determined as the difference between current expenditure and current income items. Government current expenditure items include government consumption (P_t*CG_t), government investment (P_t*IVG_t), government current transfers to the private non-government sector (GT_t), government domestic interest payments ($INDG_t$), and

government foreign interest payments (E_t*$INFG_t$). Government current income items include domestic government revenues (TG_t) and unrequited government net foreign transfers (E_t*$NTRG_t$).

The government borrowing requirement is determined by equation (14) since growth paths for all right-hand variables are derived above, including five exogenous variables (exchange rate, government real investment, government domestic revenues, government transfers to the private non-government sector, and government net foreign transfers from abroad), two pre-determined variables (government domestic interest payments, and government foreign interest payments), and two endogenous variables (absorption price deflator, and government real consumption).

Endogenous (Stock) Variable: Government Net Foreign Debt ($NFDG_t$)

The growth path for government net foreign debt is determined by equation (16):

(16) $NFDG_t = g_t * XPI_t * X_t$.

The financing of the government borrowing requirement comes from foreign and domestic sources. The ability/priority of the government to borrow from abroad is assumed to vary with export earnings. Accordingly, the government net foreign debt stock is defined as an exogenous share of foreign currency export earnings. This implies that government foreign debt financing ($\Delta NFDG_t$) is given at any given point in time.[9]

Endogenous (Stock) Variable: Government Domestic Credit (DCG_t)

The growth path for government domestic credit is determined by equation (15):

(15') $DCG_t = DCG_{t-1} + (BRG_t - (E_t * \Delta NFDG_t + \Delta NDDG_t))$.

Equation (15) establishes the capital balance of the government institutional budget account, i.e. the financing of the government borrowing requirement. The financing comes from foreign and domestic sources. The foreign financing sources include government net foreign borrowing ($\Delta NFDG_t$), while the domestic financing sources include government net domestic borrowing ($\Delta NDDG_t$) and government domestic credit taking (ΔDCG_t). Government domestic borrowing is exogenously given (see above), and government foreign borrowing is already determined (see above). It follows that government domestic credit taking is left as the residual financing source in the government budget account. The current stock of government domestic credit is therefore determined as the sum of the lagged stock of government domestic credit, and the current increase in government domestic credit defined as the difference between the government borrowing requirement and additional financing from domestic and foreign borrowing.

[9] The government net foreign debt-to-exports ratio (g_t) should be changed by the modeler, to reflect government priorities, i.e. the extent to which the government takes advantage of the ability to access foreign capital markets. This is further discussed below.

Focal Variable No. 2: Government domestic credit (DCG_t)

From the above derivation, it can be seen that the solution of (government budget equations of) the Merged Model is recursive within the given period. Accordingly, the solution of the equations relies strictly on exogenous variables, pre-determined variables, and previously determined endogenous variables (from the solution of the goods market and private sector budget equations). Moreover, the residual variable in this section of the model (equations (14)-(16)) is **government domestic credit** (DCG_t). Accordingly, if there are consistency problems between (i) the assumed (exogenous) GDP growth path and the resources needed to sustain the growth path, (ii) the resource demands from the private sector of the economy and the rest of the world, and (iii) the resource demands from the government budget, this will give rise to an unreasonable growth path for government domestic credit. Accordingly, government domestic credit is the **second focal variable** in the Merged Model.

3.3.3. Endogenous Variables: Money Market

The third set of equations in the Merged Model (Eqs. (17)-(22) in Appendix A) describes the money market accounts.

Endogenous (Flow) Variable: Nominal GDP ($GDPN_t$)

The growth path for nominal GDP is determined by equation (17):

(17) $GDPN_t = PD_t * GDP_t$.

Nominal GDP is determined as the product of real GDP (GDP_t) and the GDP deflator (PD_t). Accordingly, nominal GDP is determined from equation (17) since the growth paths of real GDP and the GDP deflator are previously derived (see above).

Endogenous (Stock) Variable: Money Demand (MD_t)

The growth path for money demand is determined by equation (18):

(18) $MD_t = (1/v_t) * GDPN_t$.

The demand for money (MD_t) is determined from a behavioural quantity specification of money demand. Private non-government sector money demand is therefore specified as the ratio between nominal GDP and the (exogenous) velocity of money circulation (v_t). Accordingly, money demand is determined from equation (18) since the growth path of nominal GDP is derived above.

Endogenous (Stock) Variable: Foreign Exchange Reserves (R_t)

The growth path for the stock of foreign exchange reserves is determined by equation (20):

(20') $R_t = R_{t-1} + d_t(MPI_t*M_t-MPI_{t-1}*M_{t-1})$

Foreign exchange reserve accumulation is determined from a behavioural relationship, which is based on an exogenous incremental foreign exchange reserve-to-import growth ratio (d_t). The specification is designed to mirror the long-run desire of policy makers, to ensure that foreign exchange reserves are available to finance a certain number of weeks of additional import demand.[10] The growth paths of real imports and the world market import price deflator are previously derived (see above). The current stock of foreign exchange reserves is therefore determined from equation (20) as the lagged stock of foreign exchange reserves plus the current increase in foreign exchange reserves defined as the incremental foreign exchange reserves-to-import growth ratio multiplied by the growth in imports.

Endogenous (Stock) Variable: Money Supply (MS_t)

The growth path for the money supply is determined by equation (22):

(22) $MS_t = MD_t$.

The money market equilibrium equation specifies that the money supply is equal to the money demand, i.e. the money supply is determined by the need to accommodate money demand. Accordingly, the money supply is determined from equation (22) since money demand is previously derived (see above).

Endogenous (Stock) Variable: Total Domestic Credit (DC_t)

The growth path for the total domestic credit stock is determined by equation (19):

(19') $DC_t = DC_{t-1} + \Delta MS_t - \Delta(E_t*R_t)$.

The money market accounting relationship in equation (19) specifies the sources of money supply growth. The accumulation of money balances (ΔMS_t) is defined as the sum of money creation from current foreign exchange reserve accumulation ($\Delta(E_t*R_t)$) and from current domestic credit expansion (ΔDC_t).[11] Growth paths for money supply expansion and foreign exchange reserve accumulation are derived previously (see above). It follows that total domestic credit expansion is the residual source of money creation. The total availability of domestic credit is therefore determined from equation (19) as the lagged stock of domestic credit plus the current increase in domestic credit defined as the difference between current money supply expansion and current foreign exchange reserve accumulation.

[10] E.g. policy makers may desire to maintain sufficient foreign exchange reserves to finance ten weeks of additional imports. In this case, the parameter (d_t) would amount to 10/52. Accordingly, the parameter should be changed by the modeller in accordance with government priorities.

[11] It may be noted that this accounting convention for money creation means that revaluation gains from foreign exchange reserve holdings (ΔE_t*R_{t-1}) will add to the outstanding stock of money.

Endogenous (Stock) Variable: Private Domestic Credit (DCP_t)

The growth path for the private domestic credit stock is determined by equation (21):

(21') $DCP_t = DC_t - DCG_t$,

Private domestic credit is determined as the residual domestic credit component. Accordingly, private domestic credit is determined as the difference between total available domestic credit and government domestic credit taking. Both of these real aggregates are previously derived (see above).

Since total domestic credit is defined as the residual source of money creation (from equation (19)), it follows that private domestic credit constitutes the overall residual source of money creation (or the overall residual recipient of domestic credit resources) among the Money Market variables.

Focal Variable No. 3: Private Domestic Credit (DCP_t)

From the above derivation, it can be seen that the solution of (the money market equations of) the Merged Model is recursive within the given period. Accordingly, the solution of the equations relies strictly on exogenous variables, pre-determined variables, and previously determined endogenous variables (from the solution of the goods market and private sector budget equations, and the government budget equations). Moreover, the residual variable in this section of the model (equations (17)-(22)) is **private domestic credit** (DCP_t). Accordingly, if there are consistency problems between (i) the assumed (exogenous) GDP growth path and the resources needed to sustain the growth path, (ii) the resource demands from the private sector of the economy and the rest of the world, (iii) the resource demands from the government budget, and (iv) the total resource availability in the credit market, this will give rise to an unreasonable growth path for private domestic credit. Accordingly, private domestic credit is the **third focal variable** in the Merged Model.

3.3.4. Endogenous Variables: Balance of Payments

The fourth set of equations in the Merged Model (Eqs. (23)-(26) in Appendix A) describes the balance of payments accounts.

Endogenous (Flow) Variable: Resource Balance ($RESBAL_t$)

The growth path for the resource balance is determined by equation (23):

(23) $RESBAL_t = (XPI_t * X_t - MPI_t * M_t)$,

The resource balance is defined as the difference between foreign currency export earnings and foreign currency import expenditures. Growth paths for world market import and export prices are exogenously specified, while real trade aggregates are previously derived (see above).

Endogenous (Flow) Variable: Net Factor Service Income ($NETFSY_t$)

The growth path for net factor service income is determined by equation (24):

(24) $NETFSY_t = NFP_t - INFG_t - INFP_t,$

Net factor service income is defined as the difference between (i) net factor payments and (ii) net foreign interest payments including private net foreign interest payments and government net foreign interest payments. The growth path for net factor payments is exogenously specified, while government and private net foreign interest payments are pre-determined (see above).

Endogenous (Flow) Variable: Current Account Balance ($CURBAL_t$)

The growth path for the current account balance is determined by equation (25):

(25) $CURBAL_t = RESBAL_t + NETFSY_t + NTRG_t + NTRP_t.$

Equation (25) establishes the current account of the balance of payments. Accordingly, the current account balance is determined as the difference between current income and current expenditure items. Current balance of payments items include the resource balance ($RESBAL_t$), net factor service income ($NETFSY_t$), unrequited government net foreign transfers from abroad ($NTRG_t$), and unrequited private net foreign transfers from abroad ($NTRP_t$).

The current account balance is determined by equation (25) since growth paths for all right-hand variables are derived above, including two exogenous variables (government net foreign transfers from abroad, and private net foreign transfers from abroad), and two endogenous variables (resource balance, and net factor service income).

Endogenous (Stock) Variable: Private Net Foreign Debt ($NFDP_t$)

The growth path for the private net foreign debt stock is determined by equation (26):

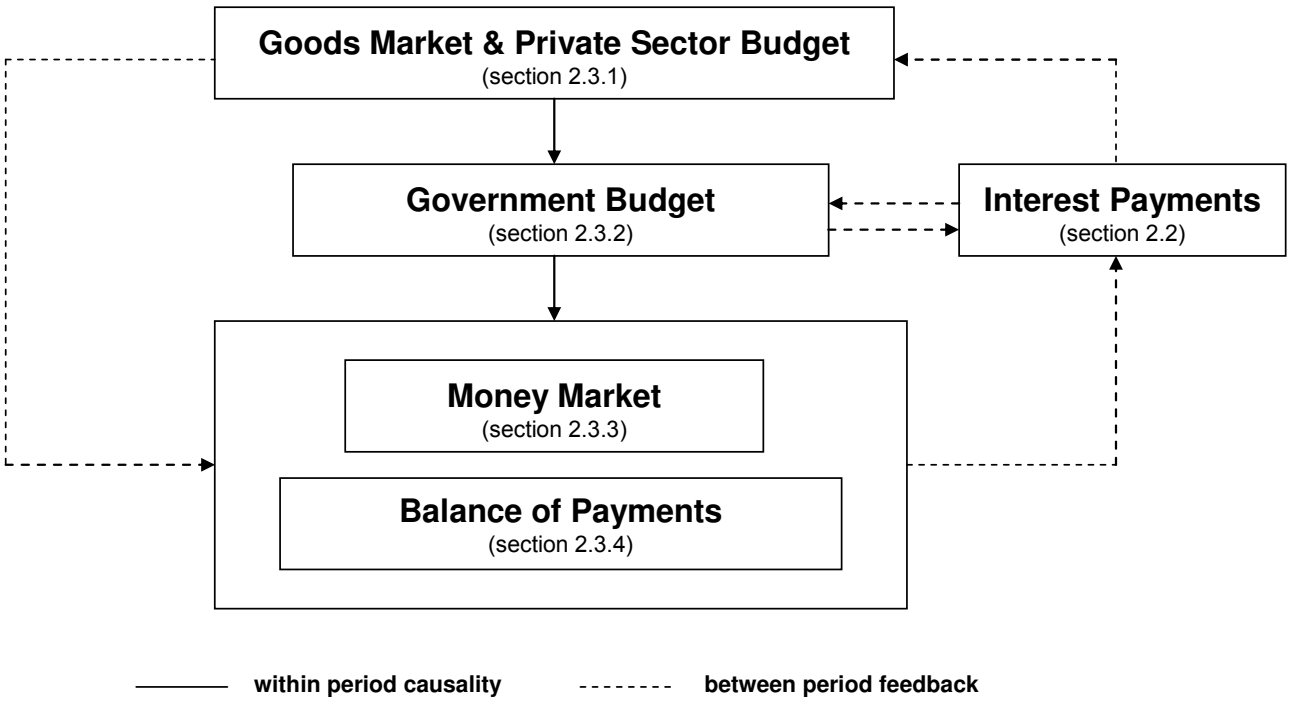
(26') $NFDP_t = NFDP_{t-1} + \Delta R_t - (CURBAL_t + \Delta NFDG_t + FDI_t)$

The balance of payments national accounting identity in equation (26) specifies the financing counterparts of the current account balance. In particular, the accumulation of foreign exchange reserves (ΔR_t) is defined as the sum of the current account balance ($CURBAL_t$) and the capital account balance ($\Delta NFDG_t + \Delta NFDP_t + FDI_t$). Since the current account balance and foreign exchange reserve accumulation are previously derived (see above), it follows that the capital account must adjust to clear the balance of payments. Moreover, since government net foreign borrowing is previously derived while foreign direct investment inflows are specified exogenously (see above), it follows that private net foreign borrowing is the residual financing source in the (capital account of the) balance of payments. Moreover, it follows that private net foreign borrowing constitutes the overall residual financing source among the Balance of Payments variables.

Focal Variable No. 4: Private Net Foreign Debt ($NFDP_t$)

From the above derivation, it can be seen that the solution of (the balance of payments equations of) the Merged Model is recursive within the given period. Accordingly, the solution of the equations relies strictly on exogenous variables, pre-determined variables, and previously determined endogenous variables (from the solution of the goods market and private sector budget equations, and the government budget equations). Moreover, the residual variable in this section of the model (equations (23)-(26)) is **private net foreign debt** ($NFDP_t$). Accordingly, if there are consistency problems between (i) the assumed (exogenous) GDP growth path and the resources needed to sustain the growth path, (ii) the resource demands from the private sector of the economy and the rest of the world, (iii) the resource demands from the government budget, , and (iv) the total resource availability in the foreign capital market, this will give rise to an unreasonable growth path for private net foreign debt. Accordingly, private net foreign debt is the **fourth focal variable** in the Merged Model.

Figure 2. Recursive Structure of the Merged Model



3.4. Model Solution

The recursive structure of the Merged Model is illustrated in Figure 2. The recursive within-period structure of the Merged Model was illustrated in the previous sections. Growth paths for twelve variables are exogenously specified as part of the model closure (Section 3.1), including seven flow variables (foreign direct investment inflows, government domestic revenues, government real investment, net factor payments from abroad, government net foreign transfers from abroad, private

net foreign transfers from abroad, and government transfers to the private sector), one stock variable (government net domestic debt), and four price variables (exchange rate, world market import price deflator, GDP deflator, and world market export price deflator). In addition, the model specification implies that three types of interest payments are pre-determined at any given point in time (Section 3.2), including government domestic interest payments, government foreign interest payments, and private foreign interest payments. Based on the set of pre-determined and exogenously specified variables, it was then demonstrated how the Merged Model solves recursively for 26 endogenous variables within each period (section 3.3), including (i) initial solution of thirteen variables from the Goods Market and Private Sector Budget (section 3.3.1), (ii) subsequent solution of three variables from the Government Budget (section 3.3.2), and (iii) final solution of six variables from the Money Market (section 3.3.3) and four variables from the Balance of Payments (section 3.3.4).

The between-period recursive structure of the Merged Model relies on the updating of financial stock variables. First, the Merged Model specification contains eight endogenous financial stock variables including total domestic credit, government domestic credit, private domestic credit, money demand, money supply, government net foreign debt, private net foreign debt, and foreign exchange reserve holdings. The solution of these level variables relies on lagged stock values. Accordingly, the solution of financial stock variables is recursive over time. Second, the Merged Model specification contains two growth equations (sectoral GDP, and sectoral exports) and two behavioural relationships (investment demand, and foreign exchange reserve accumulation) which rely on lagged values of non-financial endogenous variables. Accordingly, the solution of the four endogenous variables associated with these equations (sectoral GDP, sectoral exports, aggregate real investment, and foreign exchange reserve stock) is also recursive over time.[12] Finally, the Merged Model specification implies that interest payments are pre-determined on the basis of exogenous interest rates and lagged financial stock values. Accordingly, the solution of the three types of interest payments is also recursive over time. Overall, the Merged Model is recursive within and between periods. This is a very important feature of the Merged Model framework since it allows the user (modeller) to easily identify internal inconsistencies and diagnose inappropriate underlying growth paths.

3.5. Model Closure, Focal Variables & Diagnostic Evaluation

The Merged Model is a needs-based projection framework. The structure of equations (1)-(6) clearly demonstrates how the model is a needs-based macroeconomic planning tool. It specifies an exogenous aggregate GDP growth path for the economy and calculates the associated needs in terms of imports and capital accumulation. Subsequently, the consistency between the aggregate growth path, the resource needs to sustain the growth path, the resource needs of the rest of the economy, and the resource availability is ensured through the inclusion of a complete set of national account restrictions, private and public sector budget constraints, and behavioural specifications (equations (7)-(29)).

In particular, the model specification includes growth equations for sectoral GDP (equation 1) and sectoral exports (equation 3). While these variables are classified as endogenous, the growth paths

[12] The behavioral specification of foreign exchange reserve accumulation (equation (20)) relies on lagged imports. This account for the between-period recursive impact of Goods Market and Private Sector Budget variables on Money Market variables in figure 2.

for these variables are, nevertheless, governed by exogenous growth rates. The growth paths of real GDP (the sum of sectoral GDP), and real exports (the sum of sectoral exports) are therefore *de facto* exogenous. Accordingly, the closure of the Merged Model is designed to evaluate the consistency of the assumed (exogenous) GDP growth path with respect to (i) the real resources needed to sustain the growth path, (ii) the real resource demands from the private sector and the rest of the world, (iii) the real resource demands from the government sector, (iv) the resource availability in domestic credit markets, and (v) the resource availability in foreign capital markets.

The previous section discussed how the combined model specification and model closure leads to an overall within-period and between-period recursive model structure. The model closure ensures that the model solves recursively (within-period) for variables from four sectors of the economy, including (i) the Goods Market and Private Sector Budget, (ii) the Government Budget, (iii) the Money Market, and (iv) the Balance of Payments. Moreover, the model solves recursively (within-sector) for variables from each sector. In particular, the model solves for one residual (intermediate target) focal variable in each sector. Any inconsistency between the (exogenous) GDP growth path, the resource needs to sustain the GDP growth path, the resource demands of the remaining economy, and the resource availability from domestic and foreign financial sources, will show up in the four focal variables.

The four focal variables of the Merged Model include government consumption (residual in the Goods Market & Private Sector Budget sector), government domestic credit (residual in the Government Budget sector), private domestic credit (residual in the Money Market sector), and private net foreign debt (residual in the Balance of Payments sector). These focal variables therefore provides a check on the consistency of the assumed (exogenous) GDP growth path with respect to (i) the real resources needed to sustain the growth path (focal variable: government consumption), (ii) the real resource demands from the private sector (focal variable: government consumption), (iii) the real resource demands from the government sector (focal variable: government domestic credit), (iv) the resource availability in domestic credit markets (focal variable: private domestic credit), and (v) the resource availability in foreign capital markets (focal variable: private net foreign debt).

Consistency problems may be traced to a given sector on the basis of the following procedure: If the growth path of a focal variable in a given sector (e.g. government domestic credit in the Government Budget sector) is unreasonable, while the growth path of the focal variable in the 'previous' sector (e.g. government consumption in the Goods Market & Private Sector Budget sector) is reasonable, the problem may be traced to the given sector (i.e. the Government Budget sector). This procedure may therefore be used to identify and correct problems in relation to the projections, including assumptions regarding (i) growth rates for exogenous variables, and (ii) time paths for (calibrated and non-calibrated) model parameters including interest rates and parameter values for behavioural relationships.

4. Initialization of Variables and Calibration of Parameters

This section provides a description of the initialization of variables and calibration of parameters in the Merged Model. The sources of data for the initialization of variables are two-fold: (i) A SAM framework, and (ii) an auxiliary data set. The SAM framework provides information for the initialization of flow variables, while the auxiliary data set provides information for the benchmarking of (i) financial stock variables, and (ii) price variables. The basic data sources for the initialization and calibration of the model is described in Section 5.1, the actual initialization of variables is described in Section 5.2, while the calibration of parameter values is described in Section 5.3.

4.1. Data Sources

The basic data sources for the initialization and calibration of the 2003 Vietnam Merged Model includes a 2003 SAM framework and an auxiliary data set for the years 2002-2003. The SAM framework consists of a real SAM and a financial SAM. The SAM framework contain records off all flow transactions in the Vietnamese economy in 2003. The real SAM (RSAM) records all current (above-the-line) transactions, while the financial SAM (FSAM) records all financial (below-the-line) transactions (See appendices D-G). The auxiliary data set contains additional levels data, price data, and lagged flow data. The auxiliary data set is presented in appendix H.[13]

A summary description of the dimensions and specific entries of the real SAM is included in Appendix D. A similar description of the dimensions and specific entries of the financial SAM is included Appendix E. The dimensions of the combined SAM framework are very limited. This reflects the aggregate nature of the Merged Model. The real SAM contains one aggregate goods account, two domestic institutional accounts (private & government sectors), and one international institutional account. Moreover, the domestic institutional accounts distinguish between current and capital expenditures. Finally, two additional accounts are included to keep track of domestic and foreign interest payments. Altogether, the real SAM contains nine accounts including Commodity (COM), Private Current (PRV), Government Current (STATE), Government Capital (GCAP), Private Capital (PCAP), Aggregate Capital (ACAP), Domestic Interest Payments (DINT), Foreign Interest Payments (FINT), and Rest of the World (ROW).

The real SAM data set is outlined in Appendix F. The data set contains information on (i) the material balance (goods market equilibrium), (ii) the private non-government sector budget, (iii) the government sector current budget, and (iv) the balance of payments. The real SAM represents a closed system of n accounts. It follows that we only have to balance n-1 accounts, since the nth account will be automatically balanced. Moreover, since every expenditure item of a given account is an income item of another account (and vise versa), it follows that we only need to include balanced information for n-1 accounts in order to establish the entire real SAM. Accordingly, the real SAM was established on the basis of information regarding (i) the material balance, (ii) the

13 The development of the SAM data set and the auxiliary data set is documented in the accompanying Merged Model excel spreadsheet (Jensen & Tarp; 2007a)

government budget, and (iii) the balance of payments. Actual data were obtained from GSO (2006) and IMF (2005).[14]

The financial SAM contains one domestic money market account, and three institutional accounts including one foreign financial account, and two domestic financial accounts (private & government sectors). Two additional accounts are included to keep track of foreign direct investment inflows and revaluation gains on foreign exchange reserve holdings, while the aggregate capital account from the real SAM is included to ensure consistency between the current transactions in the real SAM and financial transactions in the financial SAM. Altogether, the financial SAM contains seven accounts including Domestic Financial (DFIN), Foreign Financial (FFIN), Foreign Direct Investment (FFDI), Government Financial (GFIN), Private Financial (PFIN), Capital Gains (CAPGAIN), and Aggregate Capital (ACAP).

The financial SAM data set is outlined in Appendix G. The data set contains information on (i) money market equilibrium (domestic financial account), (ii) balance of payments equilibrium (foreign financial account), (iii) private non-government sector financial transactions, (iv) government sector financial transactions, and (v) the savings-investment balance (aggregate capital account). The financial SAM also represents a closed system of n accounts, implying that we only have to balance n-1 accounts in order to balance the entire system. Moreover, since each liability of a given account is an asset of another account (and vise versa), it follows that we only need to include balanced information for n-1 accounts in order to establish the entire financial SAM. Accordingly, the financial SAM was established on the basis of information regarding (i) the money market, (ii) government sector financial transactions, (iii) the balance of payments, and (iv) the savings-investment balance. Actual data were obtained from GSO (2006) and IMF (2005).[15]

The auxiliary data set is outlined in Appendix H. The data set contains information on (i) financial stock data for benchmarking of stock levels, (ii) price data for benchmarking of price levels, and (iii) lagged flow data for the calibration of behavioural relationships, including the investment demand and foreign exchange reserve accumulation equations. Actual data were obtained from GSO (2006) and IMF (2005).[16]

4.2. Initialization of Variables

The initialization of variables relies on the two previously described data sources: The 2003 SAM data base which consists of a real SAM (RSAM) and a financial SAM (FSAM), and the auxiliary 2002-2003 data set (AUX). In the following, the initialization of every variable of the model is described with reference to the nature (flow; stock; price) and closure status (exogenous; endogenous) of the variable in question. Initialization covers the base year (2003), and the lagged base year (2002). Flow variables are only initialized for the base year, except real GDP and real imports which are also initialized for the lagged base year (the lagged base year values enter into behavioural relationships and are necessary for the calibration of model parameters). Moreover,

[14] Documentation of the individual data entries in the real SAM is provided in the accompanying excel spreadsheet (Jensen & Tarp; 2007a), which can be obtained from the authors on request.
[15] Documentation of the individual data entries in the financial SAM is provided in the accompanying excel spreadsheet (Jensen & Tarp; 2007a), which can be obtained from the authors on request.
[16] Documentation of the individual data entries in the auxiliary data set is provided in the accompanying excel spreadsheet (Jensen & Tarp; 2007a), which can be obtained from the authors on request.

stock variables are initialized for both the base year and the lagged base year. Finally, price variables are only initialized for the base year, except the world market import price variable which is also initialized for the lagged base year period.

In the following, references to RSAM("A","B") and FSAM(C","D") refer to respectively the (A,B) entry of the real SAM matrix (Appendix F), and the (C,D) entry of the financial SAM matrix (Appendix G). Similarly, a reference to AUX("X","2003") refers to the variable "X" for the year "2003" in the auxiliary data set (Appendix H).

4.2.1. Initialization of Exogenous Variables

Exogenous (Flow) Variable: Foreign Direct Investment (FDI_{2003})

FDI_{2003} = FSAM("PFIN","FFDI") / AUX("E","2003")

Exogenous (Flow) Variable: Government Domestic Transfers (GT_{2003})

GT_{2003} = RSAM("PRV","STATE")

Exogenous (Flow) Variable: Government Real Investment (IVG_{2003})

IVG_{2003} = RSAM("COM","GCAP") / P_{2003}

Exogenous (Flow) Variable: Net Factor Payments (NFP_{2003})

NFP_{2003} = AUX("NFP","2003")

Exogenous (Flow) Variable: Government Net Foreign Transfers ($NTRG_{2003}$)

$NTRG_{2003}$ = RSAM("STATE","ROW") / AUX("E","2003")

Exogenous (Flow) Variable: Private Net Foreign Transfers ($NTRP_{2003}$)

$NTRP_{2003}$ = RSAM("PRV","ROW")/AUX("E","2003") – AUX("NFP","2003")

Exogenous (Flow) Variable: Government Domestic Revenues (TG_{2003})

TG_{2003} = RSAM("PRV","STATE")

Exogenous (Stock) Variable: Government Net Domestic Debt ($NDDG_{2002}$ & $NDDG_{2003}$)

$NDDG_{2002}$ = AUX("NDDG","2002")

$NDDG_{2003}$ = $NDDG_{2002}$ + FSAM("GFIN","PFIN")

Exogenous (Price) Variable: Exchange Rate (E_{2003})

E_{2003} = AUX("E","2003")

Exogenous (Price) Variable: World Market Import Prices (MPI_{2002} & MPI_{2003})

MPI_{2002} = AUX("MPI","2002")

MPI_{2003} = AUX("MPI","2003")

Exogenous (Price) Variable: GDP Deflator (PD_{2003})

PD_{2003} = AUX("PD","2003")

Exogenous (Price) Variable: World Market Export Prices (XPI_{2003})

XPI_{2003} = AUX("XPI","2003")

4.2.2. Initialization of Endogenous Variables

Endogenous (Flow) Variable: Government Borrowing Requirement (BRG_{2003})

BRG_{2003} = RSAM("GCAP","ACAP")

Endogenous (Flow) Variable: Aggregate Real Consumption (C_{2003})

C_{2003} = (RSAM("COM","STATE") + RSAM("COM","PRV")) / P_{2003}

Endogenous (Flow) Variable: Government Real Consumption (CG_{2003})

CG_{2003} = RSAM("COM","STATE") / P_{2003}

Endogenous (Flow) Variable: Private Real Consumption (CP_{2003})

CP_{2003} = RSAM("COM","PRV") / P_{2003}

Endogenous (Flow) Variable: Current Account Balance ($CURBAL_{2003}$)

$CURBAL_{2003}$ = RSAM("ACAP","ROW") / AUX("E","2003")

Endogenous (Flow) Variable: Real GDP (GDP_{2002} & GDP_{2003})

GDP_{2002} = AUX("GDP","2002")

GDP_{2003} = RSAM("PRV","COM") / AUX("PD","2003")

Endogenous (Flow) Variable: Nominal GDP ($GDPN_{2003}$)

$GDPN_{2003}$ = RSAM("PRV","COM")

Endogenous (Flow) Variable: Real Sectoral GDP ($GDPS_{s,2003}$)

$GDPS_{agriculture,2003}$ = AUX("AGDPshr","2003")*GDP_{2003}

$GDPS_{industry,2003}$ = AUX("IGDPshr","2003")*GDP_{2003}

$GDPS_{services,2003}$ = AUX("SGDPshr","2003")*GDP_{2003}

Endogenous (Flow) Variable: Gross Domestic Savings (GDS_{2003})

GDS_{2003} = RSAM("GCAP","STATE") + RSAM("PCAP","PRV")

Endogenous (Flow) Variable: Private Disposable Income (GDY_{2003})

GDY_{2003} = RSAM("COM","PRV") + RSAM("PCAP","PRV")

Endogenous (Flow) Variable: Government Domestic Interest Payments ($INDG_{2003}$)

$INDG_{2003}$ = RSAM("DINT","STATE")

Endogenous (Flow) Variable: Government Foreign Interest Payments ($INFG_{2003}$)

$INFG_{2003}$ = RSAM("FINT,"STATE") / AUX("E","2003")

Endogenous (Flow) Variable: Private Foreign Interest Payments ($INFP_{2003}$)

$INFP_{2003}$ = RSAM("FINT,"PRV") / AUX("E","2003")

Endogenous (Flow) Variable: Aggregate Real Investment (IV_{2003})

IV_{2003} = (RSAM("COM","GCAP") + RSAM("COM","PCAP")) / P_{2003}

Endogenous (Flow) Variable: Private Real Investment (IVP_{2003})

IVP_{2003} = RSAM("COM","PCAP") / P_{2003}

Endogenous (Flow) Variable: Real Imports (M_{2002} & M_{2003})

M_{2002} = AUX("M,"2002")

M_{2003} = RSAM("ROW,"COM") / AUX("E","2003")

Endogenous (Flow) Variable: Bet Factor Service Income ($NETFSY_{2003}$)

$NETFSY_{2003}$ = AUX("NFP","2003") – RSAM("ROW","FINT")/AUX("E","2003")

Endogenous (Flow) Variable: Resource Balance ($RESBAL_{2003}$)

$RESBAL_{2003}$ = (RSAM("COM","ROW") – RSAM("ROW","COM") / AUX("E","2003")

Endogenous (Flow) Variable: Real Exports (X_{2003})

X_{2003} = RSAM("COM","ROW") / AUX("E","2003")

Endogenous (Flow) Variable: Real Sectoral Exports ($XS_{s,2003}$)

$XS_{agriculture,2003}$ = AUX("AXshr","2003")*X_{2003}

$XS_{industry,2003}$ = AUX("IXshr","2003")*X_{2003}

$XS_{services,2003}$ = AUX("SXshr","2003")*X_{2003}

Endogenous (Stock) Variable: Total Domestic Credit (DC_{2002} & DC_{2003})

DC_{2002} = AUX("DC","2002")

DC_{2003} = DC_{2002} + FSAM("GFIN","DFIN") + FSAM("PFIN","DFIN")

Endogenous (Stock) Variable: Government Domestic Credit (DCG_{2002} & DCG_{2003})

DCG_{2002} = AUX("DCG","2002")

DCG_{2003} = DCG_{2002} + FSAM("GFIN","DFIN")

Endogenous (Stock) Variable: Private Domestic Credit (DCP_{2002} & DCP_{2003})

DCP_{2003} = AUX("DCP","2002")

DCP_{2003} = DCP_{2002} + FSAM("PFIN","DFIN")

Endogenous (Stock) Variable: Money Demand (MD_{2002} & MD_{2003})

MD_{2002} = AUX("MD","2002")

MD_{2003} = MD_{2002} + FSAM("DFIN","PFIN")

Endogenous (Stock) Variable: Money Supply (MS_{2002} & MS_{2003})

MS_{2002} = AUX("MS","2002")

MS_{2003} = MS_{2002} + FSAM("DFIN","PFIN")

Endogenous (Stock) Variable: Government Net Foreign Debt ($NFDG_{2002}$ & $NFDG_{2003}$)

$NFDG_{2002}$ = AUX("NFDG","2002")

$NFDG_{2003}$ = $NFDG_{2002}$ + FSAM("GFIN","FFIN")/AUX("E","2003")

Endogenous (Stock) Variable: Private Net Foreign Debt ($NFDP_{2002}$ & $NFDP_{2003}$)

$NFDP_{2002}$ = AUX("NFDP","2002")

$NFDP_{2003}$ = $NFDP_{2002}$ + FSAM("PFIN","FFIN")/AUX("E","2003")

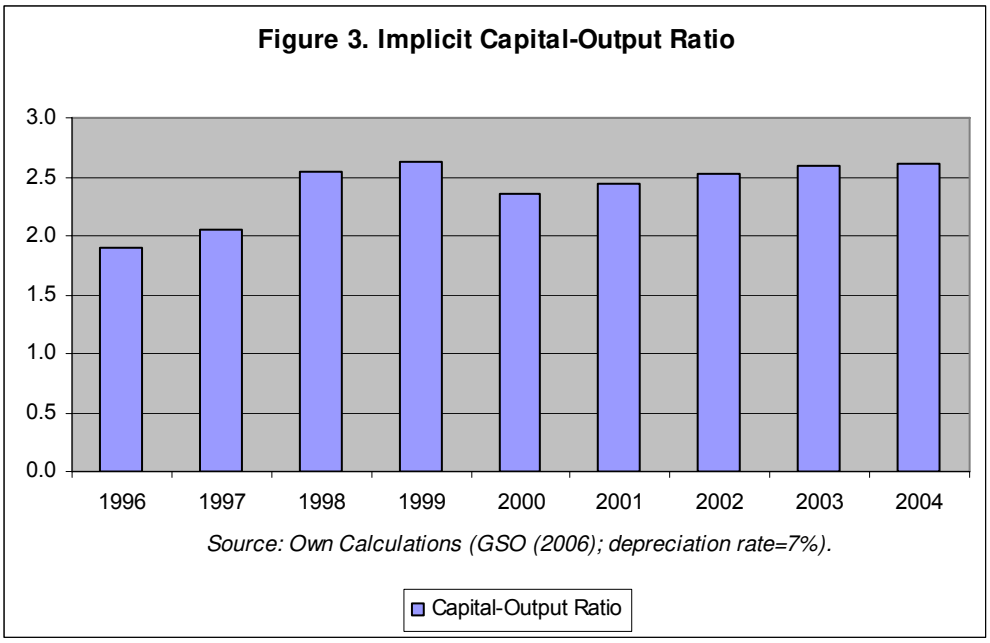
Endogenous (Stock) Variable: Foreign Exchange Reserves (R_{2002} & R_{2003})

$$R_{2002} = AUX(\text{“R”},\text{”2002”})$$

$$R_{2003} = R_{2002} + FSAM(\text{“FFIN”},\text{”DFIN”})/AUX(\text{“E”},\text{”2003”})$$

Endogenous (Price) Variable: Absorption Price Deflator (P_{2003})

$$P_{2003} = (RSAM(\text{”PRV”},\text{”COM”}) + RSAM(\text{”COM”}, \text{”ROW”}) - RSAM(\text{”ROW”},\text{”COM”})) / (PD_{2003}*GDP_{2003} - E_{2003}*(XPI_{2003}*X_{2003} - MPI_{2003}*M_{2003}))$$



4.3. Calibration of Model Parameters

4.3.1. Calibration of Behavioural Parameters

Investment Demand Parameters (k_0 & k_1)

The investment demand specification is contained in equation (5):

$$(5) \quad IV_t = k_{0,t}GDP_{t-1} + k_{1,t}\Delta GDP_t.$$

Accordingly, investment demand is a linear function of lagged GDP and current GDP growth. As noted above, the specification is a needs-based specification, which can be derived from a capital accumulation equation with depreciation rate (δ_t) and from the assumption of a constant capital-

output ratio (κ_t). On this basis, the investment demand coefficients are defined as $k_{0,t} = \delta_t * \kappa_t$ and $k_{1,t} = \kappa_t$.

The investment demand specification contains two parameters. However, only one of these parameters can be calibrated (since the two parameters do not enter into other model equations). The calibration procedure relies on an external estimate of the capital-output ratio. In the current application, the capital-output ratio is assumed to have a value of 2.5 ($\kappa_t = 2.5$). This assumption gives rise to the following (calibrated) parameters values for the investment demand parameters:

$$k_{0,2003} = (IV_{2003} - k_{1,2003}\Delta GDP_{2003})/GDP_{2002} = 0.200$$

$$k_{1,2003} = \kappa_{2003} = 2.50$$

Evidence on the capital-output ratio is hard to come by, since time series on the aggregate capital stock is not readily available. Instead, evidence may be derived indirectly from time series on real GDP, aggregate real investment, and an estimate of the depreciation rate of the capital stock. Accordingly, the investment demand specification may be inverted and solved for the capital-output ratio:

$$\kappa_t = IV_t/(\delta_t * GDP_{t-1} + \Delta GDP_t)$$

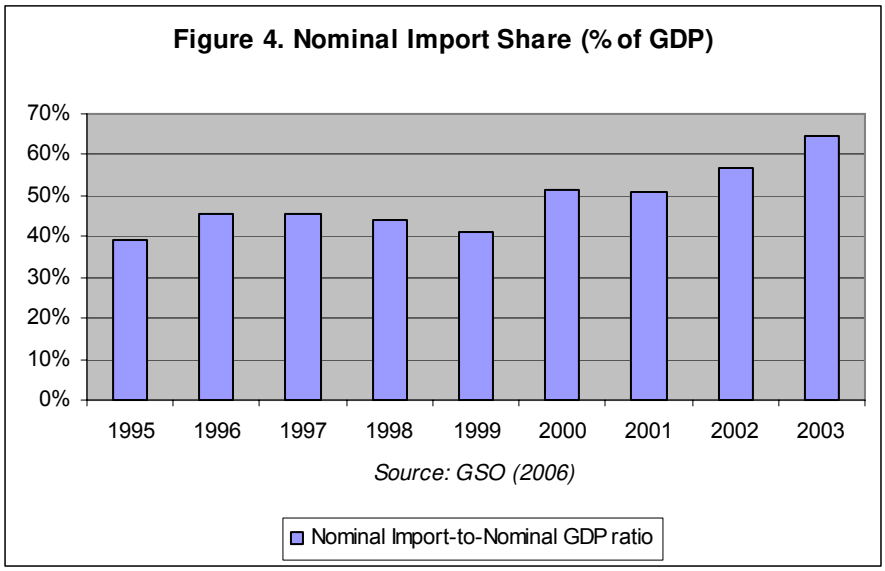
Figure 3 presents evidence on the evolution of the Vietnamese capital-output ratio over the period 1996-2004. These estimates are derived from time series data on real GDP and real investment (GSO; 2006), and from the assumption of a constant depreciation rate of 7 percent. Very low capital-output ratios characterised the Vietnamese economy during the early years 1996-1997. However, during the later period 1998-2004, the capital-output ratio has remained relatively stable around 2.4-2.6. From this evidence, it seems reasonable to assume a capital-output ratio around 2.5.

Import Demand Parameters (m_0 & m_1, m_2)

The import demand specification is contained in equation (6):

$$(6) \quad \log(M_t) = m_{0,t} + m_{1,t}\log(GDP_t) + m_{2,t}\log(E_t * MPI_t/PD_t).$$

Accordingly, import demand is a double-logarithmic function of real GDP and relative import prices. As noted above, the specification may be given a needs-based or demand-based interpretation. A needs-based relationship would focus on the import needs associated with the (exogenous) GDP growth path, while a demand-based relationship would focus on the determination of the import-to-GDP ratio from changes in relative prices. A demand-type relationship based on the CES-type specification would require an import demand elasticity with respect to GDP equal to one ($m_{1,t} = 1$), while the elasticity with respect to relative prices would be specified to reflect the degree of substitution between imports and domestic goods.



Specifically, a demand-type specification with $m_{2,t} = 1$ and $m_{2,t} = -\sigma$ would be equivalent to the first order condition for cost-minimization based on a Constant Elasticity of Substitution (CES) specification with substitution elasticity σ. In particular, an implicit CES specification with a substitution elasticity equal to one ($m_{2,t} = 1$ and $m_{2,t} = -1$) would imply that the nominal import share of GDP remained constant over time. Figure 4 presents historical evidence on the nominal import-to-GDP ratio, and it demonstrates that the nominal import share has been increasing over the period 1999-2003 and that there is no sign of deceleration. It follows that an implicit CES specification with substitution elasticity equal to one would not be an appropriate representation of the import demand specification. Either or both of the two import demand elasticities ($m_{1,t}$ and $m_{2,t}$) have to differ from one.

The import demand specification contains three parameters. However, only one of these parameters can be calibrated (since the three parameters do not enter into other model equations). Accordingly, the calibration procedure relies on external estimates of the elasticities with respect to real GDP and relative prices, while the level parameter ($m_{0,t}$) is calibrated. In the current application, the import demand elasticity with respect to real GDP is assumed to have a value of 1.20 ($m_{1,t} = 1.20$), while the import demand elasticity with respect to relative import prices is assumed to have a value of -1.00 ($m_{2,t} = -1.00$). These assumptions give rise to the following (calibrated) parameters values for the investment demand parameters:

$$m_{0,2003} = (\log(M_t) - (m_{1,t}\log(GDP_t)+m_{2,t}\log(E_t*MPI_t/PD_t)))|_{t=2003} = -3.06$$

$$m_{1,2003} = 1.20$$

$$m_{2,2003} = -1.00$$

The choice of price elasticity parameter value ($m_{2,2003} = -1.00$) reflects a relatively conservative view of the aggregate level of import trade elasticities. It is designed to reflect the combination of (i) relatively high trade elasticities in certain agricultural and food processing industries where imports are relatively low, and (ii) relatively low trade elasticities in certain investment goods sectors where imports are relatively high.

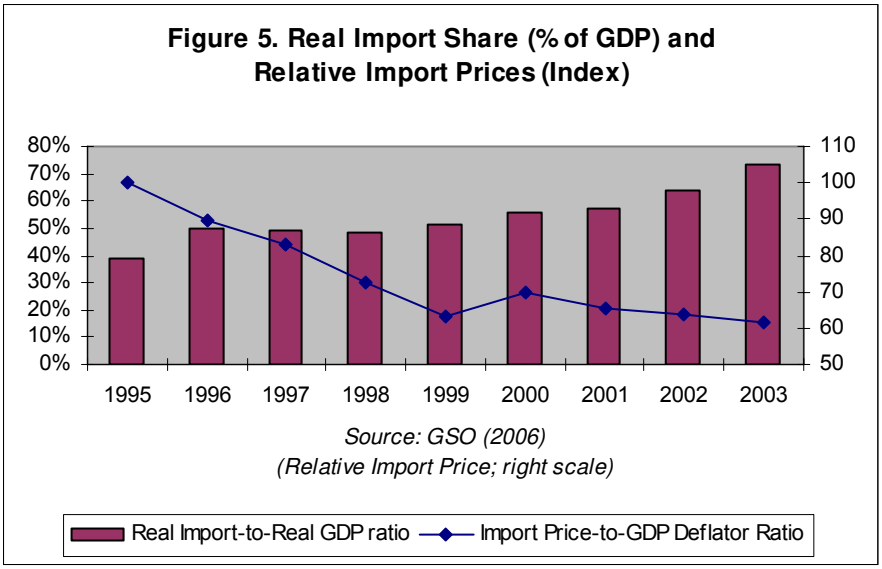
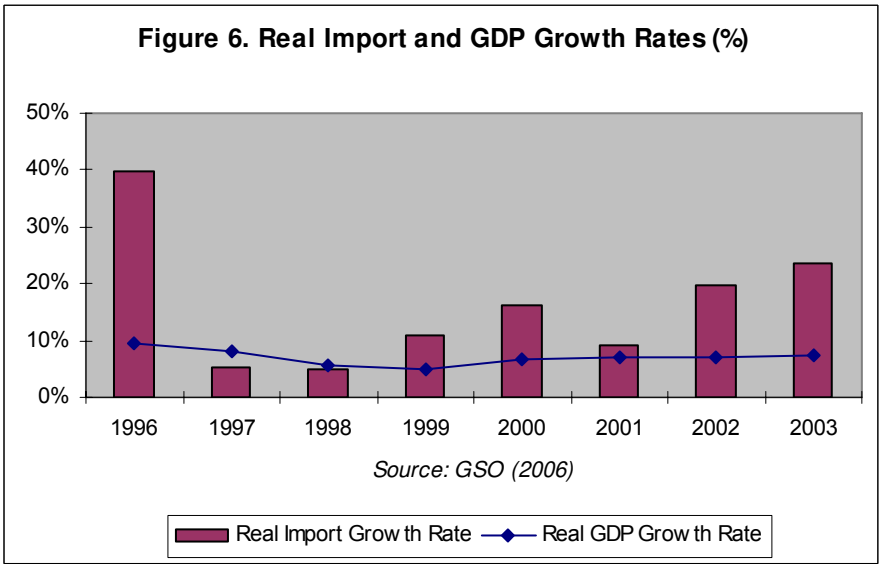


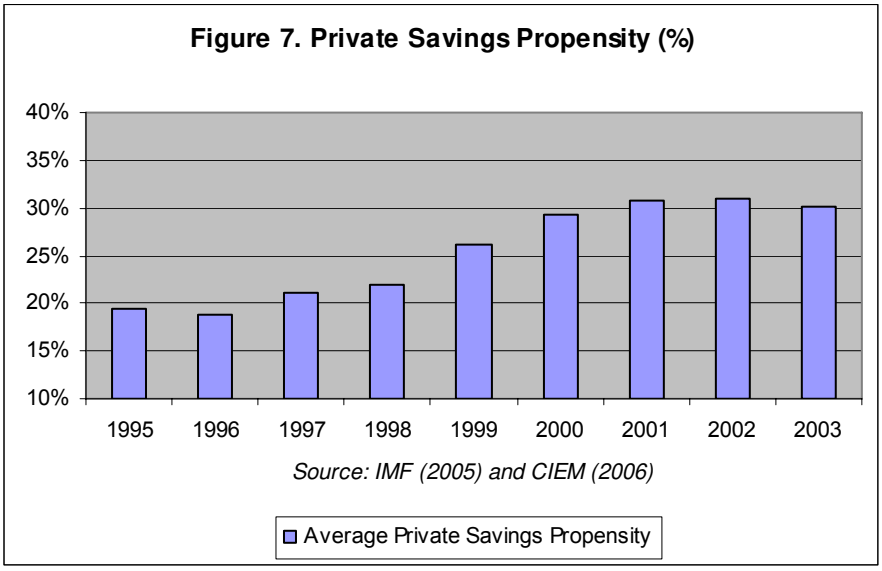
Figure 5 presents evidence on the real imports-to-real GDP ratio and the relative import price-to-GDP deflator. Over the period 1995-2003, there has been a clear tendency for the real import share to increase. Accordingly, the real import share had increased by 30 percent around 1999, and by almost 90 percent around 2003. Relative import prices have tended to decline over the same period. This seems to support the hypothesis that the shift from domestic demand to import demand has been driven by relative price changes. However, the drop in relative import prices only seems to provide part of the explanation for the increase in the real import share. By 1999, relative import prices had declined by 40 percent. This seems to be able to explain the simultaneous 30 percent increase in the real import share. However, by 2003, relative import prices remained unchanged from their 1999 level, while the real import share had increased by another 60 percent (compared to 1995).



Based on the above analysis, the period 1995-2003 seems to consist of two separate periods with respect to import growth. During the first period, 1995-1999, a secular decline in relative import

prices may have played an important role in stimulating import demand and raising the real import ratio. However, the significance of relative import prices seems to have disappeared, subsequently. This evidence strongly suggests that other factors, apart from relative price changes, have affected import demand. In particular, the evidence seems to suggest that Vietnam has entered a stage of their development process, where the need for imports of intermediate inputs and capital goods is growing faster than value added creation. The existence of a strong secular trend in real import demand is further supported by Figure 6, which presents growth rates for real GDP and import volumes over the period 1996-2003. Real GDP growth have remained relatively strong over the period 1999-2003, including growth rates of around 5 percent in 1999, and around 7 percent during 2000-2003. At the same time, real import growth has accelerated strongly from 11 percent in 1999 to 24 percent in 2003.

While the acceleration is unlikely to continue, there is no evidence to suggest that the strong secular trend growth of the real import share is going to stop over the coming years. Accordingly, the choice of parameter value for the real GDP elasticity ($m_{1,2003}$ = 1.20) reflects the recent increase in the import share of GDP and the belief that import growth will continue to outperform GDP growth (irrespective of relative price changes). At the same time, the choice of GDP elasticity also reflects that the extraordinary growth rates in import volume which has been recorded in recent years cannot be sustained – even in the medium run. The historical expansion (and the potential for continued future expansion) of import volumes should be kept in mind when the Merged Model is used to create scenarios for the future development of the Vietnamese economy.



Private Savings Propensity (b)

The determination of private consumption relies on the specification of a private savings propensity. The private consumption specification is contained in equation (9):

$$(9) \quad P_t * CP_t = (1-b_t) * GDY_{t,}$$

Nominal private consumption is specified as a linear function of private disposable income, and the average savings propensity (b_t) is used to derived the average propensity to consume ($1-b_t$) out of

disposable income. The private consumption specification only contains one parameter. It follows that the private savings propensity can be calibrated from the consumption specification on the basis of the initialized variables:

$$b_{2003} = 1 - (P_t * CP_t / GDY_t) \mid_{t=2003} = 0.272$$

The stability of the calibrated savings propensity may be judged from Figure 7, which calculates the average private savings propensity over the period 1995-2003. The figure clearly demonstrates how the private propensity to save out of disposable income, has increased over the period 1995-2003. The savings propensity seems to have grown particularly strongly during the period 1997-2000. Accordingly, while the savings propensity hovered around 20 percent during the period 1995-97, it has remained around 30 percent during the period 2000-2003.[17]

While the private savings propensity has grown strongly between 1995 and 2003, the time series estimates also seem to suggest that the savings propensity have stabilized around current levels during the recent period 2000-2003. The historical changes in the private savings propensity should be kept in mind, when the Merged Model is used to create scenarios for the future development of the Vietnamese economy.

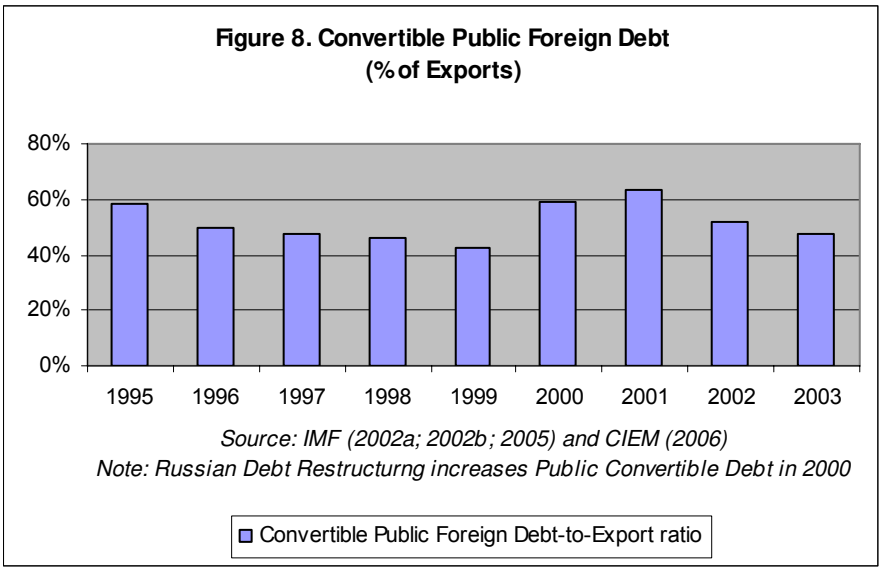
Government Net Foreign Debt-to-Exports ratio (g)

The stock of government net foreign debt is defined in equation (16):

$$(16) \quad NFDG_t = g_t * XPI_t * X_t.$$

Accordingly, the stock of government net foreign debt is specified as an exogenous share of foreign currency export earnings. The specification is designed to capture the ability/priority of the government to access foreign capital markets. If the government is constrained in its access to foreign capital markets, the ratio should reflect the degree of the constraint. In some instances, the constraint on net foreign indebtedness in terms of export earnings is explicit. This is typically the case for highly indebted countries, which has received debt relief within the enhanced HIPC initiative. Otherwise, the binding constraints may be implicitly given on the basis of country-specific circumstances (e.g. past record and future potential for repayment and default), international financial events (e.g. contagion effects from international financial crisis), and international political relations. The current Merged Model approach focuses on the potential constraint on Vietnamese government foreign borrowing in relation to the (future) potential for repayment, where the potential for repayments is proxied by the level of foreign currency export earnings.

[17] The calibrated private savings propensity for 2003 (27.2 percent) differs from the estimate in Figure 7 (30.2 percent). The reason is that the data source for the government domestic revenue data underlying the 2003 SAM data set (IMF; 2005), differ from the source of the time series data underlying Figure 7 (CIEM; 2006). The difference in revenue estimates stem from systematic differences in accounting practices. Accordingly, the time series data are likely to underestimate government domestic revenues and overestimate the private savings propensity in a systematic way. Figure 7 may therefore still be used to derive general tendencies for the development of the private savings propensity over time.



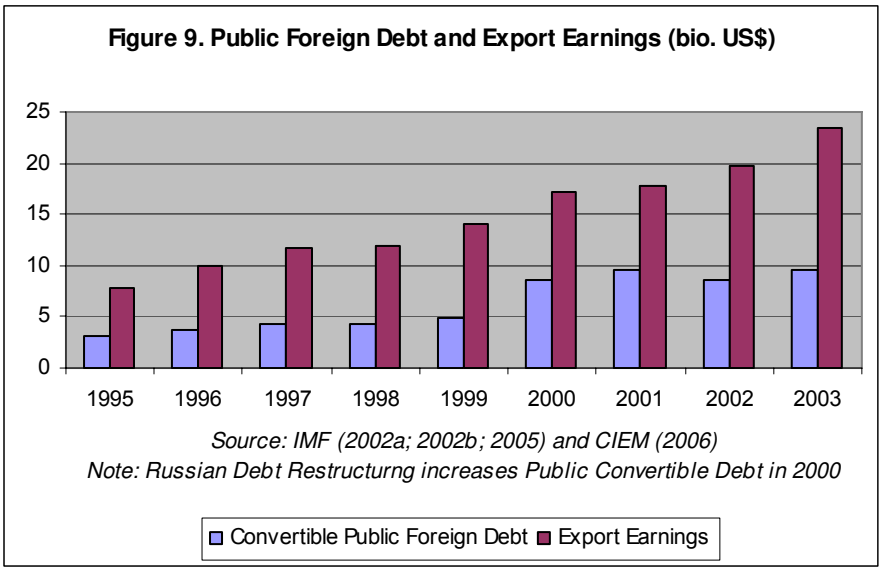
The government net foreign debt specification only contains one parameter. It follows that the government net foreign debt-to-exports ratio can be calibrated from the above specification on the basis of the initialized variables:

$$g_{2003} = NFDG_t / (XPI_t * X_t) \mid_{t=2003} = 0.430$$

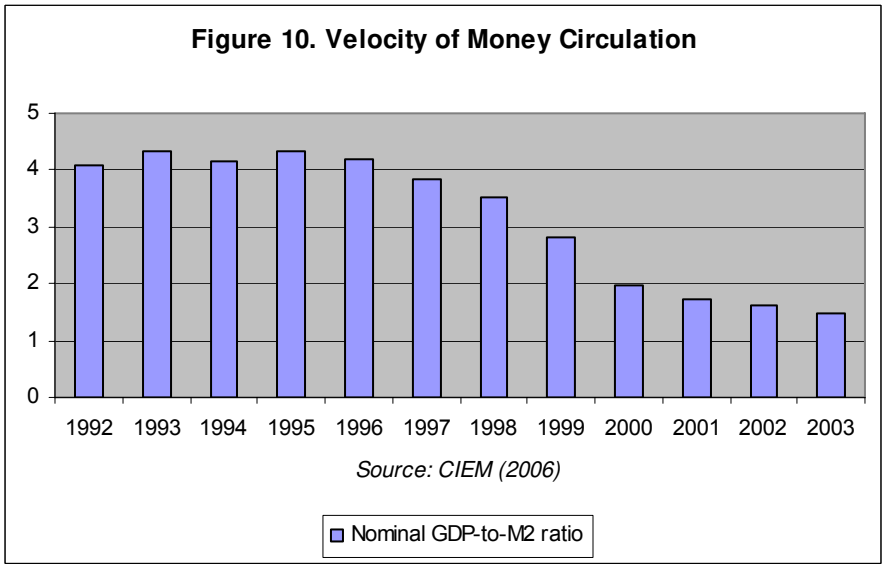
The stability of the calibrated parameter value may be judged from Figure 8, which presents historical evidence on the government foreign debt-to-exports ratio. The evidence suggests that the ratio increased strongly between 1999 and 2000. However, this is due to a structural break in the underlying time series data, where the restructuring of non-convertible Russian debt lead to a strong increase in the convertible foreign debt of the government. Apart from this anomaly, the evidence indicates that the government foreign debt-to-exports ratio has declined continuously since 1995. Accordingly, convertible foreign debt ratio declined from around 60 percent in 1995 to around 40 percent in 1999. The restructuring of the Russian debt re-established the convertible foreign debt ratio around 60 percent in 2000, but it has since been reduced to below 50 percent in 2003. [18]

Figure 9 presents the underlying time series data on government foreign debt and export earnings. The data clearly demonstrates how the restructuring of a large stock of non-convertible Russian debt (10.5 bio. USD) lead to a strong increase in the convertible public foreign debt in 2000. Apart from the structural break, the time series data suggests that the public foreign debt has increased relatively slowly over time. Accordingly, convertible public foreign debt increased from 3.2 to 4.9 bio. USD between 1995 and 1999 and from 8.6 to 9.6 bio. USD between 2000 and 2003. In contrast, export earnings have increased rapidly from 7.9 to 23.4 bio. USD between 1995 and 2003. The observed drop in the government foreign-debt-to-exports ratio over the period 1995-2003 was therefore due to the combination of (i) moderate government foreign borrowing, and (ii) strong export growth.

[18] The government foreign debt-to-exports ratio for 2003 (43 percent) differs from the estimate in Figure 8 (48 percent). The reason is that the data source for the government foreign debt data included in the auxiliary 2002-2003 data set (IMF; 2005), differ from the source of the time series data underlying Figure 8 (CIEM; 2006).



Based on the strong recent export-performance of the Vietnamese economy, it is unlikely that the Vietnamese government is currently constrained in their access to foreign capital markets. The strong drop in the government foreign debt-to-export ratio should rather be seen as a deliberate policy to reduce the dependence on foreign capital markets. It follows that the calibrated parameter value ($g_t = 0.430$) should not be interpreted as the ability of the government to access foreign capital markets. Instead, the parameter value should be interpreted as the priority of the government to access foreign capital markets. This interpretation is important to bear in mind, when the Merged Model is used to create scenarios for the future development of the Vietnamese economy.



Velocity of Money Circulation (v)

Money demand is determined in equation (19):

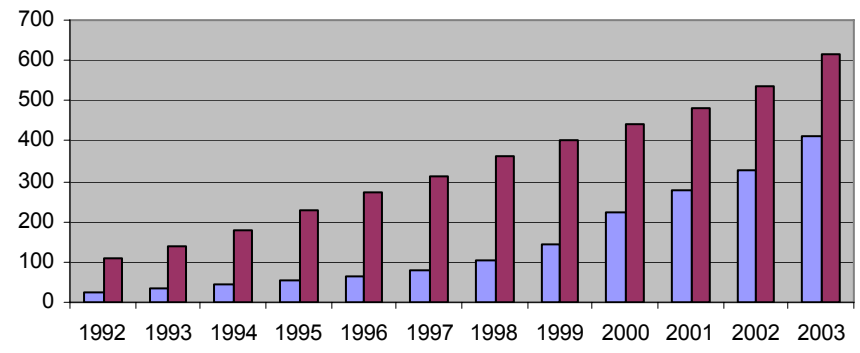
(19) $MD_t = (1/v_t)*GDPN_t$.

Accordingly, money demand is determined according to a quantity specification, which defines money demand as the ratio between nominal GDP and the velocity of money circulation (v_t). The velocity parameter is typically found to rely on other economic determinants, including interest rates (own return and opportunity cost) and the inflation rate. However, in the context of the Merged Model, the velocity of money circulation is specified as en exogenous parameter.
The money demand specification only contains one parameter. It follows that the velocity of money circulation parameter can be calibrated from the above specification on the basis of the initialized variables:

$$v_{2003} = GDPN_t/MD_t \,|_{t=2003} = 1.49$$

The stability of the calibrated parameter value may be judged from Figure 10, which presents historical evidence on the velocity of money circulation. The evidence suggests that the velocity of circulation remained fairly constant (around 4.0) during the period 1992-1996. Since then, the velocity parameter has declined rapidly. Accordingly, it declined from 4.2 (1996) to 1.7 (2001) over a period of five years. Subsequently, money velocity has continued to decline but at a slower pace. Accordingly, it declined from 1.7 to 1.5 during 2001-2003. It therefore seems likely that the money velocity is going to stabilize around or slightly below the current (calibrated) parameter value.

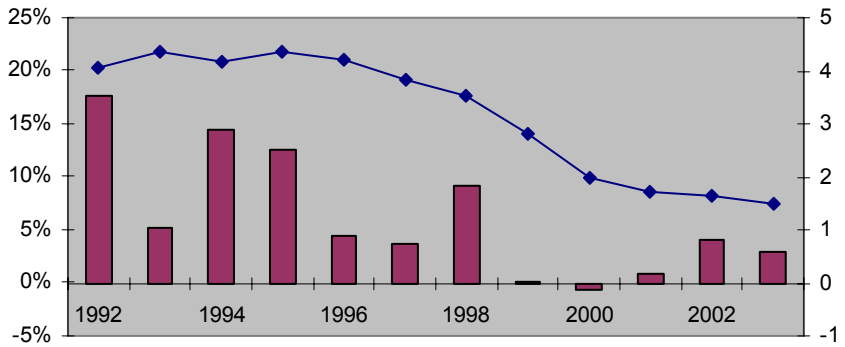
Figure 11. Money Supply and Nominal GDP (10^9 VND)



Source: CIEM (2006)

Figure 11 presents the historical time series data on nominal GDP and money supply over the period 1992-2003. Both economic indicators grew fairly rapidly over the early part of the period. Accordingly, both nominal GDP and the M2 money stock grew by 25-30 percent per year between 1992 and 1996. However, during the subsequent period (1997-2001), the growth rates of the two indicators started to diverge. The growth rate of nominal GDP declined to one-digit levels, while the money supply continued to grow around 25-30 percent per year, crowned by a record 50 percent growth rate in 2000. This explains the sharp drop in money velocity over this period. Finally, money supply growth has slowed somewhat over the period 2001-2003. However, money supply growth rates around 20-25 percent continue to outpace nominal GDP growth rates around 10-15 percent. This explains the continued drop in money velocity over the later period.

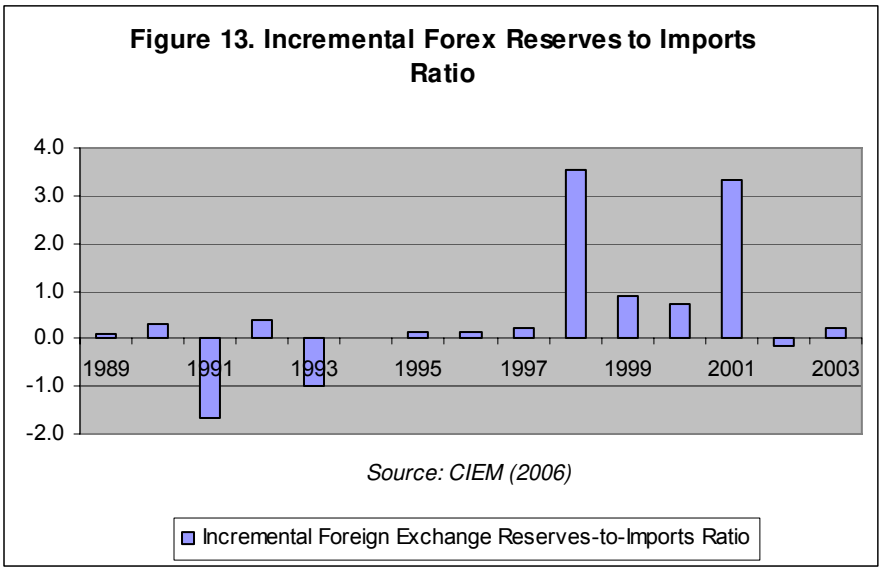
Figure 12. Money Velocity and CPI inflation



Source: CIEM (2006); (Velocity on right scale)

The explanation for the sharp drop in money velocity over the period 1997-2003 is (partly) due to the simultaneous drop in consumer price (CPI) inflation. Figure 12 presents historical evidence on the money velocity and CPI inflation over the period 1992-2003. The evidence suggests that CPI inflation was high and volatile until 1995, after which time inflation rates have come down to one-digit levels. The drop in money velocity, which started in 1997, was preceded by one-digit inflation rates during 1996-97. Moreover, the credibility of the low-inflation policy seems to have taken hold during subsequent years leading to very high (relative) money supply growth rates during 1999-2000. Subsequently, the established low-inflation regime has continued to influence household behaviour and raise money holdings relative to transactions demand.

It was noted above that the private savings propensity has increased strongly over the period 1997-2001. While the transition to a low-inflation regime may explain part of the drop in money velocity (transactions motive), the increase in money velocity may also reflect an increase in money holdings due to a change in savings behaviour (savings motive). Due to the continued low development of financial asset markets, the main savings mediums available to households remain high-powered money and current account deposits with the banking system. As noted above, both the private savings rate and the inflation rate seems to have stabilized over the most recent period (2001-2003). Accordingly, the continued downward trend of the money velocity seems unlikely to continue past the medium run. In any case, the relatively low level of the current Vietnamese money velocity (compared to international standards), would seem to indicate that a further decline is very unlikely. This should be kept in mind when the Merged Model is used to create scenarios for the future development of the Vietnamese economy.



Incremental Foreign Exchange Reserve-to-Import Growth Ratio (d)

The demand for foreign exchange reserves is determined from equation (20):

(20) $\Delta R_t = d_t(MPI_t*M_t-MPI_{t-1}*M_{t-1})$.

Accordingly, the accumulation of foreign exchange (ForEx) reserves is defined as an exogenous share of import growth at any given point in time. As noted above, this specification is designed to mirror the long-run desire of policy makers, to ensure that sufficient foreign exchange reserves are available to finance a given number of weeks of import expenditures. If ForEx reserve accumulation happens according to a long run desired foreign exchange reserve stock-to-import level ratio ($d_t = \underline{d}$), the actual foreign exchange reserves-to-imports ratio will converge asymptotically to the long run desired ratio as foreign currency import expenditures grow over time:

$$R_t / (MPI_t*M_t) \rightarrow \underline{d}\ , (MPI_t*M_t) \rightarrow \infty$$

It follows that the actual ratio between ForEx accumulation and import growth may differ from the long run desired incremental foreign exchange reserve-to-import growth ratio at any given point in time.

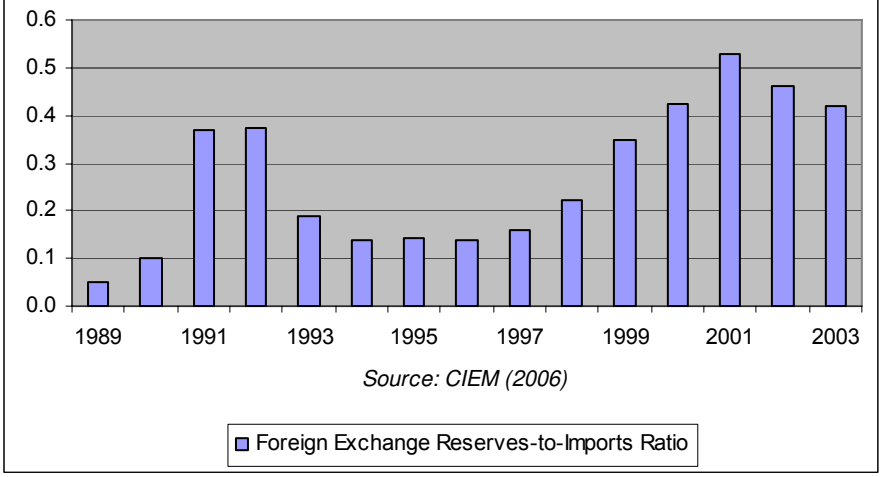
The foreign exchange reserve demand specification only contains one parameter. It follows that the incremental foreign exchange reserve-to-import growth ratio parameter can be calibrated from the above specification on the basis of the initialized variables:

$$d_{2003} = \Delta R_{2003} / (MPI_{2003}*M_{2003} - MPI_{2002}*M_{2002}) = 0.15.$$

The stability of the calibrated parameter value may be judged from Figure 13, which presents historical evidence on the incremental foreign exchange reserve-to-import growth ratio. The evidence suggests that the incremental ratio has varied strongly over time. Foreign exchange reserve holdings grew strongly compared to imports during the period 1998-2001. However, the

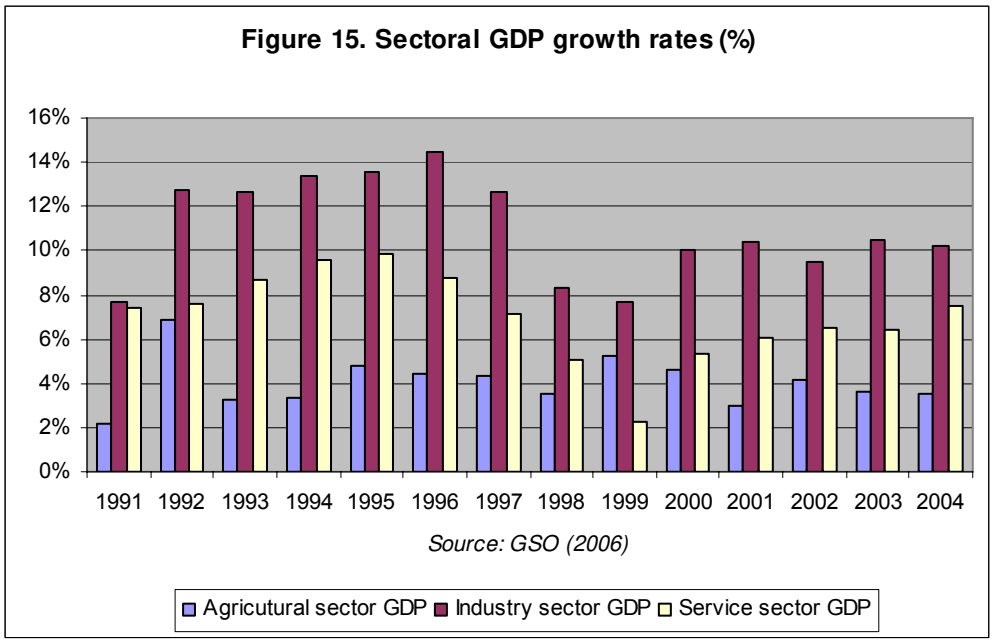
incremental ratio has come down to pre-1998 levels over the most recent period 2002-2003. The instability of the incremental ratio over time suggests that it may not be sensible to base future projections on the basis of the calibrated value.

Figure 14. Forex Reserves to Imports Ratio



Source: CIEM (2006)

Evidence on the historical development of the ForEx reserve stock-to-import level ratio is presented in Figure 14. The evidence indicates that foreign exchange reserve accumulation over the period 1997-2001 brought the levels ratio close to a level which may be deemed sensible from a policy-makers point of view. Accordingly, the levels ratio reached a maximum value of 0.53 in 2001. Subsequently, the ratio has declined to 0.42 in 2003. The 2003 levels ratio implies that the current base year level of foreign exchange reserves is sufficient to cover five months (5/12) of additional imports. This estimate is likely to be closer to the policy-makers long run desired foreign exchange reserve-to-import ratio, compared to the calibrated parameter value. Nevertheless, it is also noted that the analysis of the Vietnamese Socio-economic Development Plan in Jensen & Tarp (2007b) indicates that the long run desired ratio is closer to nine weeks of import expenditures (9/52).



4.3.2. Calibration of Non-behavioural Parameters

Sectoral GDP Growth Rates (γ_s)

The sectoral GDP growth paths are determined by equation (1):

(1) $GDPS_{s,t} = (1+\gamma_{s,t})*GDPS_{s,t-1}$.

Accordingly, growth paths for real sectoral GDP is determined on the basis of initial sectoral GDP values and exogenous sectoral GDP growth rates. Sectoral GDP is defined over three sectors including agriculture, industry, services. Accordingly, initial GDP growth rates are calibrated for the three sectors on the basis of initial and lagged variables:

$$\gamma_{agriculture,2003} = GDPS_{agriculture,2003} / GDPS_{agriculture,2002} = 0.036$$

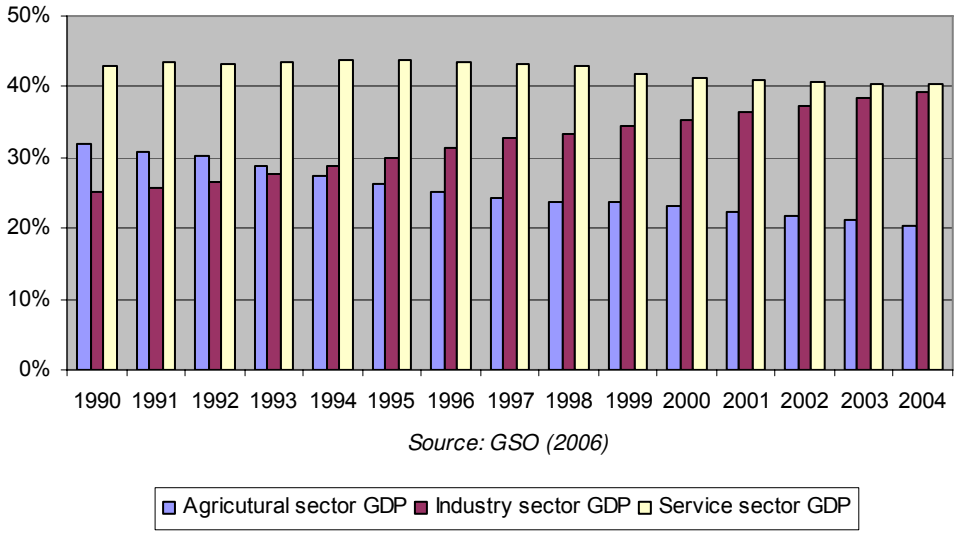
$$\gamma_{industry,2003} = GDPS_{industry,2003} / GDPS_{industry,2002} = 0.105$$

$$\gamma_{service,2003} = GDPS_{service,2003} / GDPS_{service,2002} = 0.065$$

The stability of the calibrated sectoral growth rates may be judged from Figure 15, which presents historical evidence on the sectoral GDP growth rates. Agricultural growth rates have varied (unpredictably) over time. A couple of years, including 1992 and 1999, stand out with above average agricultural growth (> 5.0 percent), while other years, including 1991 and 2001, stand out with below average growth (< 3.0 percent). However, apart from these years, agricultural growth rates have been relatively stable with a geometric average growth rate of 4.1 percent over the full period 1991-2004, and 3.8 percent over the more recent period 2000-2004. This seems to indicate that the calibrated agricultural GDP growth rate may be a reasonable starting point for developing future economic projections for Vietnam.

Industry and service sector GDP growth rates have varied more (systematically) over time. High growth rates were recorded during the early period 1992-1997, and during the later period 2000-2004, while a small slump occurred during the intermediate period 1998-1999. Industry sector GDP growth rates have remained relatively stable during the high-growth periods. Accordingly, industry sector growth rates varied around 13-14 percent per year during 1992-1997, and around 10 percent during 2000-2004. Geometric average industry sector growth rates include 10.9 percent over the full period 1991-2004, and 10.1 percent over the more recent high-growth period 2000-2004.

Figure 16. Sectoral GDP shares (%)



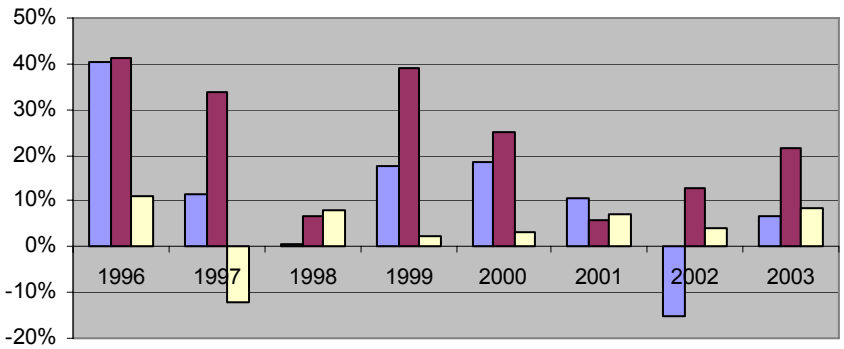
Source: GSO (2006)

The relatively stable industrial growth rate over the latter period seems to indicate that the calibrated industry sector GDP growth rate may be a reasonable starting point for developing future economic projections for Vietnam. However, this may be misleading. Figure 16 presents evidence on the historical development of sectoral GDP shares, and it shows that the high industrial growth rates have raised the industry sector share of aggregate GDP from 25 percent to 39 percent during the period 1991-2004. A continuation of the very high industry sector GDP growth rates over the medium to long run is therefore likely to raise the industry sector GDP share to an unreasonably high level. A reasonable starting point for developing economic projections would therefore (most likely) need to include the specification of a time path of gradually declining industry sector GDP growth rates over the projection horizon.

Service sector GDP growth rates have been more variable compared to industry sector growth rates during the high-growth periods. Service sector growth rates varied between 7-10 percent during 1992-1997 and between 5-7 percent during 2000-2004, and the geometric average service sector growth rates amounted to 7.0 percent over the full period 1991-2004, and 6.4 percent over the more recent high-growth period 2000-2004. Importantly, the service sector growth rates have been accelerating over the latter period. Accordingly, service sector GDP growth has increased continuously from 5.3 percent in 2000 to 7.5 percent in 2004.

The relatively strong increase in service sector GDP growth rates over the more recent growth-period 2000-2004 suggests that the calibrated service sector GDP growth rate may not be a reasonable starting point for developing future economic projections for Vietnam. This is further underlined by the evidence in Figure 15, which suggests that the share of service sector GDP in aggregate GDP remains around a relatively low level (40 percent in 2004). A reasonable starting point for developing economic projections would therefore (most likely) need to include the specification of a time path of gradually increasing service sector growth rates over the projection horizon.

Figure 17. Sectoral Export Volume Growth Rates (%)



Source: GSO (2006)

Sectoral Export Growth Rates (λ_s)

The sectoral export growth paths are determined by equation (3):

$$(3) \quad XS_{s,t} = (1+\lambda_{s,t})*XS_{s,t-1}.$$

Accordingly, growth paths for real sectoral exports are determined on the basis of initial sectoral export values and exogenous sectoral export growth rates. Sectoral esports are defined over three sectors including agriculture, industry, services. Accordingly, initial export growth rates are calibrated for the three sectors on the basis of initial and lagged variables:

$$\lambda_{agriculture,2003} = XS_{agriculture,2003} / XS_{agriculture,2002} = 0.098$$

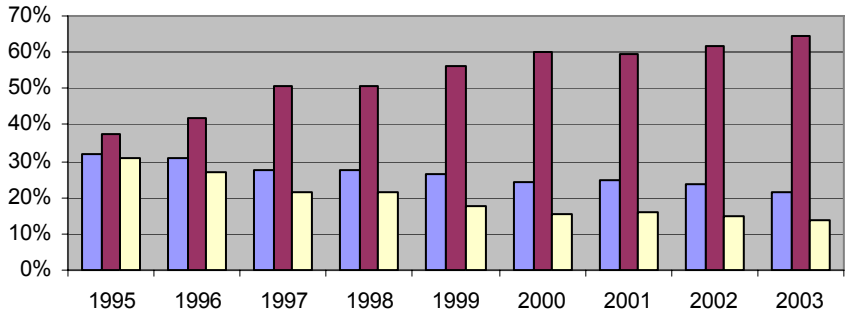
$$\lambda_{industry,2003} = XS_{industry,2003} / XS_{industry,2002} = 0.248$$

$$\lambda_{service,2003} = XS_{service,2003} / XS_{service,2002} = 0.110$$

The stability of the calibrated growth rates may be judged from Figure 17, which presents historical evidence on sectoral export growth rates. The sectoral growth rates have been varying unpredictably over the period 1996-2003. Agriculture sector export growth rates ranges from -15 percent (2002) to 41 percent (1996), industry sector export growth rates ranges from 6 percent (1998 & 2001) to 41 percent (1996), while service sector export growth rates ranges from -12 percent (1997) to 11

percent (1996). Furthermore, geometric average growth rates over the full period 1996-2003, amounts to 10.4 percent (agriculture export volume), 22.6 percent (industry volume exports), and 3.7 percent (service export volume).

Figure 18. Sectoral Export Earnings Shares (%)



Source: GSO (2006)
Sectoral export earnings are calculated in US$ terms

Agriculture Sector Exports | Industry Sector Exports | Service Sector Exports

The strong variation in the year-on-year growth rates lends little credibility to the calibrated sectoral export growth rates, as a starting point for developing future economic projections. More faith may be vested in the geometric average growth rates. This may, however, be misleading (as was the case for sectoral GDP growth rates – see above). Figure 18 presents evidence on the historical development of sectoral export (earnings) shares.[19] It shows that the high industrial export growth rates have raised the industry sector share of aggregate exports from 37 percent to 64 percent during the period 1995-2003. Accordingly, strong industry export growth has been the main driving force behind the relative expansion of Vietnamese exports.

[19] Sectoral export shares in Figure 18 are based on current export earnings (current US$ prices), while real export growth rates in Figure 17 are based on real export earnings (1995 US$ prices). Declining world market prices (for food exports) implies that export earnings slightly underestimate the development of real (food) exports. Accordingly, world market prices for food exports declined by 9 percent (total) during 1996-2003, while world market prices for non-food exports increased by 1 percent (total) during the same period.

Figure 19 presents historical evidence on aggregate exports. The evidence suggests that aggregate export earnings have expanded strongly as a share of GDP. Accordingly, export earnings as a share of GDP increased from 38 percent to 60 percent during 1995-2003. Import expenditures were slightly higher than exports earnings in 2003. It follows that the aggregate trade-to-GDP ratio hovered around 125 percent in 2003. This is a relatively high ratio compared to international standards (Dollar & Kraay, 2004; Birdsall & Hamoudi, 2002). A continuation of the very high industry sector export growth rates over the medium to long run is therefore likely to raise the aggregate export share (and trade share) to an unreasonably high level. A reasonable starting point for developing economic projections would therefore (most likely) need to include the specification of a time path of gradually declining industry sector export growth rates over the projection horizon.

The service sector export share has declined in line with the explosive growth of industry sector exports. Accordingly, the service sector share of total export earnings declined from 31 percent to 14 percent during 1995-2003. The strong drop in the service sector export share is also due to slow average service sector export growth around 3.7 percent per year. Nevertheless, important opportunities for expansion exist in major service sectors, including transit services (to China), financial services, and tourist-related services. Accordingly, it seems likely that year-on-year service sector export growth rates will increase above past growth rates. A reasonable starting point for developing future economic projections would therefore (most likely) need to include the specification of a time path of gradually increasing service sector export growth rates over the projection horizon.

The agriculture sector export share has also declined from 32 percent to 22 percent during 1995-2003. However, this is mainly due to the strong industry sector export growth. Accordingly, the geometric average growth rate for agriculture sector exports stands at 10.4 percent per year. While there are physical limitations (in terms of natural resource availability) on the expansion of agricultural production and exports, the recent entry into the WTO and the potential for a successful conclusion to the current Doha round of WTO trade negotiations seems to present opportunities for a continuation of the high level of agriculture sector export growth. A future time path of agriculture sector export growth rates based on the average agriculture sector growth rate (1995-

2003) would therefore seem to represent a reasonable starting point for developing future economic projections.

Government Domestic Interest Rate (irdg)

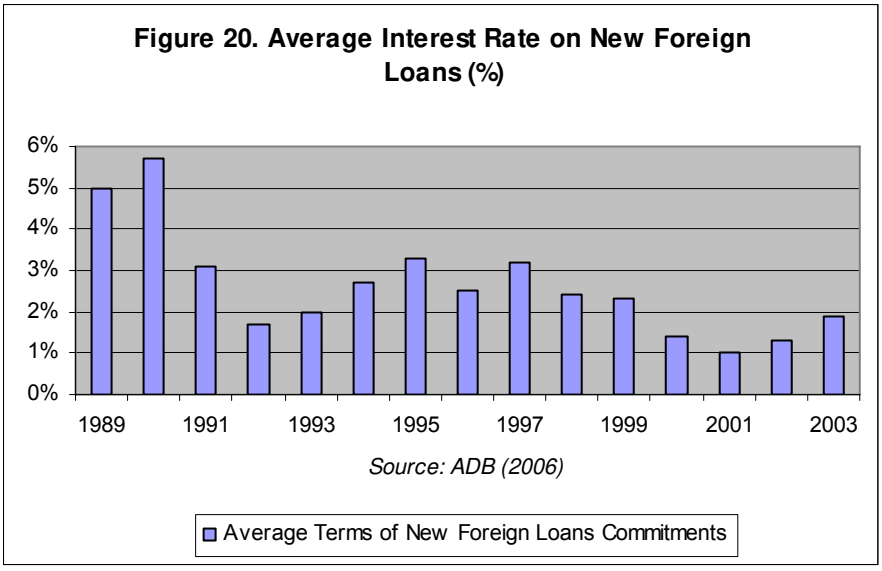
The growth path for government domestic interest payments is determined by equation (27):

(27) $INDG_t = IRDG_t * NDDG_{t-1}$.

Accordingly, the growth path for government domestic interest payments is defined on the basis of an (exogenous) growth path for the government domestic interest rate and an (endogenous) growth path for the (lagged value of the) government domestic debt stock. The initial government domestic interest rate is therefore calibrated on the basis of initial and lagged variables:

$$IRDG_{2003} = INDG_{2003} / NDDG_{2002} = 0.031$$

Time series data on government domestic interest payments are not readily available. A future time path of government domestic interest rates based on the calibrated parameter value would therefore seem to represent the most appropriate available starting point for developing future economic projections.



Government Foreign Interest Rate (irfg)

The growth path for government foreign interest payments is determined by equation (28):

(28) $INFG_t = IRFG_t * NFDG_{t-1}$

Accordingly, the growth path for government foreign interest payments is defined on the basis of an (exogenous) growth path for the government foreign interest rate and an (endogenous) growth path

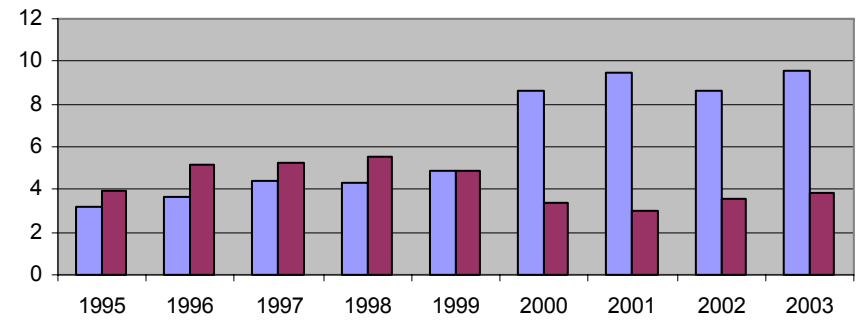
for the (lagged value of the) government foreign debt stock. The initial government foreign interest rate is therefore calibrated on the basis of initial and lagged variables:

$$IRFG_{2003} = INFG_{2003} / NFDG_{2002} = 0.015$$

Time series data on government foreign interest payments are not readily available. Accordingly, the stability of the calibrated government foreign interest rate cannot be evaluated directly from first-hand evidence. Nevertheless, time series data are available on the average interest rate of new (private and public sector) foreign loans. Figure 20 presents historical evidence on the average terms of new Vietnamese foreign loan commitments, and it indicates that government foreign debt has typically had a large grant element. Accordingly, the average interest rate on new foreign loans has varied between 1.0 percent (2001) and 3.3 percent (1995) over the period 1991-2003. Moreover, the interest rate on new loans has averaged 0.016 over the most recent 5-year period 1999-2003. The calibrated government foreign interest rate therefore seems to be in line with the (average) effective return on (private and public sector) foreign loan commitments over the recent past.

On the one hand, the low average interest rate on new (private and public sector) foreign loan commitments suggests that the interest rate on new public foreign loan commitments is lower than the calibrated parameter value for the government foreign interest rate. This would tend to suggest that a reasonable starting point for developing economic projections would include the specification of a time path of a *gradually declining* (effective) government foreign interest rate over the projection horizon. On the other hand, there is also evidence which suggests that the average government foreign interest rate is going to increase above the calibrated parameter value over the medium-to-long run. First, Figure 20 shows that the average terms of new (private and public sector) loan commitments has increased (slightly) over the period 2001-2003. Second, Vietnam has recently gained access to international capital markets on market terms. Accordingly, Vietnam successfully carried out its first international bond issue in September 2005. The Bonds carried a coupon of 6.875 percent and were circulated with a yield of 7.125 percent (WB, 2005). This would tend to suggest that a reasonable starting point for developing economic projections would include the specification of a time path of a *gradually increasing* (effective) government foreign interest rate over the projection horizon.

Figure 21. Convertible Foreign Debt (bio. US$)



Source: IMF (2002a; 2002b; 2005) and CIEM (2006)
Note: Russian Debt Restructurng increases Public Convertible Debt in 2000

Private Foreign Interest Rate (irfp)

The growth path for private foreign interest payments is determined by equation (29):

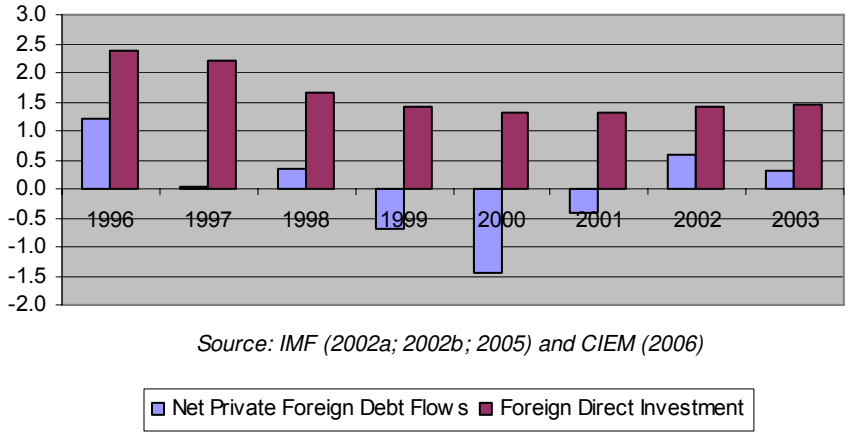
(29) $INFP_t = IRFP_t * NFDP_{t-1}$.

Accordingly, the growth path for private foreign interest payments is defined on the basis of an (exogenous) growth path for the private foreign interest rate and an (endogenous) growth path for the (lagged value of the) private foreign debt stock. The initial private foreign interest rate is therefore calibrated on the basis of initial and lagged variables:

$$IRFP_{2003} = INFP_{2003} / NFDP_{2002} = 0.058$$

Time series data on private foreign interest payments are not readily available. Accordingly, the stability of the calibrated private foreign interest rate cannot be evaluated directly from first-hand evidence. Figure 20 (see previous section on the calibration of the government foreign interest rate) presents historical evidence on the average terms of new Vietnamese (private and public sector) foreign loan commitments. However, the share of private foreign loans in total foreign loans remains relatively low. Figure 21 presents evidence on private and public convertible foreign loans, and it follows that private foreign loans amounted to 3.9 bio. US$ or 29 percent of total foreign loans in 2003. A large share of new loan commitments is made to refinance previous loans. It follows that new loan commitments are likely to be dominated by new government sector loans. The historical evidence on the average terms of new Vietnamese (private and public sector) foreign loan commitments is therefore unlikely to be representative for the general evolution in the private foreign interest rate.

Figure 22. Private Foreign Borrowing and Foreign Direct Investment (bio. US$)



Source: IMF (2002a; 2002b; 2005) and CIEM (2006)

In general, the calibrated private foreign interest rate is likely to be the most reliable parameter estimate to use as a starting point for developing economic projections. The relatively low level of the private foreign interest rate also suggests that the collateral value of large-scale private enterprises (the main private agents with access to foreign capital markets) is relatively good.

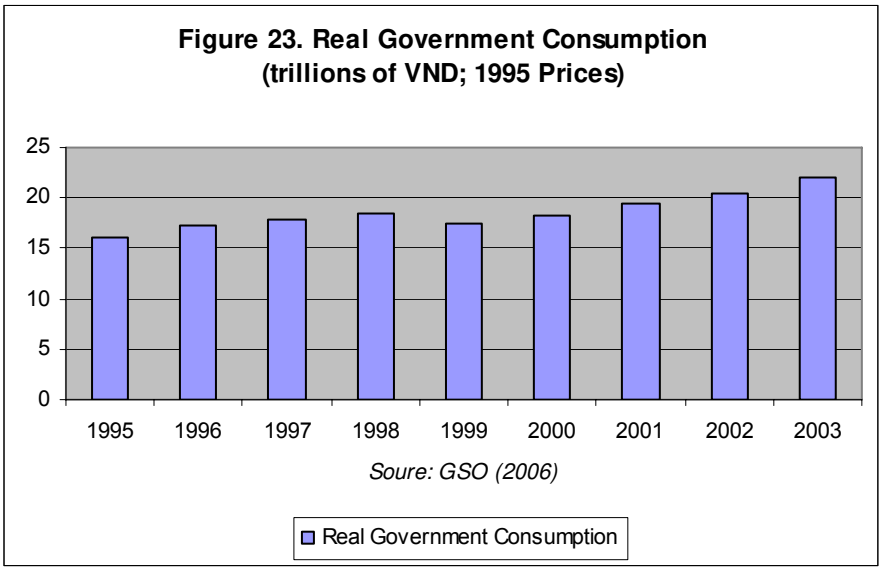
Accordingly, the increasing foreign direct investment inflows over the past decade are likely to have improved the collateral value of private Vietnamese enterprises. Figure 22 provides evidence on foreign capital inflows (FDI vs. foreign loan inflows), and it shows that FDI inflows have dominated private foreign loans as a source of private sector financing over the period 1996-2003. To the extent that foreign direct investment has been directed towards enterprises with foreign loan exposure, this is likely to have raised the collateral value of private "foreign loan"-takers and improved the terms of new private foreign loan commitments.

In any case, the relatively low calibrated value of the private foreign interest rate (combined with the (likely) past improvement in the collateral value of private enterprises) seems to suggest that the private foreign interest rate is unlikely to decline much further for current "foreign loan"-takers over the medium-to-long run. Moreover, to the extent that new private "foreign loan"-takers are well-consolidated companies the overall private foreign interest rate would be unlikely to increase. On these premises, it would seem that a reasonable starting point for developing economic projections would include the specification of a constant time path for the private foreign interest rate over the projection horizon.

5. Evaluation of Merged Model Projections

The evaluation of the consistency of a given set of Merged Model projections relies on the evaluation of the four focal variables of model. As noted above, the focal variables provides a check on the consistency of the assumed (exogenous) GDP growth path with respect to (i) the real resources needed to sustain the growth path (focal variable: government consumption), (ii) the real resource demands from the private sector (focal variable: government consumption), (iii) the real resource demands from the government sector (focal variable: government domestic credit), (iv) the resource availability in domestic credit markets (focal variable: private domestic credit), and (v) the resource availability in foreign capital markets (focal variable: private net foreign debt).

The judgement of the appropriateness of the focal variable growth paths should be based on benchmark growth paths. In particular, it is important to understand the historical and potential future development of the focal variables in order to make a proper judgement. This includes time series evidence on the past development as well as knowledge of the needs and constraints on the future development of the focal variables. In the following, the historical development of the four focal variables will be discussed, to provide the foundation for future applications of the framework.



Focal Variable No. 1: Real Government Consumption

The first focal variable is real government consumption. As noted above, this variable provides a check on the consistency of the assumed (exogenous) GDP growth path with respect to (i) the real resources needed to sustain the growth path, and (ii) the real resource demands from the private sector and the rest of the world. Figure 23 presents the historical development of real government consumption. The figure indicates that real government consumption has increased almost continuously over the period 1995-2003. The only exception is 1999 where a structural break (in the form of a one-time level change) occurred.

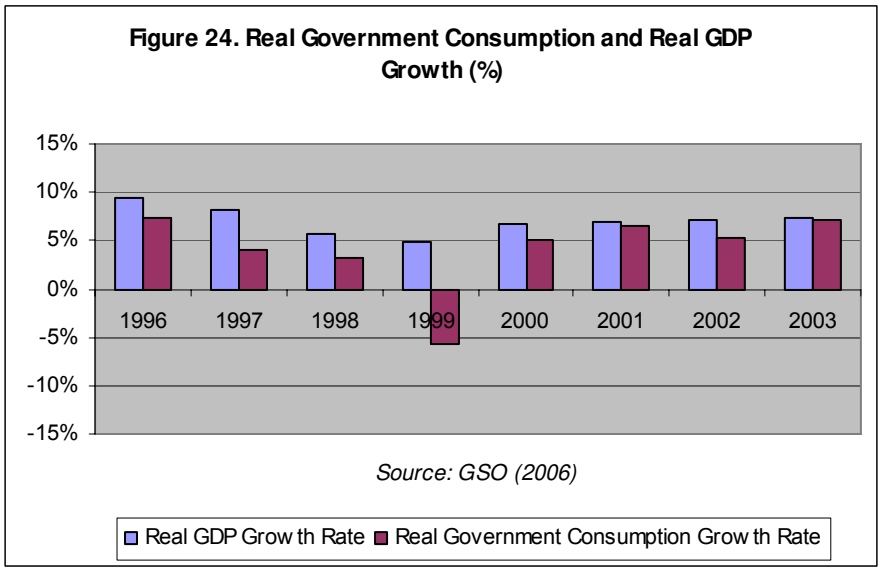
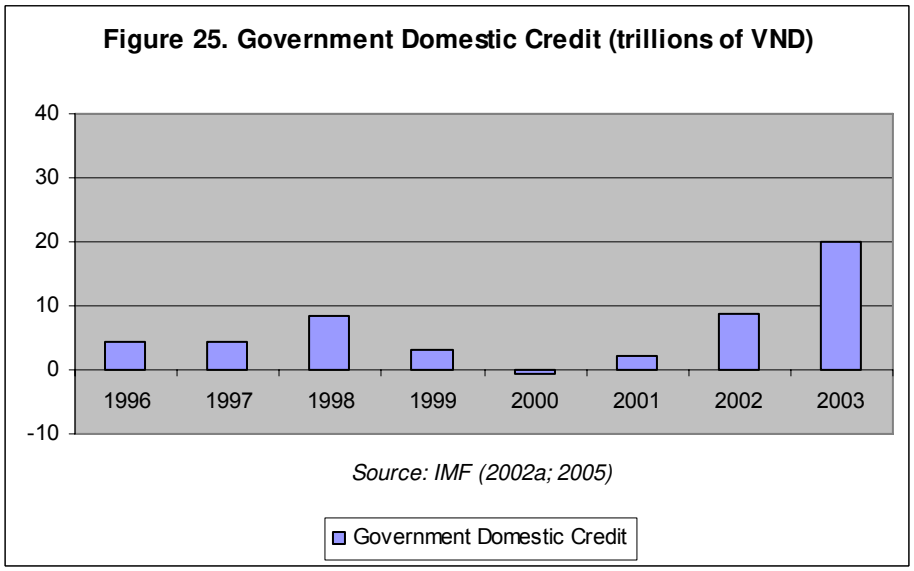


Figure 24 presents real government consumption and real GDP growth rates. The figure shows that there has been some degree of retrenchment of real government consumption prior to the year 2000. Accordingly, the gap between government consumption and GDP growth rates varied between 2-10 percent during 1996-1999. However, this gap has been reduced to 0-2 percent during the more recent period 2000-2003. In fact, real government consumption and real GDP grew respectively 7.2 percent and 7.3 percent during 2003. Accordingly, the historical evidence seems to suggest that the Vietnamese government has moved past the budget retrenchment of the 1990s, and is now pursuing a policy of balanced private and public sector growth. The evidence therefore suggests that the bench-mark growth path for the first focal variable (real government consumption) should mirror the (exogenous) growth path for real GDP.



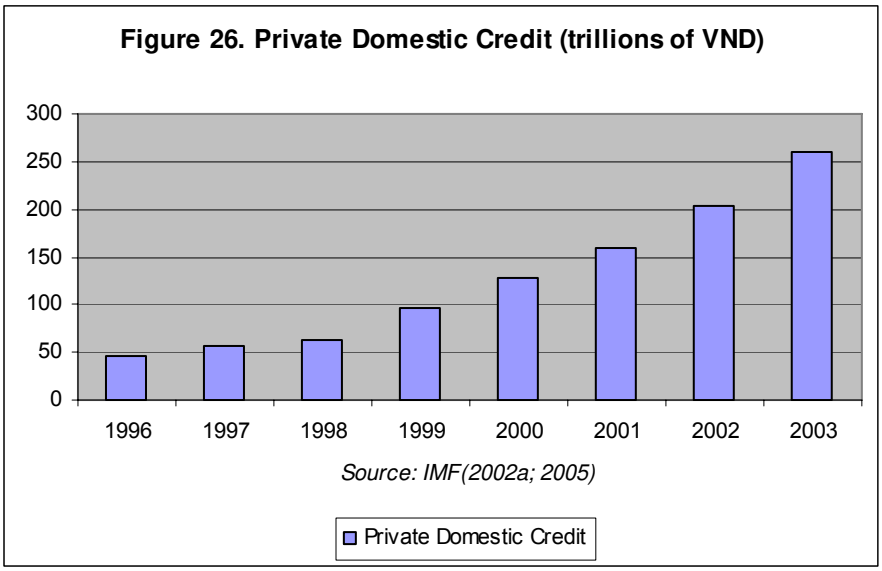
Focal Variable No. 2: Government Domestic Credit

The second focal variable is government domestic credit. As noted above, this variable provides a check on the consistency of the assumed (exogenous) GDP growth path with respect to (i) the real

resources needed to sustain the growth path, (ii) the real resource demands from the private sector and the rest of the world, and (iii) the real resource demands from the government sector. Accordingly, the evaluation of the growth path of government domestic credit supplements the evaluation based of the first focal variable (real government consumption). Furthermore, it allows for the additional evaluation of the implied government pull on monetary resources (rolling of the printing press) and the upward pressure that this exerts on domestic prices.

Figure 25 presents the historical development of the level of government domestic credit. The figure shows that government domestic credit taking has remained virtually non-existent until 2002. Recently, the government seems to have changed their behaviour and increased their recourse to monetary financing somewhat. Accordingly, the level of government domestic credit increased from 8.8 bio. VND to 20.1 bio. VND between 2002 and 2003. The recent increase in monetary financing may reflect that the Central Bank remains dependent on the legislative and executive bodies of the Vietnamese government. The current inflation targeting regime implies that it is the prerogative of the National Assembly to specify an inflation target, and the task of the State Bank of Vietnam to implement this target (Packard; 2005). Accordingly, the increase in monetary financing may reflect the fact that the Vietnamese government may not be willing to subordinate fiscal policy to the inflation targeting objective.

On the other hand, the recent increase in government domestic credit taking may also reflect the strong drop in the velocity of money circulation, which was observed in Figure 10. As noted above, the increase in money demand seems to reflect increasing credibility in the inflation targeting regime. The very strong drop in money velocity suggests that the government may have seen a (one-time) opportunity to obtain additional (non-inflationary) monetary financing during 2002-2003. The recourse to money financing does coincide with a slight increase in CPI inflation during these years, as can be observed from Figure 12. Nevertheless, the money velocity has continued to decline, implying that there may be additional opportunities for (non-inflationary) money financing beyond the year 2003. The historical evidence therefore suggests that (i) the government is intent on maintaining the credibility in their monetary policy (inflation targeting) regime, and (ii) the government may be willing to take advantage of opportunities for (non-inflationary) money financing. This suggests that the bench-mark growth path for the second focal variable (government domestic credit) should resemble a mean reverting process which may be allowed to deviate temporarily from e.g. 10 Trillion VND.



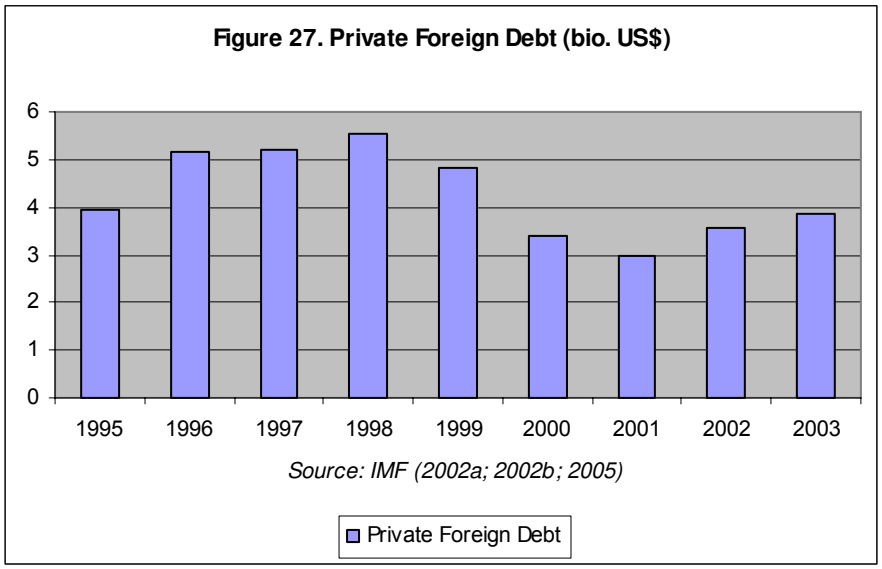
Focal Variable No. 3: Private Domestic Credit

The third focal variable is private domestic credit. As noted above, this variable provides a check on the consistency of the assumed (exogenous) GDP growth path with respect to (i) the real resources needed to sustain the growth path, (ii) the real resource demands from the private sector and the rest of the world, (iii) the real resource demands from the government sector, and (iv) the resource availability in domestic credit markets. Accordingly, the evaluation of the growth path of private domestic credit supplements the evaluation of the first and second focal variables, and allows for the additional evaluation of (the impact of the inflation targeting regime & the government pull on monetary resources on) the domestic credit availability for private sector financing purposes.

Figure 26 presents the historical development of the level of private domestic credit. The figure shows that private domestic credit taking has increased exponentially over the period 1996-2003. Growth rates have varied between 12 percent (1998) and 53 percent (1999), but have stabilized between 25-28 percent during the recent period 2001-2003. The stable growth of private sector credit expansion suggests that the recent gradual expansion of government domestic credit during 2002-2003, which can be seen from Figure 24, have had little impact on domestic credit availability for the private sector. This seems to support the notion that the recent expansion of government domestic credit reflects, that the government has taken advantage of a (one-time) opportunity for (non-inflationary and non-contractionary) monetary financing. It follows that private domestic credit taking is likely to make up the major source of money creation in the future as it has done in the past.

Nominal money demand growth rates has hovered between 18-26 percent during 2001-2003, resembling the growth rates of private domestic credit. However, nominal money demand growth is likely to slow down in the future due to a gradual stabilization of the money velocity (see discussion above). Moreover, foreign exchange reserve accumulation is likely to stabilize around the recently attained level of five months of imports (but see discussion above). In spite of the recent historical evidence, private domestic credit growth rates are therefore likely to decline somewhat from more recent levels (25-28 percent). With real GDP growth rates around 7-8 percent and GDP deflator growth rates around 5 percent, money demand and private domestic credit growth may therefore

decline to levels around 12-13 percent over the medium run (the level will also depend on whether foreign exchange reserve levels remain unchanged or starts to decline). This suggests that the bench-mark growth path for the third focal variable (private domestic credit) should resemble a decelerating exponential functional form.



Focal Variable No. 4: Private Net Foreign Debt

The fourth focal variable is private net foreign debt. As noted above, this variable provides a check on the consistency of the assumed (exogenous) GDP growth path with respect to (i) the real resources needed to sustain the growth path, (ii) the real resource demands from the private sector and the rest of the world, (iii) the real resource demands from the government sector, and (iv) the resource availability in foreign capital markets. Accordingly, the evaluation of the growth path of private net foreign debt supplements the evaluation of the first and second focal variables, and allows for the additional evaluation of (the impact of the import demand & trade balance deficit associated with the GDP growth path, on) the need for the private sector to access foreign capital markets.

Figure 27 presents evidence on the development of the private foreign debt stock. The time series data indicates that private foreign debt has been varying in a smooth fashion over the period 1995-2003. Accordingly, private foreign debt increased over the period 1995-98, declined over the period 1999-2001, and increased over the period 2002-2003. While private net foreign borrowing was positive over the most recent period 2002-2003, it was dwarfed by foreign direct investment inflows. Accordingly, Figure 21 shows that foreign direct investment has been the main source of private foreign capital inflows over the entire period 1995-2003, and that foreign direct investment inflows have been increasing since 2000. The historical evidence seems to indicate that foreign direct investment will continue to dominate private foreign borrowing over the coming years. Nevertheless, the strong inflow of foreign direct investment may indicate that the collateral value of large private companies have improved (see discussion above), and this may have increased the ability of private "foreign loan"-takers to access foreign capital markets. Accordingly, private companies may be able to access foreign loans on an increasing scale if need be. This suggests that

the bounds on the bench-mark growth path for the fourth focal variable (private net foreign debt) should be relatively wide, but the variable change (private net foreign borrowing) would be unlikely to exceed foreign direct investment inflows in any given year.

6. Conclusion

This paper has documented the development of the 2003 Merged Model for Vietnam, and outlined the scope for implementation and development of future medium term economic projections. The initialization of variables and calibration of parameters were outlined with reference to the underlying Vietnamese data set. The recursive solution structure of the Merged Model was discussed and the set of (intermediate target) focal variables were presented. Discussion (validation) of the calibrated parameter values were carried out on the basis of historical time series data, and implications for the expected future (medium term) development of model parameters were outlined. Similarly, discussion of the four focal variables was carried out on the basis of historical time series data, and expectations for the future development of the four focal variables (benchmark growth paths) were outlined. Altogether, the current documentation provides a comprehensive guide to the general structure of the Merged Model framework, and to the specific implementation of the Merged Model to develop medium-term economic projections in a Vietnamese context.

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Appendix A: The 2003 Vietnam Merged Model Equations

2003 Vietnam Merged Model			
Goods Market and Private Sector Budget			
$GDPS_{s,t}$	=	$(1+\gamma_{s,t})*GDPS_{s,t-1}$	(1)
GDP_t	=	$\Sigma_s GDP_{s,t}$	(2)
$XS_{s,t}$	=	$(1+\lambda_{s,,t})*XS_{s,t-1}$	(3)
X_t	=	$\Sigma_s XS_{s,t}$	(4)
IV_t	=	$k_{0,t}GDP_{t-1}+k_{1,t}\Delta GDP_t$	(5)
$\log(M_t)$	=	$m_{0,t}+m_{1,t}\log(GDP_t)+m_{2,t}\log(E_t*MPI_t/PD_t)$	(6)
C_t	=	CP_t+CG_t	(7)
IV_t	=	IVP_t+IVG_t	(8)
PD_t*CP_t	=	$(1-b_t)*GDY_t$	(9)
PD_t*GDP_t	=	$P_t*(C_t+IV_t) + E_t*(XPI_t*X_t-MPI_t*M_t))$	(10)
$PD_{2003}*GDP_t$	=	$P_{2003}*(C_t+IV_t) + E_{2003}*(XPI_{2003}*X_t-MPI_{12003}*M_t))$	(11)
GDY_t	=	$PD_t*GDP_t+E_t*NFP_t+E_t*NTRP_t+INDG_t+(GT_t-TG_t)-E_t*INFP_t$	(12)
GDS_t	=	$PD_t*GDP_t+E_t*(NFP_t-INFG_t-INFP_t)+E_t*(NTRP_t+NTRG_t)-P_t*C_t$	(13)
Government Budget			
BRG_t	=	$P_t*(CG_t+IVG_t)+(GT_t-TG_t)+ INDG_t +E_t*(INFG_t-NTRG_t)$	(14)
BRG_t	=	$E_t*\Delta NFDG_t+ \Delta NDDG_t+\Delta DCG_t$	(15)
$NFDG_t$	=	$g_t*XPI_t*X_t$	(16)
Money Market			
$GDPN_t$	=	PD_t*GDP_t	(17)
MD_t	=	$(1/v_t)*GDPN_t$	(18)
ΔMS_t	=	$\Delta(E_t*R_t)+\Delta DC_t$	(19)
ΔR_t	=	$d_t(MPI_t*M_t-MPI_{t-1}*M_{t-1})$	(20)
DC_t	=	DCG_t+DCP_t	(21)
MS_t	=	MD_t	(22)
Balance of Payments			
$RESBAL_t$	=	$(XPI_t*X_t-MPI_t*M_t)$	(23)
$NETFSY_t$	=	$NFP_t-INFG_t-INFP_t$	(24)
$CURBAL_t$	=	$RESBAL_t+NETFSY_t+NTRG_t+NTRP_t$	(25)
ΔR_t	=	$CURBAL_t +\Delta NFDG_t+\Delta NFDP_t+FDI_t$	(26)
Interest Payments			
$INDG_t$	=	$irdg_t* NDDG_{t-1}$	(27)
$INFG_t$	=	$irfg_t*NFDG_{t-1}$	(28)
$INFP_t$	=	$irfp_t*NFDP_{t-1}$	(29)

Appendix B: The 2003 Vietnam Merged Model Variables

2003 Vietnam Merged Model Variables

Endogenous Variables		Exogenous Variables	
Flow variables			
BRG	Government borrowing requirement	FDI	Foreign direct investment inflows (USD)
C	Aggregate real consumption	GT	Government domestic revenues
CG	Government real consumption	IVG	Government real investment
CP	Private real consumption	NFP	Net factor payments (USD)
CURBAL	Current account balance (USD)	NTRG	Government net foreign transfers from abroad (USD)
GDP	Real GDP	NTRP	Private net foreign transfers from abroad (USD)
GDPN	Nominal GDP	TG	Government transfers to the private sector
GDPS	Real sectoral GDP		
GDS	Gross domestic savings		
GDY	Private sector disposable income		
INDG	Government net domestic interest payments		
INFG	Government net foreign interest payments (USD)		
INFP	Private net foreign interest payments (USD)		
IV	Aggregate real investment		
IVP	Private real investment		
M	Real imports		
NETFSY	Net Factor Service Income (USD)		
RESBAL	Resource balance (USD)		
X	Real exports		
XS	Real sectoral exports		
Stock variables			
DC	Total domestic credit taking	NDDG	Government net domestic debt
DCG	Government domestic credit taking		
DCP	Private domestic credit taking		
MD	Money demand		
MS	Money supply		
NFDG	Government net foreign debt (USD)		
NFDP	Private net foreign debt (USD)		
R	Foreign exchange reserve holdings (USD)		
Price variables			
P	Absorption deflator	E	Exchange rate (VND/USD)
		MPI	World market price deflator for imports (USD)
		PD	GDP deflator
		XPI	World market price deflator for exports (USD)

Appendix C: The 2003 Vietnam Merged Model Parameters

2003 Vietnam Merged Model Parameters

Sectoral GDP	
γ_s	Sectoral GDP growth rates
Sectoral Exports	
λ_s	Sectoral export growth rates
Investment Demand	
k_0	Investment demand parameter with respect to lagged GDP
k_1	Investment demand parameter with respect to GDP growth
Import Demand	
m_0	Import demand level parameter
m_1	Import demand elasticity with respect to GDP
m_2	Import demand elasticity with respect to relative import prices
Private Consumption	
b	Average savings propensity
Interest Rates	
irdg	Government domestic interest rate
irfg	Government foreign interest rate
irfp	Private foreign interest rate
Government Foreign Debt	
g	Government net foreign debt-to-exports ratio
Money Demand	
v	Velocity of money circulation
Foreign Exchange Reserves	
d	incremental foreign exchange reserve-to-import growth ratio

Appendix D: Real SAM (labels)

Real SAM (Labels)										
	COM	PRV	STATE	GCAP	PCAP	ACAP	DFIN	FFIN	ROW	TOTAL
COM		Private Consumption	Government Consumption	Government Investment	Private Investment				Exports (c.i.f.)	(1)
PRV	Value Added at Market Price		Government Transfers				Government Domestic Interest Payments		Private Net Foreign Transfers + Net Factor Payments	(2)
STATE		Government Domestic Revenue							Government Net Foreign Transfers	(3)
GCAP			Government Savings			Government Borrowing Requirement				(4)
PCAP		Private Savings				Private Borrowing Requirement				(5)
ACAP									Current Account Deficit	(6)
DFIN			Government Domestic Interest Payments							(7)
FFIN		Private Foreign Interest Payments	Government Foreign Interest Payments							(8)
ROW	Imports (f.o.b.)							Total Foreign Interest Payments		(9)
TOTAL	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	

COM	Commodities account	GCAP	Govt. Capital account	DFIN	Domestic Financial account
PRV	Private Curent account	PCAP	Private Capital account	FFIN	Foreign Financial account
STATE	Govt. Current account	ACAP	Aggregate Capital account	ROW	Rest of World account

Appendix E: Financial SAM (labels)

Financial SAM (Labels)								
	DFIN	FFIN	FFDI	GFIN	PFIN	CAPGAIN	ACAP	TOTAL
DFIN					Money Supply Accumulation			(1)
FFIN	Foreign Exchange Reserve Accumulation						Current Account Deficit	(2)
FFDI		Foreign Direct Investment Inflow						(3)
GFIN	Government Domestic Credit Accumulation	Government Net Foreign Debt Accumulation			Government Net Domestic Debt Accumulation			(4)
PFIN	Private Domestic Credit Accumulation	Private Net Foreign Debt Accumulation	Foreign Direct Investment Inflow			Revaluation Gains on Forex Reserves		(5)
CAPGAIN	Revaluation Gains on Forex Reserves							(6)
ACAP				Government Borrowing Requirement	Private Borrowing Requirement			(7)
TOTAL	(1)	(2)	(3)	(4)	(5)	(6)	(7)	

DFIN	Domestic Financial account	GFIN	Govt. Financial account	ACAP	Aggregate Capital account
FFIN	Foreign Financial account	PFIN	Private Financial account		
FFDI	FDI account	CAPGAIN	Capital Gains account		

Appendix F: Real SAM (values)

Real SAM (Values)										
	COM	PRV	STATE	GCAP	PCAP	ACAP	DFIN	FFIN	ROW	TOTAL
COM		406,451	38,770	52,653	166,564				360,825	1,025,262
PRV	613,443		58,126				4,393		24,729	700,691
STATE		139,894							2,156	142,050
GCAP			38,492			14,160				52,653
PCAP		152,116				14,447				166,564
ACAP									28,608	28,608
DFIN			4,393							4,393
FFIN		2,231	2,268							4,499
ROW	411,819							4,499		416,318
TOTAL	1,025,262	700,691	142,050	52,653	166,564	28,608	4,393	4,499	416,318	

COM	Commodities account	GCAP	Govt. Capital account	DFIN	Domestic Financial account
PRV	Private Curent account	PCAP	Private Capital account	FFIN	Foreign Financial account
STATE	Govt. Current account	ACAP	Aggregate Capital account	ROW	Rest of World account

Appendix G: Financial SAM (values)

Financial SAM (Values)								
	DFIN	FFIN	FFDI	GFIN	PFIN	CAPGAIN	ACAP	TOTAL
DFIN					82,100			82,100
FFIN	12,140						28,608	40,747
FFDI		19,051						19,051
GFIN	11,300	6,494			-3,634			14,160
PFIN	56,800	15,202	19,051			1,860		92,914
CAPGAIN	1,860							1,860
ACAP				14,160	14,447			28,608
TOTAL	82,100	40,747	19,051	14,160	92,914	1,860	28,608	

DFIN	Domestic Financial account	GFIN	Govt. Financial account	ACAP	Aggregate Capital account
FFIN	Foreign Financial account	PFIN	Private Financial account		
FFDI	FDI account	CAPGAIN	Capital Gains account		

Appendix H: Auxiliary Data (values)

Auxiliary Data					
	2002	2003		2002	2003
AGDPshr		0.21	GDP	571,489	613,443
IGDPshr		0.38	GDPN	535,762	613,443
SGDPshr		0.40	GDY		
AXshr		0.22	GDS		
IXshr		0.57	RESBAL		
SXshr		0.21	NETFSY		
IRFG			CURBAL		
IRFP			NFP		
E	15.27	15.51	NTRG		
PD	0.94	1.00	NTRP		2,100
MPI	0.94	1.00	DCP	202,900	259,700
XPI	0.94	1.00	DCG	8,800	20,100
GT			DC	211,700	279,800
TG			INFG		144
CP			INFP		146
CG			MD	329,100	411,200
C			MS	329,100	411,200
IVP			NDDG	141,802	138,168
IVG			NFDG	9,585	10,004
IV			NFDP	2,500	3,480
X	20,965	23,258	R	7,687	8,470
M	22,590	26,545	BRG		