Modeling the Open Macro-Economy of Vietnam

Lord, Montague J.

ADB, Asian Development Bank

November 1998

Modeling the Open Macro-Economy of Viet Nam

Prepared by

Montague Lord and Staff Members
of the Foreign Exchange and
Economic Research Departments
The State Bank of Viet Nam

Under TA No. 2824-VIE
Asian Development Bank

November 1998

The Modeling Group

Direction: The macroeconomic model for Viet Nam has been prepared under the direction of Mr. Nguyen Doan Hung, Director of the Foreign Exchange Department, Mrs. Vu Phuong Lien, Deputy Director of the Foreign Exchange Department, and Mr. Nguyen Dinh Quang, Chief of Foreign Exchange Division, State Bank of Viet Nam.

SBV Modeling Group:

- Mr. Nguyen Van Anh, Deputy Chief, Exchange Rate Division of the Foreign Exchange Department.
- Ms. Nguyen Thi Hai An, Expert, Exchange Rate Division of the Foreign Exchange Department.
- Ms. Nguyen Huong Giang, Expert, Balance of Payment Division, Economic Research Department.
- Ms. Vu Nguyen Hoa, Expert, Monetary Policy Division, Economic Research Department.
- Mrs. Nguyen Thi Nhung, Expert, Exchange Rate Division of the Foreign Exchange Department.
- Mr. Nguyen Thanh Son, Expert, Exchange Rate Division of the Foreign Exchange Department.

PREFACE

The Asian Development Bank (ADB) has provided technical assistance to enhance the analytical capabilities of the State Bank of Viet Nam (SBV) in the areas of macroeconomic, balance of payments and exchange rate management policies. The principal channel through which the technical assistance has been implemented is through the staff of the SBV's Foreign Exchange Department and Research Department. The objective of the assistance is to provide a numerical model of Viet Nam's macro economy that examines the impact of alternative exchange rates on both the current and capital accounts of the balance of payments and provides for feedback effect between the external and domestic sectors of the macro economy.

The development of this modeling capabilities is intended to offer an easily applicable analytical framework that isolates the impact of alternative exchange rates and parameter assumptions. Close consultation with the technical staff of the Foreign Exchange Department and Research Department has ensured that the design and implementation of the model will prove to be useful to the State Bank. In conjunction with technical training sessions, the modeling process has offered an opportunity for the staff to consider areas of future expansion and disaggregation of the model.

As part of the design and implementation process, the present report aims to develop the linkages and feedback effects between changes in the balance of payments and the national income accounts. This modeling framework provides a mechanism to link policies and targets while, at the same time, providing an easy and adaptable means of both forecasting key variables and simulating the interrelationships between economic policy initiatives. As such, the system of equations provides a relatively parsimonious representation of Viet Nam’s economy that allows for considerable flexibility in its usage for forecasting and policy simulations

The nature of Viet Nam’s economic development process has motivated the design of a model that can grow and evolve with the economy. Initial work on the model began during the two-week period of 10-24 June 1998 with the intent of providing the staff of the SBV with the basic parameters of the current and capital accounts of the model and data requirements. In the subsequent four-week period of 12 October - 14 November 1998 the linkages between the balance of payments and the national income accounts were developed. In addition, considerable effort was made to provide for the disaggregation of Viet Nam's trade data by product and geographic origin and destination. This level of detail provided an opportunity to examine the impact of contraction in the Asian markets following the Asian economic crisis and its spread to other regions.

The present model was developed under a technical assistance project of the Asian Development Bank. It was designed and constructed at the State Bank under the direction of Mr. Nguyen Doan

Hung, Director of the Foreign Exchange Department, Mrs. Vu Phuong Lien, Deputy Director of the Foreign Exchange Department, and Mr. Nguyen Dinh Quang, Chief of Foreign Exchange Division, State Bank of Viet Nam.

The modeling group consisted of the following individuals:

1. Mr. Nguyen Van Anh, Deputy Chief, Exchange Rate Division of the Foreign Exchange Department;
2. Ms. Nguyen Thi Hai An, Expert; Exchange Rate Division of the Foreign Exchange Department;
3. Mr. Nguyen Thanh Son, Expert; Exchange Rate Division of the Foreign Exchange Department;
4. Mrs. Nguyen Thi Nhung, Expert, Exchange Rate Division of the Foreign Exchange Department;
5. Ms. Nguyen Huong Giang, Expert, Balance of Payment Division, Economic Research Department;
6. Ms. Vu Nguyen Hoa, Expert, Monetary Policy Division, Economic Research Department.

These staff members collaborated in all aspects of the design, estimation, and simulation of the model, and their collaboration greatly contributed to the successful development of the model.

CONTENTS

EXECUTIVE SUMMARY

The economic reform program instituted by the Government of Viet Nam has generated a need for an analytical framework to coordinate a broad set of macroeconomic and sector-specific policies required to sustain the country's transition to an open market economy. To assist in the design and analysis of those economic policies and improve the sequencing of those initiatives, the Asian Development Bank (ADB) has provided technical assistance for the development of macroeconomic modeling capabilities of the State Bank of Viet Nam (SBV). The design and implementation of the macroeconomic model for Viet Nam described in this report is an outcome of that project.

The present macroeconomic model provides real and financial sector forecasting and policy simulation capabilities under a fixed exchange rate system that is targeted to the needs of the monetary and fiscal sectors of Viet Nam. As such, it provides multisectoral simulation capabilities for analyzing the inter-relationships and feedback effects of policy-determined economic variables. The transition process of the economy has motivated the design of a model that provides for a parsimonious representation of the structure of the Viet Nam economy, one that exploits the increased availability of data for the system of national accounts, and one that recognizes time-variant parameters that can result from the transition process. The resulting model allows for considerable flexibility in its usage for forecasting, and in the selection of the policy mix and instruments for the targets of a program. In its present form, it provides a framework for making rational and consistent predictions about Viet Nam's overall economic activity, and the standard components of the production and expenditure concepts of the national accounts. It also offers a means of quantitatively evaluating the impact of monetary and fiscal policies on the economy, and assessing the feedback effects that changes in key macroeconomic variables of the economy produce in other sectors.

In its present form the model allows for considerable flexibility in its usage for forecasting, selection of the policy mix and instruments for the targets of a program, and the determination of the appropriate sequencing of policies. The conceptual approach to the present model is based on conventional economic theory, although the empirical specification of the conventional theory is not well established since there are numerous approaches to the specification, estimation and testing procedures in standard macro models. The model formulated in this study explicitly introduced into the system of equations the channels through which economic policies operate. The nature of the model therefore makes it tractable from an operational point of view, and it provides the basis for subsequent extensions of the real and financial sectors, and in both the domestic and external sectors of the economy.

I. INTRODUCTION AND BACKGROUND

1.1 Transformation of the Economy

Viet Nam is undergoing a comprehensive reform program aimed at transforming the economy from a centrally planned system to a market-oriented economy, while at the same time adjusting to the economic crisis that has swept Asia since the end of 1997. Reforms were introduced between 1988 and 1992 to facilitate the transition from a centrally planned to a market oriented economy, which helped to secure a strong macroeconomic performance.

Developments in the foreign sector have been particularly important for the economy since the combined value of exports and imports of goods and nonfactor services is nearly as large as all of Viet Nam's GDP. As a result, foreign exchange earnings impact strongly on the country's ability to import much-needed raw material and industrial products, as well as consumer goods. The Viet Nam government has sought economic partnerships both within and outside the Asian region, encouraged foreign investment, and initiating efforts to join the World Trade Organization (WTO). These efforts could provide a means by which the country can achieve higher growth and stability in its external sector if they are combined with reform policies that reduced regulatory and administrative constraints on trade and investment. While commercial policy has focused on the replacement of quantitative import measures with tariffs the elimination of export bans, quotas and taxes, and the gradual opening of trading activities to the private sector, there still remain high levels of import restrictions and export controls and domestic industries continue to benefit from substantial protection. Once Viet Nam becomes a member of the WTO, there are likely to be substantial changes in the responsiveness of importers and exporters to income and price changes in the economy.

1.2 Modeling the Transition Process

The major characteristics that need to be considered in the design and implementation of a macroeconomic model for Viet Nam concern the transformation of the economic and statistical systems in the country. The transition process accompanying such a transformation refers to the introduction of fundamental reforms in the socio-economic system which are changing the role of prices in the economy, altering institutional structures, developing the private sector, restructuring industries, creating an autonomous banking system, and establishing other financial markets.

Modeling these processes requires the explicit recognition of how the transmission mechanism affects development on the real and financial sides of the economy. One approach is to

incorporate uncertainty in the model and measure its effects on consumption and investment patterns. Another way is to include the propagation mechanism for the adjustment process on the cost side of the model, and use it to determine possible effects of incomes policies on price level increases and the rate of inflation. The inclusion of these transmission mechanisms is particularly important since there is general consensus that macroeconomic stabilization needs to be addressed early on in the reform process of economies in transition towards a market-oriented system (see, for example, Commander (1992), Corbo (1991), Fischer and Gelf (1990, 1991), and Roe (1991, 1992)).

Viet Nam's adoption of a fixed exchange rate system, while at the same time retaining controls over capital movements, has important implications for the policy instruments that are available to the government and the State Bank of Viet Nam (SBV). Capital controls are common to developing and transition economies, and they are usually combined with fixed exchange rate systems. In contrast, the industrial countries are more likely to have adopted a floating exchange rate system without restrictions on capital movements. While macroeconomic systems often avoid modeling capital controls, the explicit introduction of those controls in the present model changes the mechanism through which interest rate variations affect the economy. Modeling the mechanism through which monetary and fiscal policies affect consumption, investment, and the trade balance can help to ensure that policy instruments are correctly combined to achieve stability and growth targets for the Vietnamese economy.

The movement towards more flexible market-determined prices has also brought about fundamental changes in the way businesses and households respond to economic conditions. In modeling economic behavior, these changes imply a greater responsiveness of economic agents to changes in relative prices, and therefore possible parameter changes in the system of equations.[1] If parameter changes occur, then the use of time-invariant parameters can make the system of equations unstable. The alternative approach consists of the introduction of time-varying parameters that capture the transition process in the structure of the economic system. These types of parameters can introduce an element of subjectivity in the operation of the model, and a decision to adopt time-varying parameters therefore should be approached with caution.

Another manifestation of the transition process that needs to be considered in the model for Viet Nam concerns household and business adjustments to fundamental changes in operating procedures. The introduction of a value-added tax in early 1999, for example, can create assimilation difficulties for many enterprises, particularly in terms of product and service pricing. As Corbo, Coricelli and Bossak (1991) point out, these adjustment difficulties reflect the decades

[1] A parallel issue is that put forward under the Lucas (1976) critique of large-scale model that do not take into account changing expectations as policy rules change. Considerable progress has been made in addressing expectations variables that address Lucas' concerns, and the use of structural forward-looking models that take into account information updates by agents in their expectations generating equations. For an application of Hendry's (1988) distinction between forward-looking and backward-looking models, see Lord (1991).

of operation under institutions and incentives systems that were different from those found in market economies. It is therefore important that the analytical framework be developed in such a way as to reflect changes in fiscal measures associated with adjustment programs.

In addition to the development of basic fiscal institutions such as tax and budgetary systems, the introduction of new taxes, including value-added taxes and personal income taxes, are impacting the dynamic underlying the adjustment process of different components in the economy. The consequence of such adjustment difficulties, and their associated short-term costs, can be modeled through both the introduction of appropriate lag structures, and the inclusion of possible transient disturbance terms in particular sectors of the economy that account for obstructions to business activities resulting from the economic reform process.

The opening up of the economy and the ability to attract capital inflows, especially in the form of foreign direct investment, has been critical to Viet Nam's economy. Modeling the reform process in Viet Nam therefore requires that explicit consideration be given to ongoing changes in foreign markets and domestic institutions affecting trade. Consequently, the balance of payments component of the model needs be sufficiently disaggregated to permit the consideration of trade and exchange rate policies at a fairly detailed level. Moreover, as economic reforms take hold, cost and price competitiveness are becoming more strongly related to trade and investment flows, and the ability to measure the transmission effects of relative price changes on the domestic and external sectors is becoming increasingly important.

Initial developments of macroeconomic modeling of transition economies were often based on the use of a vector autoregressive (VAR) system. More recently, the use of theory-consistent structural models, particularly those based on dynamic time-series equations systems, has been found to forecast better for long horizons, expecially when the equations take the form of the error-correction mechanism (ECM).[2] As a result, a decision was made to develop a medium-size model for Viet Nam that would provide details as to the overall structure and operation of the economy, and which could be modified and expanded according to the needs of the SBV.

The present macroeconomic model aims to provide a theory-consistent representation of the general structure of the Viet Nam economy and, as such, it offers real and financial sector forecasting and policy simulation capabilities targeted to the needs of the SBV. The model serves a dual purpose. First, it provides a framework for making rational and consistent predictions about Viet Nam's overall economic activity, the standard components of the balance of payments, and the production and expenditure concepts of the national accounts. Secondly, it offers a means of quantitatively evaluating the impact of exchange rate policies and other policy changes on the Vietnamese economy, and assessing the feedback effects that changes in key macroeconomic variables of the economy produce in other sectors. These two objectives are, of course, closely

[2]See, for example, Banerjee, Dolado, Galbraith, and Hendry (1993), Chapter 11, and references therein.

related since the capacity to make successful predictions depends on the model's ability to capture the interrelationships between the real and financial sectors of the economy.

The modeling procedure has sought to account for the structure of the Viet Nam economy, the availability of data, and the degree of stability of time-series estimates of parameters during the country's transition process.[3] The nature of the transition process of the Viet Nam economy has motivated the design of a model that can grow and evolve with the economy. The present model therefore aims to provide a mechanism to link policies and targets while, at the same time, providing an easy and adaptable means of both forecasting key macroeconomic variables and simulating the interrelationships between economic policy initiatives. As such, the model provides a relatively parsimonious representation of the Vietnamese economy that allows for considerable flexibility in its usage for forecasting, selection of the policy mix and instruments for the targets of a program, and determination of the appropriate sequencing of policy changes.

1.3 Scope of the Study

This report is organized as follows:

- Chapter 1 provides a general introduction to the transition process in Viet Nam, monetary and fiscal management policies, and the motivation for the construction of the model.
- Chapter 2 expands on the data issues and the characterization of the Vietnamese economy.
- Chapter 3 describes the modeling framework for the real sectors of the economy.
- Chapter 4 describes the modeling framework for the financial sector of the economy.
- Chapter 5 describes the modeling framework for the balance of payments and the foreign exchange market.
- Chapter 6 examines the effectiveness, or lack thereof, of macroeconomic policy instruments.
- Chapter 7 describes the major blocks of the model and explains the system of equations as a whole.
- Chapter 8 describes the dynamic specification of the behavioral equations and shows how their long-run, or steady-state, solutions replicate the system of equations described in the earlier chapters.

[3] For a recent application of this type of model to Eastern European and Central Asian economies, see Lord (1994) and Lord et al. (1995).

- Chapter 9 presents the empirical estimates of the behavioral equations in the model.
- Chapter 10 describes the solution of the system of equations as a whole, and charts the effects of changes in some key policy variables on the economy.
- Chapter 11 provides a summary and sets forth some of the major conclusions.
- Annex lists the model specification in the EView program used to estimate and simulate the macroeconomic model.
- Statistical Appendix contains the data used in the construction of the model.
- References lists the citations in the study.

2. CHARACTERIZATION OF THE EGYPTIAN ECONOMY

The modeling procedure has sought to account for the structure of the Egyptian economy, the availability of data, and the degree of stability of time-series estimates of parameters during the country's transition process. The nature of the transition process has motivated the design of a model that can grow and evolve with the economy. The present form of the model therefore provides a relatively parsimonious representation of the Egyptian economy. This chapter highlights some of the major characteristics of the economy.

2.1 National Income Accounts and the Balance of Payments

The present model is based on data classified according to the UN national accounts system. The main aggregate, GDP, is calculated by sector of production origin and use, or by type of expenditures, utilizing the following accounting identity:

Production	=	***Expenditures***
Value added in:		Investment
Primary sector		+ Private consumption
+ Secondary sector		+ Government consumption
+ Tertiary sector		+ Balance of goods and nonfactor services
= GDP		= GDP

To arrive at overall GDP, the model derives solutions for expenditure concepts and uses those results to solve for the production levels. In that sense, the model is demand-driven. There are four major blocs: the national income accounts bloc, the monetary sector bloc, the fiscal sector bloc, and the balance of payments bloc. The national income accounts bloc contains a considerable amount of interrelationships between the endogenous variables in the system in order to capture feedback effects in the economy. The monetary sector bloc provides information about the interrelationships between the real and financial sectors. It also incorporates the relationship between changes in foreign exchange assets in the balance of payments and changes in the supply of money. The fiscal sector contains details of revenue, especially that based on international trade taxes, and it shows how the monetarization of the fiscal deficit affects both the real and financial sectors. The balance of payments bloc generates information about the major balance of payments components, especially trade of different commodity classifications, and it yields a solution for the balance of goods and non-factor services that is used in the national

income accounts, and the changes in net foreign assets that is used in the monetary sector bloc and international trade taxes affecting revenue in the fiscal sector bloc.

2.3 Trade

2.3.1 Trade Data Sources and Validation

Trade data have been derived from the United Nations' COMTRADE database for Egypt's exports and imports with all trading partners. The data used in the model are based on detailed information at the product level to permit both volume and value information to be obtained for all of Egypt's exports and imports. Data based on the 5-digit level of the Standard International Trade Classification (SITC), Revision 1, nomenclature were extracted for all of Egypt's trade in the period 1970-98. The results provided information on Egypt's exports by country of destination and its imports by country of origin.

The trade data were aggregated according to the specific interests of the GOE in measuring the revenue implications of trade liberalization and the effects of relative exchange rate changes on the country's balance of payments. Based on these considerations, export data were aggregated into the three major regional markets of Egypt:

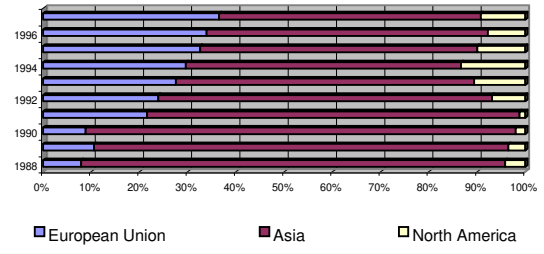
- The European Union
- North America, with separate market estimates for Canada and the United States.
- The Middle East

The geographic origin of imports is important to the determination of the revenue implications of trade liberalization, since Egypt has a number of preferential trade arrangements. In contrast, the geographic destination of exports is important to the determination of the balance of payments and economic growth effects of exchange rate policy reforms, since imperfect competition associated with the existence of product differentiation by Egypt's export markets gives Egypt some degree of market power in its export product markets. For this reason, trade data were compiled by geographic origin of imports and geographic destination of exports.

2.3.2 Structure of Trade

Egypt maintains strong links with both developing Asian and industrialized countries. Over 60 percent of exports are directed to the industrialized economies, and those markets provided nearly 30 percent of Egypt's total imports. Developing Asian countries provide over 50 percent of the country's imports, while those same countries absorb less than 20 percent

Figure 2.3
Geographic Distribution of Exports, 1988-97



of Egypt's exports (see Figure 2.3). Japan is by far Egypt's most export market, absorbing over one-fourth of Egypt's foreign shipments. Other leading markets are Germany, Singapore, France and Austria. On the import side, Singapore and Korea are leading suppliers of goods to the country, followed by Taiwan and Japan.

2.3.3 Foreign Direct Investment

Egypt's foreign direct investment (FDI) originates from a relatively few countries, many of which are from the Asian region. Figure 2.4 shows the 1997 composition of FDI by major investor. The 10 major foreign investment sources accounted for 87 percent of Egypt's total FDI.

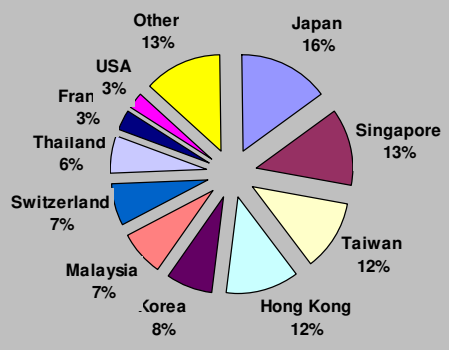
These data represent flows by external partners and external borrowings by domestic partners. The figures differ from those reported in the balance of payments, which excludes external borrowing by the domestic counterparts. Since the State Bank of Egypt is particularly interested in FDI by origin to assess the impact that changes in the real exchange rate might have on the actions of investor countries, the data on FDI flows by country of origin were used in the model. The sum of the results of the individual estimates for the major foreign investing countries were then applied to the FDI concept in the balance of payments.

2.4 The Monetary Sector

On the monetary policy side, the State Bank has progressively stabilized the exchange rate and reduced inflation. Monetary control has been facilitated with the introduction of bank-by-bank credit ceilings, improvements in the required reserve arrangements, and a reduction in the role of state bank refinancing credit. Domestic bank financing of the budget has been avoided and the rate of growth of credit to state enterprises has been curbed. Real interest rates on household deposits have been positive since the early 1990s.

The major monetary instruments are credit ceilings, reserve requirements, and refinancing facilities. The GOE uses to help achieve targets for the growth of monetary aggregates and credit. The ceilings initially were imposed only on the state-owned commercial banks, but later were extended to other banks. The required reserve ratio has been unified across institutions and types of deposit, and the refinancing rate has been unified since 1994. Treasury bills are auctioned and mostly bought by the state commercial banks.

Figure 2.3
Sources of FDI flows in Viet Nam, 1997



2.5 Characteristics of the Time Series Data

The first step in modeling the Egypt economy is to study the data generating processes of the key variables in the economy. The are two possible

approaches to estimating the behavioral relationships underlying the data generating process. The first approach consists of the utilization of annual data since the reforms introduced in the late 1980s; the second involves the utilization of quarterly data in the recent past to account for the structural changes in trade and those in the domestic economy. The selection criterion should be based on purely statistical grounds, independent of subjective preferences. As such, the use of descriptive statistics and tests can help to determine whether one data set is preferable to that of another.

Annual data are consistency with the level of periodicity of the national income and balance of payments accounts. In principle, one would expect that the long-term relationships between consumption and income, between investment and output, between imports of primary and intermediate products and output, between imports of final products and income would be cointergrated. Variables are said to be cointegrated if individually each is nonstationary but there exists a linear combination of the variables that is stationary. An error correction mechanism (ECM) can show how adjustments occur between variables to correct for short-term disequilibrium associated with the long-term equilibrium growth path of the variables.

In the market-oriented system of the Egyptian economy, changes in prices, interest rates and exchange rates are generally not expected to impact on the long-run equilibrium growth path of an economy. Instead, the economy usually has a transient response to changes in these variables, and it is appropriate to constrain their long-term effects to zero.[1] As such, it is important to differentiate between long-term equilibrium relationships of cointegrated variables, and the transient effects of changes in prices, interest rates, and exchange rates on the key macro variables in the present market-oriented economy.

Quarterly data can provide consistent information for the recent structure of the Egyptian economy, but the quality of the estimates for the national income and balance of payments accounts are poor since they are often derived from data of annual periodicity. Since data need to be invented in their conversion to higher frequencies, there is little, if any, relationships between that data and actual observations for prices, interest rates, and exchange rates. Movements in these variables are often policy-related, however, and it is therefore important to capture the effects of their changes on the real and financial sectors of the economy.

Table 2.3 presents some descriptive statistics of data series. The statistics on the first four moments (mean, standard deviation, skewness, excess kurtosis) refer to the change in the log of each variable since, if the variables are nonstationary, the statistics themselves will be nonstationary; moreover, the log change is an approximation of the percentage change, so that

[1]The intuitive explanation for limiting the effects of changes in prices, interest rates, and exchange rates on variables such as consumption and investment is that relative prices for goods cannot continue to deviate from one another since otherwise consumers will eventually purchase only the increasingly cheaper good; similarly, differences between the prices of the same good originating from different countries could not continue indefinitely without consumers eventually only purchasing the good from the country with the decreasing relative price for that product.

the minimum and maximums are the minimum and maximum percentage change of each variable, and the standard deviation is expressed as a percentage.

The statistics generally follow the pattern of similar ones for developing and transition economies (see for example, Engel and Meller, 1993). For the national income account components, the standard deviations ranges from a low of 6.3 percent for consumption to a high of 19.6 percent for imports. For the interest rate and the exchange rate, the standard deviations are much larger. All the variables have excess kurtosis, indicating that the distribution have fat tails, and implying that there is a large probability of wide fluctuations, compared with those that would be expected from changes in series having a normal distribution. The tests reject normality for these variables.

For series that tend to grow either positively or negatively over time, it is first necessary to examine whether or not the series are themselves stationary before proceeding to find the long-term equilibrium relationship of two or more economic variables. A brief intuitive description of stationarity and equilibrium relationships shows its importance to the macroeconomic data for Egypt.[2]

In theory, an economic relationship refers to a state where there is no inherent tendency to change. Such a relationship is, for example, described by the consumption function in the log linear form $c = \beta y$. In practice, however, an equilibrium relationship is seldom observed, so that measures of the observed relationship between c and y include both the equilibrium state and the discrepancy between the outcome and postulated equilibrium. The discrepancy, denoted d, cannot have a tendency to grow systematically over time, nor is there any systematic tendency for the discrepancy to diminish in a real economic system since short-term disturbances are a continuous occurrence. The discrepancy is therefore said to be stationary insofar as over a finite period of time it has a mean of zero.

Individual time series that are themselves stationary are statistically related to each other, regardless of whether there exists a true equilibrium relationship. Thus, before estimating the economic relationships in the model for Egypt, it is useful to determine whether the data generating process of each of the series is itself stationary. Since national account variables have a tendency to grow (positively or negatively) over time, the variables themselves cannot be stationary, but changes in those series might be stationary. Series that are integrated of the same order, however, are said to be cointegrated and to have a long-run equilibrium relationship.[3] For trending variables that are themselves non-stationary, but can be made stationary by being differenced exactly k times, then the linear combination of any two of those series will itself be stationary. It is therefore important to test the order of integration of the key series in the model.

[2]For details of stationarity processes and the specification of dynamic models for equilibrium relationships, see Banerjee, Dolado, Galbraith and Hendry (1993)

[3]A series is said to be integrated of order k, denoted I(k), if the series needs to be difference k times to form a stationary series. Thus, for example, a trending series that is I(1) needs to be differenced one time to achieve stationarity.

Tests for stationarity are derived from the regression of the changes in a variable against the lagged level of that variable. Consider the following simple levels regression:

$$y_t = a + by_{t-1} + d$$

where *a* and *b* are constants and *d* is an error term. If *y* is non-stationary, the *b* will be close to unity. By subtracting y_{t-1} from both sides, we obtain

$$\Delta y_t = a + (b-1)y_{t-1} + d$$

The disturbance term *d* now has a constant distribution and the t-statistic on y_{t-1} provides a means for testing non-stationarity. If the coefficient on y_{t-1} is less than the absolute value of 1, then *b* must be less than 1, and *y* is therefore stationary. The Augmented Dickey-Fuller test is a test on the t-statistic of the coefficient on y_{t-1}.

The second test for non-stationarity is the Durbin-Watson (DW) test on the levels regression specified above. Since the DW statistically is given by

$$DW = 2(1-r)$$

where *r* is the correlation coefficient between y_t and y_{t-1}, then *y* is white noise when *r* is zero. The DW is therefore 2 when *y* is stationary.

In practice, when only a one-period lag of the dependent variable is included in the regression, then a Dickey-Fuller (DF) test is performed to determine whether the series is stationary. When first difference terms are included in the regression, then an Augmented Dickey-Fuller (ADF) test is performed. The number of lagged first difference terms to include in the regression should be sufficient to remove any serial correlation in the residuals, in which case the DW statistic should approximate 2.

A constant and trend variable should be included if the series exhibits a trend and non-zero mean in the descriptive statistics. Alternatively, if the series does not exhibit any trend but has a non-zero mean, only a constant should be included in the test regression. Finally, if the series appears to fluctuate around a zero mean, neither a constant nor a trend should be included in the test regression.

Initially the test is performed on the levels form of the regression. If the test fails to reject the test in levels then a first difference test regression should be performed. If the test fails to reject the test in levels but rejects the test in first differences, then the series is of integrated order one I(1). If, on the other hand, the test fails to reject the test in levels and first differences but rejects the test in second differences, then the series is of integrated order two I(2).

For Egypt's real GDP, for example, the following statistics are reported for the second difference of its log level:

ADF Test Statistic	-14.38
The critical values for rejection of hypothesis of non-stationarity are as follows:	
1% Critical Value*	-6.67
5% Critical Value	-4.58
10% Critical Value	-3.74

The test therefore failed to reject the test in levels and first differences but rejects the the test in second differences, which indicated that the series is of integrated order I(2). In this case, the series exhibited a trend and non-zero mean so both a constant and trend variable were included in the test regression.

The results of the Augmented Dickey-Fuller test and the Durbin-Watson test are presented in the bottom of Table 2.3. As expected, the tests all fail to establish stationarity of the log levels and indicate that all the log levels are integrated processes. In particular, investment, consumption, exports and imports, and gross domestic product are all of integrated order 2, while prices, interest rates and exchange rates are of integrated order 1.

Table 2.3
Descriptive Statistics of Some Key Macroeconomic Variables
(Calculated for percentage changes in real value data of annual periodicity)

	GDP	Invest-ment	Consum-ption	Exports	Imports	GDP Deflator	Interest Rate	Real Exchange Rate
Mean	7.2	12.5	5.1	17.8	21.7	23.2	-17.1	30.5
Median	8.9	12.2	5.6	22.8	16.2	14.3	-12.7	-6.7
Maximum	9.8	34.5	15.7	32.5	53.6	82.6	216.7	323.5
Minimum	-2.5	-24.0	-3.5	-1.5	-2.2	3.5	-146.4	-14.5
Std. Dev.	4.1	16.0	6.3	15.9	19.6	27.1	111.9	110.1
Skewness	-1.7	-1.2	0.2	-0.3	0.5	1.3	0.9	2.5
Kurtosis	4.4	4.4	2.1	1.3	1.8	3.2	3.1	7.1
Order of Integration *	I(2)	I(2)	I(2)	I(2)	I(2)	I(1)	I(1)	I(1)
Augmented Dickey-Fuller (ADF) Test:								
ADF t-statistic	-14.38	-2.31	-5.03	-4.65	-2.07	5.64	-9.08	-6.89
Critical value **	1%=-6.67	5%=-2.01	1%=3.36	5%=-3.74	5%=-2.00	5%=-4.35	1%=6.76	1%=6.67
Durbin-Watson Statistic	1.77	1.75	1.49	2.49	1.67	2.56	2.13	1.98

Note: The sample period is 1988-97
* Order of integration on log levels of corresponding variables.
** MacKinnon critical values. A negative D-F t-statistic that is larger (in absolute terms) than the critical value allows rejection of the hypothesis of a unit root and suggests that the series is stationary.

3. MODELING THE OUTPUT MARKET

3.1 Overview

The present model represents an application of the conventional Mundell-Fleming model using the IS-LM framework to the Vietnamese economy and, as a policy-oriented system, it incorporates key parameters for the formulation of economic policies. At the onset, the model is designed as a parsimonious representation of the underlying data generating system for key behavior relationships. A similar approach is adopted by the IMF staff's macroeconomic model-building applications and is used in IMF-sponsored adjustment programs, except that the underlying structure of those models are related to the monetary approach to the balance of payments (Frenkel and Johnson, 1976).[1] The conceptual approach of the present model is instead based on conventional economic theory as described in standard textbooks such as Obstfeld and Rogoff (1997), Farmer (1998), Hall and Taylor (1997), Mankiw (1997), Barro (1997), and Sachs and Larrain (1993).

The empirical specification of the conventional theory, however, is not well established since there are numerous approaches to the specification, estimation and testing procedures in standard macro models. Moreover, no one theory or dynamic specification can provide a complete description of the Vietnamese economy. What is essential is that key features of the economic and financial process be represented in the system used to characterize the economy. The resulting system can therefore be viewed as an interpretation of the process by which real and financial transactions in the economy take place, and the way in which economic policies operate to affect those transactions.

3.2 Output Determination

To simplify the exposition that follows, Box 1 summarizes the notations used in the model.

3.2.1 Aggregate Demand

In an open economy, aggregate demand, *Y*, is the sum of domestic absorption, *A*, and the trade balance, *B*:

$$Y_t = A_t + B_t \tag{3.1}$$

[1] A description of the monetary approach to the balance of payments can be found in Frenkel and Mussa (1985); and Krugman and Obstfeld (1997). For a prototype IMF monetary model of the IMF, see Khan and Montiel (1989); for a sampling of IMF macro models, see Khan, Montiel and Haque (1991).

Box 1
Notations in the Model

A	=	real domestic absorption
B^b	=	overall balance of payments
B^c	=	current account balance
B^k	=	capital account balance
B^t	=	trade balance
C	=	real private consumption expenditure
D	=	domestic credit from the monetary sector
D^p	=	domestic credit from the monetary sector to the private sector
D^g	=	domestic credit from the monetary sector to the public sector
D^{gs}	=	domestic credit from the monetary sector to the state government
D^{gr}	=	domestic credit from the monetary sector to the rest of the government
e^n	=	nominal exchange rate
e^r	=	real exchange rate
F	=	external debt of public sector, denominated in foreign currencies
G	=	real government expenditure
G^s	=	real state government expenditures
G^r	=	real rest of government expenditures
H	=	nominal debt of State Government
I	=	real gross domestic investment expenditure
i	=	nominal interest rate
i^f	=	nominal interest rate prevailing in world market
K	=	stocks
M	=	broad money
N	=	real non-tax revenue of public sector
P	=	domestic price level
P^f	=	foreign currency price of goods purchased abroad
r	=	real interest rate
R	=	net foreign assets
R^b	=	net foreign assets of commercial banks
R^c	=	net foreign assets of SBV
R^g	=	net foreign assets of government
R^p	=	net foreign assets of private sector
T	=	taxes
V	=	velocity of money
X	=	real exports
Y	=	real aggregate demand
Y^a	=	real output of primary sector
Y^b	=	real output of secondary sector
Y^c	=	real output of tertiary sector
Y^d	=	real net household income
Y^f	=	real foreign market income
Z	=	real imports

Domestic absorption measures total spending by domestic residents and public and private entities. It is composed of total private consumption, investment, and government expenditures:

$$A_t = C_t + I_t + G_t \tag{3.2}$$

where *C* is real private consumption expenditure, *I* represents real gross domestic investment expenditures, and *G* is real government expenditures.

The trade balance measures the net spending by foreigners on domestic goods. It is defined as:

$$B_t = X_t - Z_t \tag{3.3}$$

where *X* denotes real exports, and *Z* represents real imports. As with domestic absorption, the trade balance is defined in real terms.

3.2.2 The Output Market

A useful analytical tool for examining the effects of policy initiatives or shocks on the economy is the IS-LM curves. These curves provide a framework within which to show the equilibrium output solution of the Vietnamese economy under different predetermined variables, including those representing policy instruments.

There are four steps to the derivation of the IS curve. The first consists of the determination of the long-run, or steady-state, equilibrium solutions of the individual behavior relationships. The second involves the addition of the government's budget constraint to the system of equations. The third consists of the derivation of the reduced-form equation relating output to the predetermined variables in the economy. The final step consists of the determination of the relationship between interest rates and output to find the slope of the IS curve.

The steady state solution of a variable is a timeless concept. Thus for any variable $Y_t = Y = Y_{t-1}$. Similarly, $\Delta Y_t = \Delta Y = \Delta Y_{t-1}$ is the rate of growth. In what follows, we present the steady-state solution for the behavioral equations that make up the system of equations in the model:

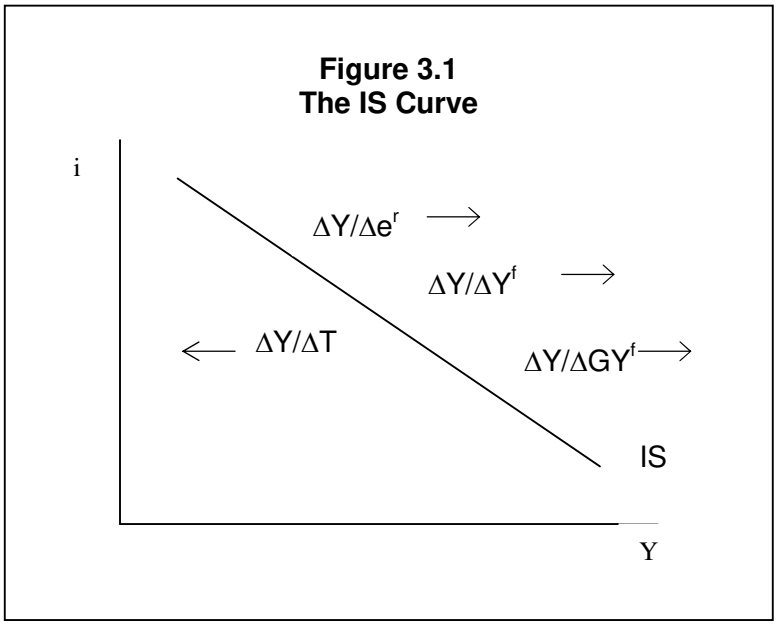
Private Consumption is positively related to income and negatively related to interest rates.

$$C = k_1 + \beta_{11}Y + \beta_{12}r \tag{3.4}$$

The coefficient β_{11} is the *marginal propensity to consume out of current income (MPC).*

Investment is positively related to income and negatively related to interest rates.

$$I = k_2 + \beta_{21}Y + \beta_{22}r \tag{3.5}$$



The coefficient β_{21} is the *marginal propensity to invest out of current income (MPI).*

Exports are positively related to foreign market income and positively related to the real exchange rate.

$$X = k_4 + \beta_{41} Y^f + \beta_{42} e^r \tag{3.6}$$

The coefficient β_{41} is the *marginal propensity to export out of foreign market income (MPX).*

Imports are positively related to domestic income and negatively related to the real exchange rate.

$$Z_t = k_5 + \beta_{51} Y + \beta_{52} e^r \tag{3.7}$$

The coefficient β_{51} is the *marginal propensity to import out of domestic income (MPM).*

In equations (3.6) and (3.7) the real exchange rate is defined as $e^r = e^n P^f / P^d$, where e^n is the nominal exchange rate, P^f is the foreign currency price of goods purchased abroad, and P^d is the domestic price level. Variations in e^r influence the quantity of Viet Nam's goods demanded by foreign markets relative to competing foreign and domestic suppliers to those markets.

3.3 Aggregate Demand and the IS Curve

The total demand for a country's output, expressed in terms of its individual components, is derived from the aggregate demand identity in equation (3.1) and the domestic absorption and trade balance identities in equations (3.2) and (3.3):

$$Y = C + I + G + X - Z \tag{3.8}$$

Substitution of the steady-state solutions of the individual relationships in equations (3.4) through (3.7) into the absorption and trade balance components yields the aggregate demand relationship in its explicit function form:

$$Y = \theta_o + \theta_1 r + \theta_2 e^r + \theta_3 G + \theta_4 Y^f \tag{3.9}$$

where $\theta_1 < 0$, $\theta_2 > 0$, $\theta_3 > 0$, $\theta_4 > 0$. Aggregate demand is therefore negatively related to the real interest rate, and positively related to the real exchange rate, government expenditures, and foreign market income.

The total effects of a change in interest rates, government expenditures, the real exchange rate, and foreign income are given by the corresponding coefficients of these variables in equation (3.9). An increase in foreign income, Y^f, for example, causes aggregate domestic income, Y, to increase by an amount that is always greater than the original increase in foreign economic activity. The increase in foreign income initially increases exports, which expands domestic aggregate income. The expansion then increases consumption and investment, though there is also some leakage from the accompanying increase in imports. That expansion then leads to a further increase in consumption and investment, thereby leading to a new round of aggregate income increases, until the full impact of the increase in foreign income has been completed. Hence, a unit increase in foreign income always leads to a more than proportional increase in aggregate domestic income. Similar multiplier effects occur with change in interest rates, government expenditures, and the real exchange rate. In each case, the final effect on aggregate demand is more than proportional to the change in these variables.

The effect of a change in the real exchange rate on aggregate demand, however, is less clearly defined. For a relatively small country like Viet Nam, the law of one price will ensure that the demand curve for traded goods is perfectly elastic, so that a devaluation will shift the export demand curve in proportion to the devaluation if there is underutilization of capacity. There is a large literature on possible contractionary effects of a devaluation of output (for a survey, see Lizondo and Montiel, 1989). The theoretical reasons for contractionary devaluations have been summarized by Edwards (1991: 311-330). They arise from the effects that a devaluation can have through either price rises that cause a negative real balance effect, the redistribution of demand from a sector having a low marginal propensity to save to one with a high one, a low price elasticities of demand for exports and imports, or supply-side rigidities.

The IS (investment-savings) curve relates the level of output of a country like Viet Nam to its real interest rate. The IS curve is obtained from the relationship between the level of aggregate demand and the level of the interest rate in equation (3.9):

$$\Delta r/\Delta Y = 1/\theta_1 < 0 \tag{3.10}$$

The curve relating the level of aggregate demand to the level of interest rates is therefore downward sloping.

Shifts in the IS curve result from changes the real exchange rate, government expenditures, and foreign income. An increase in the real exchange rate causes both foreign and domestic residents to shift their consumption to relatively less expensive Viet Nam goods, causing aggregate demand to rise and the IS curve shifts to the right for the given level of interest rates. The amount by which the curve shifts is $\Delta Y/\Delta e^r = \theta_2 > 0$. A similar rightward shift in the IS curve occurs when there is an increase in foreign market income, and the amount by which aggregate demand increases equals $\Delta Y/\Delta Y^f = \theta_4 > 0$. For government expenditures, the increase in aggregate demand equals $\Delta Y/\Delta G = \theta_3 > 0$. These shifts are demonstrated in Figure 3.1. If we were to include taxes, an increase in taxes would reduce disposable income, thereby lowering consumption and shifting the IS curve to the left for the given level of interest rates. The amount of the shift would be given by $\Delta Y/\Delta T = \theta_5 < 0$.

3.4 Aggregate Supply

Having determined aggregate demand, we need to find aggregate supply to determine the output of the economy. Aggregate supply is given by the value added by each sector. The value added of all industries in a sector is the sum of the difference between their total revenue and the cost of their purchases from other industries or firms. In the present model, the output levels of both the secondary and tertiary sectors are endogenous, while the primary sector is predetermined.

The output of the secondary sector is a positive function of aggregate investment, *I*, and the real exchange rate:

$$Y^b_t = \alpha_{60} + \alpha_{61}I_t + \alpha_{62}e^r_t + \mu_6 \tag{3.11}$$

The expected signs are $\alpha_{61} > 0$ and $\alpha_{62} > 0$. Similarly, the output of the tertiary sector is a positive function of aggregate investment, *C*, and the real exchange rate:

$$Y^c_t = \alpha_{63} + \alpha_{64}C_t + \alpha_{65}e^r_t + \mu_6 \tag{3.12}$$

The expected signs are $\alpha_{64} > 0$ and $\alpha_{65} > 0$. Similarly, the output of the tertiary

The output level of primary sector is determined by the economy's overall expenditure level and the activity of the other two sectors.

4. Modeling the Money Market

4.1 The Supply and Demand for Money

The banking system of Viet Nam is composed of the State Bank of Viet Nam as the central bank and a commercial banking system that is dominated by state banks. The State Bank of Viet Nam controls the monetary base, or supply of currency in circulation and commercial bank reserves, through a set of policy instruments that are gradually evolving in importance. The current limitations on international movements of capital means that the growth of the money supply is closely related to the domestic component of the stock of money. In general, the domestic money stock is made up of net foreign assets of the consolidated banking system, plus bank credit to the public and private sector. Thus, control over capital movements has allowed the SBV to focus on the domestic stock of money component.

In general, money is classified into the following categories:

- *High-powered money* is made up of currency in circulation plus cash reserves of commercial banks in the SBV.
- *M1 money* consists of liquid assets that include currency, demand deposits, traveler's checks, and other types of deposits against which checks can be drawn.
- *M2 money*, or *broad money*, is composed of M1 plus *quasi money* such as savings deposits and money market deposits.

4.1.1. The Supply of Money

The supply of money, M, is composed of dong and foreign currency liquidity. The level of this liquidity equals M2, denoted M_2, and is composed of (a) net domestic assets, denoted D, and net foreign assets, denoted R (in domestic currency terms). Hence:

$$M_t = e^n_t R_t + D_t \tag{4.1}$$

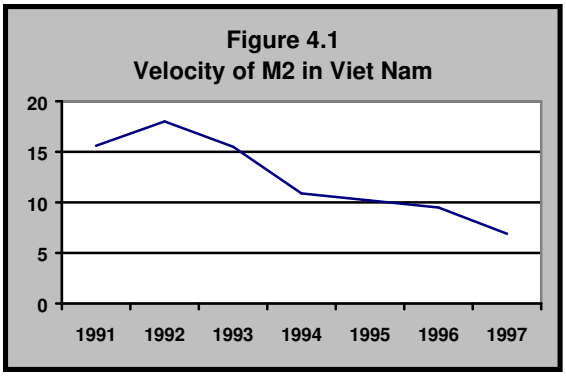
where total domestic credit is given by:

$$D_t = D^p_t + D^g_t \tag{4.2}$$

and net foreign assets is made up of net foreign assets of the SBV, denoted R^c, net foreign assets of commercial banks, denoted R^b, net foreign assets of the private sector, denoted R^p, and net foreign assets of the government, denoted R^g:

$$R_t = R^c_t + R^b_t + R^p_t + R^g_t \quad (4.2)$$

The *velocity of money* defines the number of times that the each unit of money circulates in the economy each year. For M2 money, the velocity of money, denoted V_2, is defined as:



$$V_2 = YP / M_2 \quad (4.3)$$

If V_2 is relatively constant and real output, Y, is determined by other factors, then the supply of money, M, should grow in a fixed proportion to Y to keep prices, P, stable, since equation (4.3) implies that P = MV/Y. These circumstances generally describe the monetarist doctrine, under which a stable growth of M precludes the use of a proactive monetary policy. In Viet Nam, however, V_2 has not remained constant and under appropriate conditions, monetary policy can play an important role in the economy.

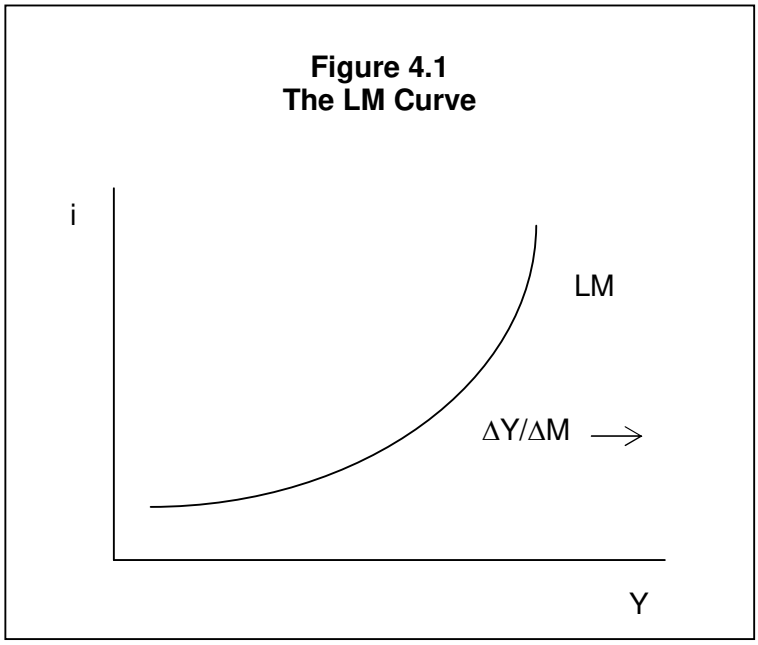
4.1.2. The Demand for Money

The conventional approach to the demand for money derives from the Baumol-Tobin model (for details, see Obstfeld and Rogoff, 1997; Farmer, 1998; Hall and Taylor, 1997; Mankiw, 1997; Barro, 1997; and Sachs and Larrain, 1993). It defines the demand for money in an analogous way as the demand for stocks by companies. Money, like stocks, is held by individuals and firms to ensure that they have the necessary liquidity to pay for goods and services. Thus as income expands, the demand for money increases; as income contracts, money demand decreases.

There is, however, an opportunity cost associated with holding money, associated with foregone earnings from holding interest-bearing financial asset such as bonds. The desire to hold money is therefore negatively related to the interest rate. As interest rates rise, the opportunity cost of holding money increases and the demand for money expands; as interest rates fall, the demand for money contracts due to the lower opportunity cost incurred from holding money. The aforementioned relationships between the demand for money and both income and interest rate are specified in real terms, since the demand for money is generally considered to be absent of any money illusion. Variations in prices therefore lead to proportional changes in nominal income, interest rates, and money demand.

The demand for money, M, is therefore defined in terms of real balances, M/P, and it relates the demand for those balances to the real rate of interest, r, and the level of income, Y:

$$M/P = k_{70} + \beta_{71} r + \beta_{72} Y \quad (4.6)$$



The coefficient β_{71} is used to measure the interest elasticity of money demand, and the coefficient β_{72} serves to measure the real-income elasticity of money demand.

4.2 Derivation of the LM Curve

The LM curve relates the level of aggregate demand to the interest rate for a given level of real money balances. Thus, at each point in the curve, the aggregate demand associated with a given interest rate is consistent with money market equilibrium.

The LM curve is found from the steady-state equilibrium solution of equation (4.1) and equation (4.6) in terms of interest rate:

$$r = \kappa_0 - \kappa_1 Y + \kappa_2(e^n R + D)/P \tag{4.7}$$

where $\kappa_0 = k'_7$, $\kappa_1 = (\beta_{72}/\beta_{71})$, and $\kappa_2 = (1/\beta_{71})$.

The slope of the LM curve is given by:

$$\Delta r/\Delta Y = - \kappa_1 \tag{4.8}$$

Since $\kappa_1 = \beta_{72}/\beta_{71}$, and $\beta_{71} < 0$ and $\beta_{72} > 0$, the slope of the LM curve is positive. A higher interest rate lowers the demand for money and a higher aggregate demand increases the demand for money. Hence, for a given real money balance, *M/P*, money demand can only be equal to the given money supply if an increase in interest rates is matched by an increase in aggregate demand.

Increases in the money supply, say from an increase in net foreign assets, *R*, shifts the LM curve to the right. When the money supply expands, it creates an excess supply of money at the prevailing interest rate and level of output. The excess supply causes households to convert their money to bonds and other securities, which drives down the interest rate. The lower interest rate, in turn, increases investment and leads to an overall expansion in aggregate demand. This effect is shown in Figure 4.1.

4.3 Monetization of the Fiscal Deficit

The fiscal deficit associated with the government's current revenue and expenditures is critical to the level of inflation in Viet Nam since deficit financing generally leads to an increase in the supply of money. The fiscal deficit, or the change in the government's debt, is the difference between the government's current expenditures and revenue. Government expenditures consist of nominal expenditures on domestic goods, *PG*, interest payments on domestic debt, $i_t\ D^g_{t-1}$, and interest payments on foreign debt, $i_t\ F_{t-1}$. The government revenues derive from tax receipts (in nominal terms), PT, and income from capital and other sources (in nominal terms), PN. The difference between revenue and expenditures represents the change in government debt:

$$\Delta D^g_t = PG + i_t\ D^g_{t-1} + i_t\ F_{t-1} - PT - PN \tag{4.9}$$

The change in the government debt can be financed through an increase in the money supply, ΔM_t, a decrease in foreign exchange reserves, $e^n_t \Delta R_t$, an increase in the amount borrowed from the private sector, ΔD^p_t, or an increase in the amount transferred from extra-budgetary funds, ΔD^{gr}_t. These sources of deficit financing can be derived from the money supply equation (4.1) and equation (4.3):

$$\Delta D^g_t = \Delta M_t - e^n_t \Delta R_t - \Delta D^p_t - \Delta D^{gr}_t \tag{4.10}$$

The government budget relates the sources of the deficit in equation (4.9) to the financing of the deficit in equation (4.10):

$$PG + i_t\ D^g_{t-1} + i_t\ F^g_{t-1} - PT - PN = \Delta M_t - e^n_t \Delta R_t - \Delta D^p_t - \Delta D^{gr}_t \tag{4.11}$$

The *budget constraint* in equation (4.11) states that the government can finance its deficit by increasing the money supply, borrowing from the public sector, or reducing its foreign exchange holdings.

5. MODELING THE FOREIGN EXCHANGE MARKET

5.1 Balance of Payments Equilibrium

Over equilibrium in the balance of payments is the sum of trade balance, *B*, and the balance in the capital account, *K*:

$$B^b_t = B_t + K_t \tag{5.1}$$

The capital account is determined by the interest rate in Viet Nam relative and foreign and domestic income. Using equation (3.6) for exports and equation (3.7) for imports in the trade balance component, we can specify the relationship for the balance of payments as follows:

$$B^b_t = k_8 + \beta_{81} Y^f_t + \beta_{82} Y_t + \beta_{83} e^r_t + \beta_{84} r_t \tag{5.2}$$

The FE curve relates the level of domestic aggregate demand, *Y*, to the interest rate, *r*, for a given level of the exchange rate, e^r, and foreign aggregate demand, Y^f. Thus, at each point in the curve, the aggregate demand associated with a given interest rate is consistent with equilibrium in the balance of payments such that $B^b = 0$. Hence, the FE curve is found from the steady-state equilibrium solution of equation (5.2) in terms of interest rate:

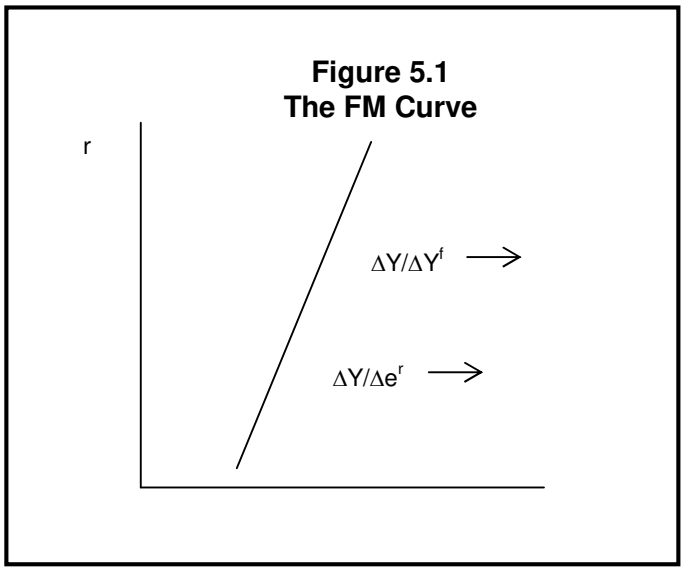
$$r = \omega_0 + \omega_1 Y + \omega_2 Y^f + \omega_3 e^r \tag{5.3}$$

where $\omega_1 = -(\beta_{82}/\beta_{84})$, $\omega_2 = -(\beta_{81}/\beta_{84})$ and $\omega_3 = -(\beta_{83}/\beta_{84})$.

The slope of the FE curve is given by:

$$\Delta r/\Delta Y = \omega_2 \tag{5.4}$$

Since $\omega_2 = -\beta_{81}/\beta_{84}$, and $\beta_{81} > 0$ and $\beta_{84} < 0$, the slope of the FM curve is positive. When capital is highly immobile, the curve is vertical. Shifts in the FM curve result from changes in the real exchange rate and foreign income. A devaluation of the real exchange rate causes the curve to shift to the right. The amount by which the curve shifts is $\Delta Y/\Delta e^r = \omega_3 > 0$. A rightward shift in the FM curve also occurs when there is an increase in foreign market income, and the amount by which aggregate demand increases equals $\Delta Y/\Delta Y^f = \omega_2 > 0$. These effects are shown in Figure 5.1.



5.2 The Balance of Payments and Money Market Equilibrium

The link between money and the balance of payments is through the change in foreign exchange reserves, ΔR. The balance on the current account can run down foreign exchange reserves in a deficit, or it can increase them with a surplus. Hence, the relationship between the current account, B^c, and the change in foreign exchange reserves, ΔR_t, is given by

$$\Delta R_t = B^c = \Delta R^c_t + \Delta R^b_t + \Delta R^p_t + \Delta R^g_t \tag{5.6}$$

In the same way, capital inflows from direct or portfolio investments and borrowing from banks, foreign governments and international organization such as the World Bank and International Monetary Fund can increase foreign exchange reserves. In this case the relationship between the capital account, B^k, and the change in foreign exchange reserves, ΔR_t, excludes changes in foreign exchange reserves of the SBV. Hence,

$$B^k = \Delta R^b_t + \Delta R^p_t + \Delta R^g_t \tag{5.7}$$

Finally, the overall balance of payments is the sum of current and capital accounts in equations (5.6) and (5.7). That difference equals the change in foreign exchange reserves of the SBV:

$$B^b = \Delta R^c_t \tag{5.8}$$

5.3 Balance of Payments Relation to Savings and Investment

Capital inflows allow domestic investment to exceed national savings when they finance a current account deficit. As such, capital inflows that finance the current account deficit can increase investment and the rate of economic growth of a country like Viet Nam. The relationship between the current account balance and domestic savings and investment can be demonstrated in the following manner. From equation (3.1) suggests that the balance on trade in goods and non-factor services (B) is the difference between total GDP (Y) and domestic absorption (A):

$$B_t = Y_t - A_t \tag{5.9}$$

Since consumption is composed of private (C) and public sector (G), and since domestic investment (I) is equal to national savings (S) plus the current account deficit (B) or foreign savings, then the following identity holds:

$$S_t = Y_t - C_t - G_t \tag{5.10}$$

Substituting equation (5.9) into equation (5.10) gives the expression for the trade balance in terms of savings and investment:

$$B_t = S_t - I_t \tag{5.11}$$

Hence the balance on trade in goods and non-factor services is the difference between savings and investment.[1] If Viet Nam invests more than its saves, then the country is producing an amount of output Y that is smaller than the total spending on goods for consumption and investment purposes (C+G+I). The excess absorption over GDP, or the excess of investment over savings, implies that Viet Nam has a trade deficit.

To finance the deficit and pay for the excess of consumption (C+G) over income/output (Y), Viet Nam needs to reduce its assets or borrow from abroad. Whether assets are run down or new foreign borrowing is undertaken, Viet Nam's net foreign assets (R) will be reduced by the amount of the current account deficit:

$$B_t = \Delta R_t \tag{5.12}$$

Hence, the change in the net foreign assets (R), a stock concept, will be equal to the current account, a flow concept

[1] Although the term B has been used to represent the balance on trade in goods and non-factor services, in practice, B should be treated as the current account balance, excluding official transfers, when calculating gross national savings.

6. ECONOMIC POLICY WITH FIXED VERSUS FLEXIBLE EXCHANGE RATES

6.1 Overview

Macroeconomic management requires three basic elements: first, accurate and up-to-date economic and financial data necessary for the design of effective policies; secondly, an effective reform of the public institutions and the banking sector to support market-oriented activities in the real and financial sectors; and finally, an understanding of the direction, magnitude, and dynamics of responses by economic agents to specific policy changes. The remained of this chapter examines key macroeconomic relationships under Viet Nam's current fixed exchange rate system, and compares the operation of that system with one operating under a flexible exchange rate system.

The effectiveness of economic policy instruments can vary considerably under fixed and flexible exchange rate regimes, depending on the extent to which prices, wages, and capital are free to move in response to changes in market conditions. When capital is allowed to move freely, international investors arbitrage differences in interest rates across countries. Differences in real interest rates, adjusted for expectations about exchange rate movements, generate large capital movements that tend to eliminate those differences. Consequently, interest rates tend to equalize among countries without controls over capital movements.

When controls over capital movements exits, domestic interest rates do not adjust to international interest rates, with the result that the mechanism by which monetary policy operates differs from that under a system without capital controls. In Viet Nam capital movements remain restricted.

Finally, in a small open economy such as Viet Nam trade plays an important role in the basic macroeconomic adjustment process.[1] When a current account deficit appears, for example, the less foreign credits that are available, the more quickly does the deficit have to be removed. The standard prescription is that total expenditures by the government and the private sector will need to fall. This process represents the reduction in absorption which reduces demand for both tradables and non-tradables. In addition, there will need to be a real devaluation to shift the pattern of domestic demand from tradables towards non-tradables.

The adjustment between tradables and non-tradables represents a switching policy that ensures that the process of external balance takes place while internal balance (overall employment) is

[1] The analytical basis for macroeconomic adjustment is well summarized by Corden (1989). See also Corden (1985, chapter 1) for a diagrammatic exposition of this standard analysis. The basic theory originated with Meade (1951) and the concept of switching with Johnson (1958).

maintained. Without such a switching, the reduction in domestic demand required to improve the current account would result in excess supply and lead to unemployment in the non-tradable sectors of the economy.

If the policy instrument to bring about switching is to be exchange rate adjustment, a real devaluation will need to occur as a result of nominal devaluation. If wages rise when the price of imports and the cost of living rise, or if there has not been an adequate expenditure reduction so that the devaluation-induced rise in demand for non-tradables creates excess demand and then some inflation of non-tradable prices (or, more broadly, of prices of home-produced goods), a real devaluation will not be achieved. In other cases, a nominal devaluation does bring about an initial real devaluation, but its effects are partially eroded over time. A great deal hinges on whether monetary policies are accommodating or not.

6.2 Aggregate Demand and Overall Equilibrium

The equilibrium values for the interest rates and aggregate demand are determined by the intersection of the IS and LM curves. At that point, the real output demand and the money market are in equilibrium for a given levels of domestic prices, P, for a given level of foreign income, Y^f, and for given levels of the policy instruments (taxes, T, government expenditures, G,, and the real exchange rate, e^r). To derive aggregate demand, substitute equation (4.7) of the LM-curve into equation (3.9) for the IS-curve, and solve for aggregate demand:

$$Y = \lambda_0 + \lambda_1(M/P) + \lambda_2 e^r + \lambda_3 G + \lambda_4 T + \lambda_5 Y^f \qquad (6.1)$$

where $\lambda_1 = \theta_1\kappa_2/(1+\theta_1\kappa_1)$, $\lambda_2 = \theta_2/(1+\theta_1\kappa_1)$, $\lambda_3 = \theta_3/(1+\theta_1\kappa_1)$, $\lambda_4 = \theta_4/(1+\theta_1\kappa_1)$, and $\lambda_5 = \theta_5/(1+\theta_1\kappa_1)$. Thus aggregate demand, Y, is positively related to the real money balance, M/P, since λ_1 is positive. However, since $0 < \lambda_1 < 1$, a change in real money balances always leads to a less than proportional change in aggregate demand, since the resulting change in interest rates also affects aggregate demand. An increase in real money balances, for example, leads to an excess supply and a shift from money to bond purchases. The resulting increase in bond prices lowers their interest rate, which in turn stimulates investment and consumption, and leads to an overall increase in aggregate demand.

The effect on aggregate demand from changes in fiscal and exchange rate policy instruments, as well as exogenous foreign market demand are also shown in the final aggregate demand equation. Aggregate demand is negatively related to taxes since $\lambda_4 < 0$; it is positively related to the real exchange rate, e^r, since $\lambda_2 > 0$; it is positively related to government expenditures, G, since $\lambda_3 > 0$; and it is positively related to aggregate demand in foreign markets, Y^f, since $\lambda_4 > 0$.

As Figure 6.1 shows, the equilibrium level of output and prices is determined by the intersection of aggregate demand and aggregate supply. For supply of the secondary sector, the steady-state solution for the total aggregate supply is given by:

$$Y = Y^a + \phi_0 + \phi_1 I + \phi_2 P^b + Y^c \tag{6.2}$$

The price index of the secondary sector, P^b, is related to the general price level, P, according to the following relationship:

$$P^b = \gamma_0 + \gamma_1 P + \mu_7 \tag{6.3}$$

Overall equilibrium of the Vietnamese economy is achieved when aggregate demand in equation (6.1) is equal to aggregate supply in equation (6.2). The solution for the general price level is given by:[2]

$$P = \zeta_0 + \zeta_1 M + \zeta_2 e^r + \zeta_3 G + \zeta_4 T + \zeta_5 Y^f + \zeta_6 (Y^a + Y^b) \tag{6.4}$$

where $\zeta_1 = \lambda_1/(\tau_1+\theta_2) > 0$, $\zeta_2 = \lambda_2/(\tau_1+\theta_2) > 0$, $\zeta_3 = \lambda_3/(\tau_1+\theta_2) > 0$, $\zeta_4 = \lambda_4/(\tau_1+\theta_2) < 0$, $\zeta_5 = \lambda_5/(\tau_1+\theta_2) > 0$, and $\zeta_6 = -1/(\tau_1+\theta_2) < 0$. Prices are positively related to the monetary, fiscal, and exchange rate policy instruments, *M*, *G*, and e^r, and they are negatively related to the fiscal policy instrument, *T*. However, since $0 < \zeta_1 < 1$, the price rise associated with a monetary expansion is always less than proportional to the increase in the supply of money. Prices are positively related to foreign market demand, since an increase in demand with capacity unchanged leads to a price rise. In contrast, prices are negatively related to a real output expansion in the primary and tertiary sectors since the increase in productive capacity, with demand unchanged, drives down prices.

Equilibrium output is found from the substitution of the price equation (6.4) into the aggregate demand equation (6.1):[3]

$$Y = \omega_0 + \omega_1 M + \omega_2 e^r + \omega_3 G + \omega_4 T + \omega_5 Y^f + \omega_6 (Y^a + Y^b) \tag{6.5}$$

where $\omega_1 = \lambda_1 - \lambda_1\zeta_1 > 0$, $\omega_2 = \lambda_2 - \lambda_1\zeta_2 > 0$, $\omega_3 = \lambda_3 - \lambda_1\zeta_3 > 0$, $\omega_4 = \lambda_4 - \lambda_1\zeta_4 < 0$, $\omega_5 = \lambda_5 - \lambda_1\zeta_5 > 0$, and $\omega_6 = -\lambda_1\zeta_6 > 0$. Output is positively related to the monetary, fiscal, and exchange rate policy instruments, *M*, *G*, and e^r, and it is negatively related to the fiscal policy instrument, *T*. However, since $0 < \omega_1 < 1$, the final effect on output is always smaller than the initial rise in aggregate demand associated with the policy change, the reason being that the associated price change dampens the initial shift in the demand schedule. A similar situation occurs with a change in foreign market income. The resulting rise in prices dampens the initial increase and causes a lower expansion in output. Finally, as expected, output is positively associated with a change in output from the primary and tertiary sectors.

[2] For ease of computation, it is useful to approximate M/P by M-P.

[3] Again, for ease of computation, it is useful to approximate M/P by M-P.

6.3 Monetary Policy

Under a fixed exchange rate system monetary policy is generally ineffective in changing aggregate demand, whether or not capital controls exists. However, the mechanism through which monetary policy becomes ineffective differs. With capital controls, a monetary expansion shifts the LM-curve in Figure 6.2 to the right, and the increase in the money supply induces a fall in the interest rate. Domestic absorption, A, in equation (3.1) increases as both domestic consumption and investment expand. Thus the monetary expansion initially causes interest rates to fall and aggregate demand to increase. The increase in the domestic demand, however, induces an expansion in imports, and since exports remain unchanged with the exchange rate fixed, the trade balance, B, in equation (3.1) will decrease. As aggregate demand decreases, interest rates rise, and the process continues until the interest rate and aggregate demand return to the level prior to the monetary expansion. Although monetary policy is effective in the short run, it is otherwise ineffective. Indeed, the monetary expansion causes a loss in foreign exchange reserves equal to the expansion in the money supply.

Under a fixed exchange rate system with complete capital mobility, the real interest rate, r, will adjust to the average interest rate in international capital markets, r^f. A monetary expansion would initially shift the LM-curve in Figure 5.2 to the right. However, the resulting lower domestic interest rate would drive domestic investors to sell domestic assets in order to purchase foreign assets. As domestic investors exchanged the local currency for foreign exchange to purchase the foreign bonds, the central bank would have to sell foreign exchange in exchange for local currency. The initial monetary expansion would eventually be offset by central bank absorption of local currency until international arbitrage again equalized domestic and foreign interest rates at the original position of the LM-curve. Thus under a fixed exchange rate system, monetary policy is ineffective with both capital mobility and capital controls, but the mechanism differs.

In contrast, under a flexible exchange rate regime with capital mobility, monetary policy operates through changes in the exchange rate, rather than through interest rate variations. It therefore affects aggregate demand via the trade balance rather that domestic absorption. A monetary expansion, for example, shifts the LM-curve in Figure 6.2 to the right and drives down interest rates. The capital outflow resulting from the domestic and foreign interest rate differential causes the exchange rate to depreciate, which in turn improves the trade balance through the effects on the export demand equation (3.6) and import demand equation (3.7). The expansion in aggregate demand shifts the IS-curve to the right. The rightward shifts in both the LM-curve and the IS-curve result in a new equilibrium at a larger aggregate demand but at the original interest rate.

The mechanism differs when there are capital controls. In this case, a monetary expansion operates through a change in domestic absorption rather than the trade balance. An increase in the money supply shifts the LM-curve in Figure 6.2 to the right and lowers interest rates. With restricted capital movements the domestic and foreign interest rate differential remain. The lower

domestic interest rate stimulates investment and consumption, and thereby causes an increase in aggregate demand.

6.4 Fiscal Policy

Under a fixed exchange rate system with capital controls, fiscal policy tends to be ineffective since it simply shifts expenditures from the private to the public sector. An increase in government expenditures, for example, shifts the IS curve in equation (3.9) to the right. Absorption, A, in equation (3.1) increases and, as aggregate demand expands, interest rates rise. The expansion in aggregate demand leads to an expansion in imports, and since exports remain unchanged with the exchange rate fixed, the trade balance, B, in equation (3.1) decreases. The increase in imports causes a reduction in foreign exchange holdings of the monetary sector, and the total money supply in equation (4.1) decreases.

The decrease in the money supply shifts the LM curve to the left and causes interest rates to rise. The process continues until the trade deficit is eliminated and aggregate demand return is returned to its level prior to the fiscal expansion. The final result is a higher interest rate that drives down private consumption and investment by the amount of the government expenditure increase. The outcome is an unchanged aggregate demand. What changes is the composition of demand, as government expenditures have increased while private consumption and investment has decreased. Thus with a fixed exchange rate and the absence of capital mobility, fiscal policy is ineffective.

In contrast, capital mobility permits fiscal policy to be fully effective. An increase in government expenditures would shift the IS-curve to the right and result in a short-term equilibrium along the original LM-curve at a higher interest rate. The differential between the domestic and foreign interest rates would induce purchases of domestic bonds, which in turn would lead the SBV to purchase foreign exchange and sell lie to satisfy the great demand for domestic currency. The resulting rightward shift in the LM-curve would eventually lead interest rates to return to their original level, but aggregate demand would have expanded.

Under a flexible exchange rate, an expansionary fiscal policy has a crowding out effect under both capital mobility and capital controls. However, the channels through which fiscal policy impacts on the economy differ. With capital mobility, an increase in government expenditures would shift the IS-curve to the right and initially increase aggregate demand and raise the interest rate. However, the interest rate differential will attract capital inflows and lead to an appreciation of the currency. As exports decrease in equation (3.6) and imports increase in equation (3.7), the trade balance in equation (3.1) worsens. The contraction in aggregate demand continues until the interest rate differential disappears.

With capital controls, an increase in government expenditures would also shift the IS-curve to the right and initially increase aggregate demand and raise the interest rate. In this case, however, capital movements do not eliminate interest rate differentials. Instead, the higher interest rates

induce a reduction in investment and consumption, which drives aggregate demand back towards its original level.

6.5 Exchange Rate Policy

Under a fixed exchange rate regime, the SBV has control of the official exchange rate. A devaluation by the SBV, for example, raises the real exchange rate in equation (3.9), and improves the trade balance in equation (3.1) through its effect on exports in equation (3.6) and imports in equation (3.7). The resulting shift to the right of the IS-curve initially increases both aggregate demand and the interest rate. The interest rate differential induces a capital inflow. The SBV purchases of foreign exchange and sales of local currency increase the money supply and shift the LM-curve to the right. Capital inflows continue until capital movements eliminate interest rate differentials. Final aggregate demand increases, while the interest rate returns to its original level. With capital controls, the devaluation improves the trade balance in equation (3.1) and interest rate differentials are not eliminated.

Although a devaluation would normally be expected to expand aggregate output through an improvement in the trade balance, in practice the effect for a relatively small country like Viet Nam is not clearly defined. Normally, the law of one price would ensure a perfectly elastic demand curve for traded goods, so that devaluation would shift the export demand curve in proportion to the devaluation if there were underutilization of capacity. However, contractionary devaluations can arise through either price changes that cause a negative real balance effect, the redistribution of demand from a sector having a low marginal propensity to save to one with a high one, a price inelastic demand for exports and imports, or supply-side rigidities. The extensive literature on possible contractionary effects of a devaluation of output therefore suggests that care must be taken in the interpretation of the coefficients of the present model of the Vietnamese economy.

7. STRUCTURE OF THE MODEL

The macroeconomic model for the Viet Nam economy consists of 192 equations, of which 29 are behavioral. Since the model aims to provide fairly detailed information on the international competitiveness of the economy, a relatively high degree of disaggregation has been introduced with the country's trading partners and investors. The model solves for GDP and it can be inverted to solve for any of the other variables in the model for any target growth rate. The set of solutions provided by the system of equations therefore depends on the policy application of interest.

7.1 Overview

To arrive at the overall and sector-specific levels of economic activity, the model derives solutions for four major blocks: the national income accounts block, the public sector block, the financial sector block, and the balance of payments block. The balance of payments block generates information about the major balance of payments components, and it yields a solution to the balance of goods and non-factor services, which is then used in the national income accounts block. The national income accounts block contains a considerable amount of interrelationships between the endogenous variables in the system in order to capture feedback effects in the economy, including those in the public sector block.

The financial sector block helps to determine the real and nominal variables in the economy. The resulting system allows for a broader-ranged analysis of monetary policy: the interest rate can be determined through the SBV's adjustment of reserve requirements or the currency in circulation; the financing of the government deficit is linked to the financial sector, and can therefore be used to determine the government's level of net transfers, current expenditures, or public investment; monetary policy affecting the interest rate can influence the rate of inflation through the demand for money equation; the desired rate of increase of the money supply can be derived from the policy-determined target inflation and real GDP growth rates; and both credit availability and the interest rate will influence the level of investment.

7.1.1 Balance of Payments Block

In modeling trade the key assumption about trade in the two-goods model is that the home country produces output that is differentiated from that of the rest of the world. The relative price of goods produced in the home country and foreign countries vary according to quality, reliability of supply sources, differences in marketing and customs regulations, and historical and political ties with supply sources. As those prices vary to reflect changing differences, consumers will alter their demand for domestic and foreign goods. Indeed, suppliers often seek to increase product differentiation between their goods and those of other suppliers producing the same type of good to

have greater control over the domestic or foreign markets through their pricing policies.[1] As a result, the trade balance depends not only on the level of output and consumption in the domestic and foreign economies, but also on the relative price of domestic and foreign goods.

The volume of exports depends on the economic activity of foreign markets, and the real exchange rate. In addition, relative export prices are important to the determination of Viet Nam's exports insofar as they reflect the country's competitiveness in the export markets; they therefore influence the quantity of Viet Nam goods demanded by foreign markets relative to competing foreign and domestic suppliers to those markets. By the very nature of relative export prices, calculations of these prices need to be undertaken from bilateral trade flow data. These data are available from the COMTRADE database and have been used to derive information on Viet Nam's export volumes and prices, as well as the import demand of each geographic market.

Merchandise imports depend on the economic activity of the domestic market, and the real exchange rate. Time series for unit import prices and volume indices have been constructed from disaggregated data at the product level from the COMTRADE database.

Once exports and imports of goods and non-factor services are estimated, the model calculates the balances for the merchandise account, non-factor services, goods and non-factor services, factor services, and the current account. Changes in foreign reserves are currently endogenous in the model since the Government does not establish target levels of reserves relative to imports or other activity variables. Once target levels of reserves are established, it will be important to introduce this policy-determined target into the model. In its present form, the model calculates total borrowing needs, total external debt, and the balance on the capital account.

Since 1992 foreign exchange reserve holdings have been targeted at about six to eight weeks of imports. In the model, such a policy-determined target has been maintained by calculating the change in foreign exchange holdings as equal to the overall balance of the balance of payments, subject to the constraint that those holdings not fall below six weeks of merchandise imports. An overall balance of the balance of payments that exceeds that amount is obtained from additional external financing.

The model can provide information on Viet Nam's external financial requirements. In its present form, the model calculates total borrowing needs, total external debt, and the balance on the capital

[1]Product differentiation underlies much of the new theory of international trade related to imperfect competition and economies of scale. Products are *vertically differentiated* when differences between suppliers of the same good arise from variations in the quality of a commodity. Products *horizontally differentiated* when importers differ in their choice of the geographic origin of the good even though its quality does not vary from country to country. Importer distinctions of homogeneous products from different exporting countries arise because of attributes related to the export of the product. Among these attributes are adjustment costs involved in switching from one supplier to another, the reliability of supply sources, differences in marketing and customs regulations, the desire for diversification of supply sources, and historical and political ties with countries. For a format treatment of product differentiation in the context of the new theory of international trade, and the resulting import and export demand functions, see Lord, 1991, chapters 1 and 3.

account. The solution provides the total amount of borrowing needed to finance the deficit in the current account. It is straightforward to include estimates of the borrowing needs beyond existing commitments. To calculate the additional borrowing needs, programmed disbursements and amortization payments would be subtracted from the total borrowing needs estimated by the model.

7.1.2 Fiscal Block

The model aims to provide an opportunity to examine fiscal policies at the national level. On the revenue side, taxes are divided into trade and other taxes. The average tax rate on trade is approximated from current trade levels. Rates on import duties are policy variables in the model. It would be useful to further divide import taxes in the form of tariffs into those applicable to three major import categories: intermediate goods, capital goods, and consumer goods. That level of disaggregation would permit an analysis of the effects of policy changes that, for example, raised the tax rate on imports of consumer goods, and lowered the rates on capital or intermediate goods. The disaggregation of major government revenue sources would allow more stable relationships to be derived between each of the tax collection flows and their more narrowly defined revenue bases, without the need to estimate new revenue base variables. A value-added tax will be introduced in January 1999.

Government expenditures are separated into current and capital expenditures. Within current expenditure, there is a further breakdown into interest payment of foreign and domestic loans and other expenditures.

7.1.3 Financial Sector

The earlier discussion of monetary policy in a fixed exchange rate system provides much of the motivation for the present design of the financial sector block in the model. There are a number of ways to model the financial sector, and the present formulation is intended to establish the basic relationships needed to characterize this sector in Viet Nam.[2] The financial sector is divided into two components: the SBV and the banking system. The structure of the financial sector component reflects the balance sheets of SBV and the banking system. At present, there is relatively little detail in the monetary survey data since problems remain about the availability and reliability of data and the link between the data that appear in the balance of payments and the monetary survey.

7.1.4 Value Added

The system of equations simultaneously solves for total production and expenditures of the Viet Nam economy. The tertiary sector, which accounts for over 40 percent of the total value added of

[2]The motivation underlying the specification of the conventional financial sector components are well documented in the literature related to the World Bank's RMSM-X model and other macroeconomic models (see, for example, Easterly et al. (1990), De La Viña (1993), Everaert, Garcia-Pinto, and Ventura (1990), Everaert (1992), Serven (1990), and Serven and Solimano (1991).

the economy, is endogenous; its level depends on investment and consumption activities. Although the primary sector is predetermined in the model, the secondary sector is endogenous. Given the growing importance of the secondary and tertiary sectors in the coming years, it is particularly important to ensure that these sectors are explicitly considered in the solution of the system of equations, particularly when policy simulations are performed to measure their impact on different sectors of the economy.

7.2 Specification of the model

Notations:

L	=	Dong currency
D	=	Dollar currency
R	=	Real value

NB Predetermined variables are underscored.

2.1 Balance of Payments

Exports of Goods

XMEQR	=	f_1(NYMKR, EUSDR)	Exports of merchandise, real value
XMEPD	=	f_2(PMUVP)	Exports of merchandise, dollar price
XMEVD	=	XMEQR x XMEPD	Exports of merchandise, dollar value

Imports of Goods

MMEQR	=	f_3(NY1QR, EUSDR)	Imports of merchandise, real value
MMEPD	=	f_4(PMUVP)	Imports of merchandise, dollar unit price
MMEVD	=	MMEQR x MMEPD	Imports of merchandise, dollar value

Non-Factor Services

CSRVD	=	f_5(NYWDR, EUSDR)	Service receipts, dollar value
CSPVD	=	f_6(NYVNR, EUSDR)	Service payments, dollar value

Factor Services

CYRVD	=	CYRVD	Income receipts, dollar value
CYPVD	=	CRPVD + CPRVD	Income payments, dollar value
CRPVD	=	CRPVD	Interest payments, dollar value
CPRVD	=	f_8(KFIVD)	Profit remittances, dollar value

Balances in Current Account

CTBVD	=	XMEVD - MMEVD	Trade balance, dollar value
CSBVD	=	CXRVD - CSPVD	Net services, dollar value
CYBVD	=	CYRVD - CYPVD	Net income, dollar value
CTBVD	=	CTPVD + CTOVD	Net transfers, dollar value
CCBVD	=	CTBVD + CSBVD + CYBVD+ CTBVD	Current account balance, dollar value

Capital Account

KFIVD	=	f_9(NYVNR, NYTIR, EUSDR)	Foreign direct investment, dollar value
KLLVD	=	KLLVD	Medium and long-term loans, dollar value
KSLVD	=	KSLDD - KSLAD	Short-term capital, net, dollar value
KKBVD	=	KFIVD + KLLVD + KSLVD	Balance on capital account, dollar value

Overall Balance, Financing, and Debt

BOBVD	=	CCBVD + KKBVD + OMIVD	Overall balance of balance of payments, dollar value
DFMRD	=	- BOBVD	Change in foreign exchange reserves, dollar value
FMRVD	=	DFMRD + FMRVD	Foreign exchange reserve holdings, dollar value
FOBVD	=	-BOBVD + DFMRD	Additional external financing requirements, dollar value

2.2 National Income Accounts

Balance on Goods and NFS

NTBVR	=	NXBVR - NMBVR	Balance of goods and nfs, 1992 prices
NXBVR	=	[(XMEVD + CSRVD) x EUSDL]/ NYVNP	Exports of goods and nfs, 1992 prices
NMBVR	=	(MMEVD + CSPVD) x EUSDL]/ NYVNP	Imports of goods and nfs, 1992 prices

Investment

NITVR	=	NIFVR + NIOVR	Total investment, 1992 prices
NIGVR	=	(KFIVD * EUSDL) / NYVNP	Foreign direct investment, 1992 prices
NIOVR	=	f_{10}(NYVNR, VIBOR)	Other private investment, 1992 prices

Saving Derivation

CCBOD	=	CCBVD - CTOVD	Current Acct Bal. - Official Trans, dollar value
CCBOL	=	CCBOD * EUSDL/1000	Current Acct Bal. less Official Transfers, dong
NITVL	=	NITVR * (NYVNP/100)	Gross Capital Formation, dong
NSTVL	=	CCBOL + NITVL	Gross Savings, dong
NSTVR	=	NSTVL/(NYVNP/100)	Gross Savings, 1992 prices

Government Budget

(a) Revenue:

NGTTR	=	(NXBVR - NMBVR)*(NGTTR(-1) /(NXBVR(-1) - NMBVR(-1)))	Taxes on trade, 1992 prices
NGTOR	=	NGTOR	Other taxes revenue, 1992 prices
NGTXR	=	NGTOR + NGTTR	Total tax revenue, 1992 prices
NGNTR	=	NGNTR	Non-tax revenue, 1992 prices
NGRVR	=	NGRVR	Grants, 1992 prices
NGTRR	=	NGTXR + NGNTR	Total revenue, 1992 prices
NGRGR	=	NGTRR + NGRVR	Total revenue and grants, 1992 prices

(b) Expenditures:

NGIFR	=	NGIFD	Interest payments: foreign loans, 1992 prices
NGIDR	=	NGIDR	Interest payments: domestic loans,1992 prices
NGIPR	=	NGIFR + NGIDR	Total interest payments, 1992 prices
NGOER	=	NGOER	Other expenditures, 1992 prices
NCGVR	=	NCGVR(-1) * NGOER/NGOER(-1)	Government Consumption in NIA, 1992 prices
NGCER	=	NGIPR + NGOER	Current expenditures, 1992 prices

NGCPR	=	NGCPR	Capital expenditures on lending, 1992 prices
NGTER	=	NGCER + NGCPR	Total expenditures, 1992 prices
NGBOR	=	NGRGR + NGTER	Overall balance, 1992 prices
NGDFR	=	NGRGR + NGTER - NGRVR	Overall balance before grants, 1992 prices

Private Consumption

NCPVR = f_{11}(NYVNR, VIBOR)
Private consumption, 1992 prices

Total Consumption

NCTVR = NCGVR + NCPVR Total consumption, 1992 prices

Gross Domestic Product

NYVNR = NTBVR + NITVR + NCTVR + NOMIR GDP of Viet Nam, 1992 prices

Exchange Rates

EUSDR = EUSDL x (NYUSP/NYVNP) Exchange rate, real

3. Aggregate Supply

NASVR	= NYVNR - NISVR - NSSVR	Primary sector, value added, 1992 prices
NISVR	= f_{12}(KFIVD)	Secondary sector, value added, 1992 prices
NSSVR	= f_{13}(NCTVR)	Tertiary sector, value added, 1992 prices
NBSVR	= NASVR + NISVR + NSSVR	Value added, total, 1992 prices

4. Monetary Sector

FNFAL	=	FNFAL(-1) + (BOBVD*EUSDL)	Net foreign assets
FNDGL	=	FNDGL(-1) + NGDFR + /NGDFR(-1)	Net domestic assets
FNDAL	=	FNDAL(-1) + FNDGL	Net domestic assets
FNTLL	=	FNFAL + FNDAL	Total liquidity
FM2VL	=	FNTLL	M2, dong
VIBOR	=	f_{14}(NYVNR, FM2VL/NYVNP)	Interest rate in Viet Nam, real

8. Dynamics Specification of the Model

To facilitate the presentation of the IS-LM framework used for policy analysis in Viet Nam, the behavioral equations have been presented in the levels form of the variables. However, empirical estimates in the levels form of the behavior equations would yield parameters whose implied elasticities would vary over the historical and forecast period. In contrast, behavioral equations estimated in their log-linear form yield direct elasticity estimates whose values remain constant over both the historical and the forecast periods. The present estimates of the Vietnamese model are therefore based on log-linear relationships.

8.1 Preliminaries

The dynamic processes underlying Viet Nam's adjustments of key economic variables to changes in their determinants are described by stochastic difference equations. The general form of the equation for any dependent variable Y and the explanatory variables X_i is:

$$Y_t = \Sigma^m_{i=1} \alpha_i Y_{t-i} + \Sigma^n_{i=0} \beta_i X_{it} + \varepsilon_t \qquad (8.1)$$

Like all dynamic equations, the stochastic difference equation imposes an *a priori* structure on the form of the lag to reduce the number of parameters that need to be estimated. Since Viet Nam's national income account data are limited in terms of their range and annual periodicity, the parsimonious representation of the data generating process afforded by the stochastic difference equation is advantageous to the modeling process.

This class of equations has three other important advantages. First, as pointed out by Harvey (1991: ch. 8), the stochastic difference equation lends itself to a specification procedure that moves from a general unrestricted dynamic model to a specific restricted model. At the outset all the explanatory variables postulated by economic theory and lags of a relatively higher order are deliberately included. Whether or not a particular explanatory variable should be retained and which lags are important are decided by the results obtained. The approach is appropriate for an economy like that of Viet Nam where there is uncertainty about the explanatory variables to be included in the behavioral equation.

The second advantage of the use of the stochastic difference equation lies in the estimation procedure. Mizon (1983) has noted that, given sufficient lags in the dependent and explanatory variables, the stochastic difference equation can be so defined as to have a white noise process in the disturbance term. As a result, the ordinary least squares estimator for the coefficients will be fully efficient.

Finally, stochastic difference equations lend themselves to long-run solutions that are consistent with economic theory. This characteristic is useful for the present modeling framework for Viet

Nam, which builds from theory to dynamic specification, and finally to estimation and testing of the theory. When restrictions are imposed by economic theory, the relationships between variables are determined by *co-integration analysis*, and equations known as *error correction models* are used to yield long-run solutions that are consonant with economic theory.

In annual time-series data, the dynamics underlying economic relationships can be restricted to one period since adjustments to the explanatory variables tends to decline exponentially over time. It is therefore useful to review some of the widely used empirical models which equation (8.1) encompasses for the following case:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \beta_1 X_t + \beta_2 X_{t-1} + \varepsilon_t \qquad (8.2)$$

There are at least four widely used models embedded in equation (8.2) (see Hendry, Pagan and Sargan, 1984):

(a) Static Model ($\alpha_1 = \beta_2 = 0$): $Y_t = \alpha_0 + \beta_1 X_t + \varepsilon_t$

(b) Distributed Lag Model ($\alpha_1 = 0$): $Y_t = \alpha_0 + \beta_1 X_t + \beta_2 X_{t-1} + \varepsilon_t$

(c) Partial Adjustment Model ($\beta_2 = 0$): $Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \beta_1 X_t + \varepsilon_t$

(d) First-Difference Model ($\alpha_1=1$, $\beta_1 = -\beta_2$): $\Delta Y_t = \alpha_0 + \beta_1 \Delta X_t + \varepsilon_t$

8.2 Specification of the Relationships for Consumption and Investment

Private Consumption: The level of private consumption, *C*, is positively related to income, *Y*, and negatively related to the domestic real rate of interest, *r*.[1] For data with annual periodicity, the relationship is described by a first-order stochastic difference equation in its linear form:

$$C_t = \alpha_{10} + \alpha_{11} C_{t-1} + \alpha_{12} Y^d_t + \alpha_{13} Y^d_{t-1} + \alpha_{14} r_t + \mu_1 \qquad (8.3)$$

The expected signs are $0 < \alpha_{11} < 1$, $\alpha_{12} + \alpha_{13} > 0$, $\alpha_{14} < 0$. Empirically the effect of real interest rate changes on consumption, or dis-savings, is ambiguous, and it is therefore not always clear whether real interest rate changes are negatively related to consumption (for a theoretical discussion, see Sachs and Larrain, 1993: 106-109; for empirical evidence, or lack thereof, in developing countries, see Giovannini, 1983).

In equation (8.3), disposable personal income is defined as the difference between real GDP and taxes, *T*:[2]

[1]The real interest rate is measured by subtracting the inflation rate from nominal interest rate.

$$Y^d_t = Y_t - T_t \tag{8.4}$$

***Investment*:** Total investment is separated into gross fixed investment, I^g, and changes in stocks, ΔK_t.

$$I_t = I^g_t + \Delta K_t \tag{8.5}$$

As with all other activity variables in the model, the behavioral relationships of both of these concepts are estimated in real terms.

Gross fixed investment, I^g, is positively related to the general level of economic activity and negatively related to the real interest rate.[3] The relationship described by a first-order stochastic difference equation is:

$$I^g_t = \alpha_{20} + \alpha_{21} I^g_{t-1} + \alpha_{22} Y_t + \alpha_{23} Y_{t-1} + \alpha_{24} r_t + \mu_2 \tag{8.6}$$

The expected signs are $0 < \alpha_{21} < 1$, $\alpha_{22} + \alpha_{23} > 0$, $\alpha_{24} < 0$.

Stocks are held by companies to ensure that they are able to meet future orders. The amount of stock actually held is determined by medium and long-term demand estimates of the companies. In the short run, stock changes reflect company decisions to maintain stable production levels. Since stable production is more cost-efficient than production targeted to current market conditions, stocks tend to build up during downswings in the business cycle, and are drawn down during upswings. Thus changes in stocks, *K*, at any period *t* are determined by change in economic activity, as measured by real GDP, *Y*:

$$\Delta K_t = \alpha_{31} \Delta Y_{t-1} + \mu_3 \tag{8.7}$$

where $\alpha_{31} < 0$.[4] In general, stock levels would be expected to be drawn down as aggregate expenditures increased, and they would tend to accumulate as expenditures declined. In Viet Nam, during the early year of the transition to a market economy the large accumulation of stocks during downturns in economic activity need not be the result of the aforementioned stable

[2]Formally, disposable income is output plus interest earnings minus taxes. However, Viet Nam's interest earnings on its stock of wealth are relatively small and have been omitted here for simplicity. In an expanded model, disposable income would be composed of wages and salaries of households plus other household income. In the formation of household wages and salaries in an expanded model, the wage rate would be related to value added, which itself would depends on the overall level of economic activity.

[3]In an expanded model, gross operating surplus could be included as an explanatory variable. Since gross operating surplus is the difference between GDP and net household income plus government tax revenue, both of which are indirectly dependent on the formation of GDP, investment would also be closely related to private and public sector activities in the expanded model.

[4]Note that first differencing the levels form of the stock equation eliminates the intercept.

production rationale, but rather the lack of an adequate market price system that would otherwise provide an effective signal for the efficient allocation of resources.

8.3 Specification of the Relationship for the Trade Components

The key assumption about trade in the two-goods model is that the home country produces output that is differentiated from that of the rest of the world. The relative price of goods produced in the home country and foreign countries vary according to quality, reliability of supply sources, differences in marketing and customs regulations, and historical and political ties with supply sources. As those prices vary to reflect changing differences, consumers will alter their demand for domestic and foreign goods. Indeed, suppliers often seek to increase product differentiation between their goods and those of other suppliers producing the same type of good to have greater control over the domestic or foreign markets through their pricing policies. As a result, the trade balance depends not only on the level of output and consumption in the domestic and foreign economies, but also on the relative price of domestic and foreign goods.

Exports: The volume of exports, X, is a positive function of economic activity in foreign markets, Y^f, and a positive function of the real exchange rate, e^r:

$$X_t = \alpha_{40} + \alpha_{41}X_{t-1} + \alpha_{42}Y^f_t + \alpha_{43}Y^f_{t-1} + \alpha_{44}e^r_t + \mu_4 \qquad (8.8)$$

The expected signs are $0 < \alpha_{41} < 1$, $\alpha_{42} + \alpha_{43} > 0$, $\alpha_{44} > 0$. Equation (8.8) is a reduced form equation that incorporates a two-stage process in the importers' determination of its demand for exports. In the first stage, a decision is made about how much to consume of a set of products, based on income and prices. In the next stage a choice is made about how much to consume from different suppliers, both foreign and domestic. Separability in the preference ordering means that the amount to consume of a set of products and all other products, whose composite forms a numeraire, is independent of how the amount spent on the set of products is allocated among different exporters.[5]

***Imports*:** The demand for imports of Viet Nam has a long-term response to income, and a short-term response to the constant dollar price of each product. As such, imports have a long-term response to income changes, while they have a transient response to price changes. The reason for this transient response is that the relative price of a product, say that of perishables, can alter the import demand for that product in the short run, but in the long run, the price of perishables relative to that of competing products or all other goods in general cannot continually deviate from one another, since otherwise consumers would permanently switch from that product.

The volume of imports, Z, is positively related to domestic economic activity, and it is negatively related to the real exchange rate:

[5]For a formal derivation of export demand function in the new theory of international trade, see Lord, 1991, chapter 3.

$$Z_t = \alpha_{50} + \alpha_{51}Z_{t-1} + \alpha_{52}Y_t + \alpha_{53}Y_{t-1} + \alpha_{54}e^r_t + \mu_5 \quad (8.9)$$

The expected signs are $0 < \alpha_{51} < 1$, $\alpha_{52} + \alpha_{53} > 0$, $\alpha_{54} < 0$. Separability in the preference ordering of importers means that the amount spent on imported goods is independent of how much is spent on consumption of domestic goods.[6]

To introduce the effects of a nominal exchange rate, $e^{n,}$, and the real exchange rate, e^r, into the model, the constant local currency price of the product, P, is defined as:

$$P^m = P^{fm} / D * e^r \quad (8.10)$$

where P^{fm} is the US dollar price of imports and D is the US dollar price deflator. Since $e^r = e^n P^f / P^d$, imports depend on the constant dollar price of the foreign goods and that price can be influenced by the nominal exchange rate *and* the foreign currency price of goods purchased abroad relative to the domestic price level.

8.4 Aggregate Supply

Secondary Sector: Output of the secondary sector depends on investment, consumption, and exports of goods and nonfactor services:

$$\ln Y^b_t = \beta_{60} + \beta_{61}\ln I_t + \mu_6 \quad (8.11)$$

where the expected signs is $\beta_{61} > 0$.

Tertiary Sector: Output of the tertiary sector depends on consumption:

$$\ln Y^b_t = \beta_{62} + \beta_{63}\ln C_t + \mu_6 \quad (8.12)$$

where the expected signs is $\beta_{63} > 0$. Hence total output is given by:

$$Y_t = Y^a_t + Y^b_t + Y^c_t \quad (8.13)$$

8.5. Interest Rates and Prices

The real rate of interest, *r*, is determined by the inverse of the relationship for the demand for money, *M,* and is specified in terms of real balances, *M/P*, and the level of income, *Y*:

$$r_t = \alpha_{70} + \alpha_{71}(M/P)_t + \alpha_{72}Y_t + \alpha_{73}Y_{t-1} + \mu_7 \quad (8.14)$$

[6]For a derivation of the import demand function and the dynamics underlying trade, see Lord (1991: Chapters 3 and 8).

The expected signs are $\alpha_{71} < 0$, $\alpha_{72} > 0$, $\alpha_{73} > 0$.

The ***price level*** depends on the equilibrium output of the economy. The relationship for the price level is derived from the aggregate supply of output and the dynamic specification of the LM-curve. The supply of output is given in its levels form by:

$$Y_t = \beta_{60}/(1-\beta_{61}) + \beta_{62}/(1-\beta_{61})P_t + 1/(1-\beta_{61})(Y^a+Y^a) \tag{8.15}$$

The demand for output is derived from the dynamics specification for the LM-curve:

$$Y_t = -\alpha_{70}/\alpha_{73} + 1/\alpha_{73}(M/P)_t - \alpha_{71}/\alpha_{73}(M/P)_{t-1} - \alpha_{72}/\alpha_{73}r_t - \alpha_{74}/\alpha_{73}Y_{t-1} \tag{8.16}$$

Hence the equilibrium solution for the price level, *P*, equals:[7]

$$P_t = \beta_{70} + \beta_{71}P_{t-1} + \beta_{72}M_t + \beta_{73}r_t + \beta_{74}Y_t + \mu_7 \tag{8.17}$$

where $\beta_{71} = \alpha_{71}/\alpha_{73}\Theta$, $\beta_{72} = 1/\alpha_{73}\Theta$, $\beta_{73} = \alpha_{72}/\alpha_{73}\Theta$, $\beta_{74} = \alpha_{74}/\alpha_{73}\Theta$, and where $\Theta = \beta_{62}/(1-\beta_{61}) + 1/\alpha_{73}$.

In its log-linear form, the expression becomes:

$$\ln P_t = \beta_{80} + \beta_{81}\ln P_{t-1} + \beta_{82}\ln M_t + \beta_{83}\ln(r)_t + \beta_{84}\ln Y_t + \mu_8 \tag{8.18}$$

with expected signs $0 < \beta_{81} < 0$, $\beta_{82} > 0$, $\beta_{83} < 0$, and $\beta_{84} > 0$. Thus, as expected, the price level is positively related to the money supply and output, and negatively related to the interest rate.

8.6 Steady-State Solution

In steady-state the dynamic specification of the model can replicate the system of equations used to represent the Vietnamese economy in Chapters 3 through5. Recall that the steady state solution of a variable is a timeless concept, so that for any variable $Y_t = Y = Y_{t-1}$. Similarly, $\Delta Y_t = \Delta Y = \Delta Y_{t-1}$.[8] Hence we can derive the steady-state solutions for the behavioral equations that make up the system of equations in the model as follows:

[7] For ease of computation, it is useful to approximate M/P by M-P. Also, for purposes of simplification, the lagged exogenous variables have been left out since their effect can be captured by the specification of the equation as a first-order difference equation.

[8] Care must be taken in the interpretation of the steady-state solution of variables. For instance, the rate of growth of real GDP, approximated by $\Delta\ln(Y)$, is expected to have a positive or negative long-term growth path. In contrast, that of relative prices, approximated by $\Delta\ln(P^f/P)$, is likely to have a mean of zero since otherwise the terms of trade would diverge and the divergence between prices would increase over time. Where that to occur, eventually, all consumers would switch to the relatively cheaper market. That this situation appears to have occurred in the overall terms of trade between primary commodities and manufactures during the last 100 years suggests the possibility of exceptions to some relative price movements.

Private Consumption:

$$C = k_1 + \beta_{11} Y^d + \beta_{12} r \tag{8.19}$$

where $\beta_{11} = (\alpha_{12} + \alpha_{13}) / (1 - \alpha_{11}) > 0$, and $\beta_{12} = \alpha_{14} / (1 - \alpha_{11}) < 0$ in equations (8.3).

Investment:

$$I = k_2 + \beta_{21} Y + \beta_{22} r \tag{8.20}$$

where $\beta_{21} = (\alpha_{22} + \alpha_{23}) / (1 - \alpha_{21}) > 0$, and $\beta_{22} = \alpha_{24} / (1 - \alpha_{21}) < 0$ in equations (8.6).

Exports:

$$X = k_4 + \beta_{41} Y^f + \beta_{42} e^r \tag{8.21}$$

where $\beta_{41} = (\alpha_{42} + \alpha_{43}) / (1 - \alpha_{41}) > 0$, and $\beta_{42} = \alpha_{44} / (1 - \alpha_{41}) < 0$ in equations (8.8).

Imports:

$$Z_t = k_5 + \beta_{51} Y + \beta_{52} e^r \tag{8.22}$$

where $\beta_{51} = (\alpha_{52} + \alpha_{53}) / (1 - \alpha_{51}) > 0$, and $\beta_{52} = \alpha_{54} / (1 - \alpha_{51}) < 0$ in equations (8.9).

Substitution of the steady-state solutions of the individual relationships in equations (8.13) through (8.16) into the absorption and trade balance components yields the aggregate demand relationship in its explicit function form:[9]

$$Y = \theta_o + \theta_1 r + \theta_2 e^r + \theta_3 G + \theta_4 Y^f \tag{8.23}$$

where $\theta_1 < 0$, $\theta_2 > 0$, $\theta_3 > 0$, $\theta_4 > 0$. As before, the multiplier effect of a unit increase in interest rates is given by θ_1, whose value is greater than unity.

[9]From equations (8.13) are (8.16), the coefficients of the reduced form equation are:

$\theta_1 = [\alpha_{14}/(1-\alpha_{11}) + \alpha_{24}/(1-\alpha_{21})]/B$

$\theta_2 = [\alpha_{44}/(1-\alpha_{41}) + \alpha_{54}/(1-\alpha_{51})]/B$

$\theta_4 = [(\alpha_{12}+\alpha_{13})/(1-\alpha_{11})]/B$

$\theta_5 = [(\alpha_{42}+\alpha_{43})/(1-\alpha_{41})]/B$

where $B = 1 - [(\alpha_{12}+\alpha_{13})/(1-\alpha_{11})] + [(\alpha_{22}+\alpha_{23})/(1-\alpha_{21})] + [(\alpha_{52}+\alpha_{53})/(1-\alpha_{51})]$.

9. EQUATION ESTIMATES

The behavioral equations in the model were normally estimated using annual data for the period between 1988 and 1997. The equations were estimated using ordinary least squares after preliminary evidence indicated that estimates using least squares and instrumental variables differed by only relatively trivial amounts. Due to the structural changes in the economy since 1992, tests of parameter constancy were carried out for some of the key equation estimates for which a sufficient number of observations was available.

9.1 Private Consumption

Consumption by the private sector depends on income and, in principal, the real interest rate. As real interest rates have been negative in the early years of the sample period, the ratio of interest to inflation rather than the difference was used to make all values positive, thereby allowing the logarithm of all values in the series to be calculated.

The income elasticity is reasonable in magnitude and has the expected signs. Interest rates were not found to be statistically significant in explaining movements in private consumption. Changes in income produce their full impact on consumption in the same period. The income elasticity is 0.8. Despite the relatively simple definition of income, the variable provided a reasonably good explanation of consumption behavior in Viet Nam. Future extensions of the model could incorporate as an explanatory variable the net household income, composed of wages and salaries of households plus other household income.

The final equation was as follows:

$$\ln(\text{NCPVR})_t = 1.86 + \underset{(12.5)}{0.82}\ \ln(\text{NYVNR})_t$$

$R^2 = 0.98$ DW = 2.3 Period: 1993-97

where NCPVR Private consumption, real
NYVNR GDP, real value

9.2 Investment

Investment is composed of fixed investment and changes in stocks. Due to lack of data, however, both components were estimated together for both the government and private sectors. However, given the importance of foreign direct investment (FDI), that component was calculated separately from other investment activity. Moreover, since much of Viet Nam's FDI flows often

originate from other Asian countries, separate equations were estimated for each of the major investors to capture changes in the adjustment process that is underway in the Asian economies. The ten largest foreign investment sources accounted for 87 percent of Viet Nam's FDI in 1997. Taiwan, a major investor, was excluded for lack of data on some of the key variables explaining FDI movements.

As with all other activity variables in the model, the concepts in the behavioral relationship are estimated in real terms. The final estimated relationship shows that the coefficient for the output variable is of the correct sign. FDI responds to domestic economic activity in the investor country and the real exchange rate for the investor in his own currency relative to that of Viet Nam. The final equations for the major sources of investment are as follows:

(a) Japan

$$\ln(KFJPD)_t = 9.6 + \underset{(0.12)}{2.75}\ln(NYJPR)_{t-1} - \underset{(1.2)}{3.99}\ln(EJPDR)_t$$

$R^2 = 0.82$ DW = 1.8 Period: 1993-97

where KFJPD FDI inflow from Japan, US dollar value
NYJPR GDP of Japan, real value
EJPDR Real exchange rate (VN dong per Japanese yen)

(b) Singapore

$$\ln(KFSGD)_t = -18 + \underset{(8.5)}{4.9}\ln(NYSGR)_{t-1}$$

$R^2 = 0.95$ DW = 2.8 Period: 1993-97

where KFSGD FDI inflow from Singapore, US dollar value
NYSGR GDP of Singapore, real value
ESGDR Real exchange rate (VN dong per Singapore dollar)

(c) Hong Kong

$$\ln(KFHKGD)_t = 14.7 + \underset{(2.5)}{6.9}\ln(NYHKR)_t - \underset{(2.1)}{4.11}\ln(EHKDR)_t$$

$R^2 = 0.87$ DW = 2.4 Period: 1992-97

where KFHKD FDI inflow from Hong Honk, US dollar value
NYHKR GDP, real value

EHKDR Real exchange rate (VN dong per Hong Kong dollar)

(d) Korea

$$\ln(KFKRGD)_t = -17.7 + 3.03 \ln(NYKRR)_{t-1} + 3.63 \ln(EKRDR)_{t-1}$$
$$(34.3) \qquad (33.7)$$

$R^2 = 0.99$ DW = 2.5 Period: 1994-97

where KFKRD FDI inflow from Korea, US dollar value
NYKRR GDP of Korea, real value
EKRDR Real exchange rate (VN dong per Korean won)

(e) Malaysia[1]

$$\ln(KFMYD)_t = -9.9 + 3.11 \ln(NYMYR)_{t-1}$$
$$(3.4)$$

$R^2 = 0.90$ DW = 3.0 Period: 1993-97

where KFMLD FDI inflow from Malaysia, US dollar value
NYMYR GDP of Malaysia, real value
EMLDR Real exchange rate (VN dong per Malaysian ringgit)

(f) Thailand[2]

$$\ln(KFTLD)_t = 10.4 + 1.72 \ln(NYVNR)_{t-1} - 2.52 \ln(ETLDR)_t$$
$$(2.6) \qquad (7.0)$$

$R^2 = 0.99$ DW = 2.5 Period: 1993-97

where KFTLD FDI inflow from Thailand, US dollar value
NYTLR GDP of Thailand, real value
ETLDR Real exchange rate (VN dong per Thailand baht)

[1] Includes a binary variable for 1994 (1 in 1994; 0 otherwise).
[2] Includes a binary variable for 1994 (1 in 1994; 0 otherwise).

g) France[3]

$$\ln(KFFRD)_t = -5.3 + 2.15 \ln(NYFRR)_t$$
$$(1.0)$$

$R^2 = 0.99$ DW = 2.5 Period: 1993-97

where KFFRD FDI inflow from France, US dollar value
NYFRR GDP of France, real value
EFRDR Real exchange rate (VN dong per French franc)

(h) USA[4]

$$\ln(KFUSD)_t = -49.9 + 7.86 \ln(NYUSR)_{t-1} + 1.91 \ln(EUSDR)_t$$
$$(3.9) \qquad (2.0)$$

$R^2 = 0.94$ DW = 2.8 Period: 1994-97

where KFUSD FDI inflow from the United States, US dollar value
NYUSR GDP of the United States real value
EUSDR Real exchange rate (VN dong per US dollar)

Table 9.1 summarizes the long-term, or steady-state, equilibrium solutions of the estimated FDI equations.

Table 9.1
Steady-State Solution of FDI Equations

	Income Elasticity	Cross-Rate Elasticity
Japan	2.75	-3.99
Singapore	4.91	-0.77
Hong Kong	6.88	-1.80
Korea	3.03	3.62
Malaysia	3.12	0.98
Thailand	1.72	-2.52
France	2.15	-1.29
USA	7.87	1.91

For other investment, domestic economic activity in Viet Nam and the real domestic interest rates (lending rate) were included as explanatory variables. Because real interest rates were

[3] Includes binary variables for 1994 and 1996.
[4] Includes a binary variable for 1994 (1 in 1994; 0 otherwise).

negative in some of the early years in the sample, the logarithm of the variable could not be calculated for those years. Instead, the variable used was the logarithm of the ratio of the nominal interest rate to the domestic rate of inflation. This allowed the full sample period to be included in the equation estimate. The final equation is as follows:[5]

$$\ln(NIOVR)_t = -2.17 + 1.04 \ln(NYVNR)_t - 0.01 \ln(VIBOL/NINFP)_t$$
$$(15.4) \qquad (0.1)$$
$$R^2 = 0.99 \qquad DW = 2.8 \qquad \text{Period: 1993-97}$$

where	NIOVR	Investment excluding FDI, real value
	NYVNR	GDP, real value
	VIBOL	Interest rate, nominal
	NINFP	Inflation, based on CPI index.

Future estimates of investment should separate gross capital formation from changes in stocks. Stock changes are normally inversely related to the general level of economic activity. An increase in economic activity leads to a draw-down of stocks, and conversely, a cutback in economic activity often results in an accumulation of stocks.

9.3 Imports

The imports equation is estimated for the aggregate of all goods imported by Viet Nam.[6] Imports are related to the current real value of GDP and both the current and lagged real effective exchange rate. The estimated coefficients are of the right signs and magnitudes. As data becomes available, imports should be decomposed into consumer goods, intermediate goods and capital goods. Also, future extensions of the model should consider commercial policies that include trade liberalization policies through tariff reductions.[7]

---

[5] Includes a binary variable for 1993 (1 in 1993; 0 otherwise).

[6] An effort was made to desegregate imports into the following components: Consumer goods (SITC 0 + 1 + 8), petroleum (SITC 3), intermediate goods (SITC 2 + 4 + 5 + 6), and capital goods (SITC 7). However, data limitations prevented such a disaggregation. As information becomes available for these categories, their inclusion in the model would permit policies to be examined in terms of their effects on consumer goods versus capital and intermediate goods. In the estimation of these functions, the activity variable used to explain Vietnamese imports would be determined by the purpose of the import. In the case of consumer goods, oil, and intermediate goods, real GDP would be used as the explanatory variable. In the case of capital goods, it would be preferable to use fixed investment and test for the significance of (a) total fixed investment, and (b) private and government fixed investment separately, since the level of the response of these two sectors might be significantly different from one another.

[7] The effective, or observed, import price includes tariffs. Consequently, expenditure-switch policies in the form of tariffs can easily be modeled by the explicit separation of the tariff rate from the price variable in the import demand equation. The tariff rate is the value of tariff collected relative to the value of merchandise imports in each category. A description on how to model trade policies, including tariffs and non-tariff barriers to trade, exchange rate policies,

The final equation for import volume is:[8]

$$\ln(MMEQI)_t = \underset{}{-1.91} + \underset{(3.1)}{1.53}\ln(NYVNR)_t - \underset{(4.7)}{1.96}\ln(EUSDR)_t - \underset{(1.7)}{0.73}\ln(MMEPI)_{t-1}$$

$R^2 = 0.97$ DW = 1.7 Period: 1989-97

where MMEQI Merchandise imports, real value
NYVNR GDP, real value
EUSDR Real effective exchange rate (VN dong per US dollar)

Import prices are related to world trade price of manufactures. In the final equation, the price of Vietnamese imports has a one-year lagged response to changes in world trade prices of manufactures. Moreover, Viet Nam's import prices have a more-than-proportional response to changes in the representative world price of manufactures. The magnitude this responsiveness is time invariant since its magnitude is the same over different sample periods of the regression estimate. Over the long run, the percentage change in Viet Nam's import prices would be expected to be the same as that of world market prices (that is, import prices would be expected to have a unitary elasticity with respect to world market prices). The observed non-unitary elasticity in the medium term is likely to reflect differences in the geographic and commodity composition of the price index from that which has been used as the reference price for world trade of manufactures in the model (the reference price is the widely used unit value of manufactured exports maintained by the World Bank and the International Monetary Fund).

The final import price equation is as follows:

$$\ln(MMEPI)_t = \underset{}{-3.97} + \underset{(9.02)}{1.86}\ln(PMUVP)_{t-1}$$

$R^2 = 0.95$ DW = 2.0 Period: 1990-97

where MMEPI Unit value of merchandise imports, index of US dollars
PMUVP Export unit value index for manufactures of the advanced countries, US dollar

In addition two binary variables were used to account for significant outliers in the estimated equation in 1992 and 1993.

Non-factor service payments are related to the current real value of GDP and both the current real effective exchange rate. The estimated coefficients are of the right signs and magnitudes. The final equation is as follows:

---

and export promotion policies, can be found in Lord (1991).

[8] Includes a binary variable for 1990 (1 in 1990; 0 otherwise).

$$\ln(CSPVD)_t = -6.7 + 2.80 \ln(NYVNR)_t - 2.12 \ln(EUSDR)_t$$
$$(5.1) \qquad (3.9)$$

$R^2 = 0.99$ DW = 2.2 Period: 1991-97

where CSPVD Non-factor service payments, US dollars, nominal value
NYVNR Real GDP
EUSDR Exchange rate, US dollar, real

Profit remittances equal the returns on FDI relative to total portfolio investment, which is given by the following:

$$PR_t = r_t FDI_t$$

where
PR = profit remittances
r = return on FDI

9.4 Exports

The volume of exports is related to the economic activity of Viet Nam's foreign markets and the real exchange rate. Viet Nam's exports are generally responsive to changes in the economic activity of its foreign markets. The coefficient estimate for the real exchange rate is also significant and generally has the correct sign. The relatively large magnitude of the coefficient shows that changes in the real exchange rate can have a significant impact on exports via either nominal exchange rate changes or relative price movements.

Export markets have been separated into three major regions: (a) Asia, with separate market estimates for Japan, China and the ASEAN member countries of Indonesia, Malaysia, Singapore, and Thailand; (b) the European Union; and (c) North America, with separate market estimates for Canada and United States. The following are the results of the equation estimates:

(a) Japan[9]

$$\ln(XMJPR)_t = 0.67 + 0.61 \ln(XMJPR)_{t-1} + 0.95 \ln(NYJPR)_t + 0.08 \ln(EJPDR)_{t-1}$$
$$(18.1) \qquad (2.4) \qquad (5.9)$$

$R^2 = 0.99$ DW = 1.9 Period: 1989-97

where XMJPR Exports to Japan, in 1992 dollars

[9] Includes binary variables for 1991 and 1994.

NYJPR GDP of Japan, in 1992 dollars
EJPDR Real exchange rate (VN dong per Japanese yen)

(b) Singapore

$$\ln(XMSGR)_t = -11.4 + 3.2 \ln(NYSGR)_t + 0.94 \ln(ESGDR)_{t-1}$$
(8.6) (0.3)

$R^2 = 0.71$ DW = 1.8 Period: 1992-97

where XMSGR Exports to Singapore, in 1992 dollars
NYSGR GDP of Singapore, in 1992 dollar
ESGDR Real exchange rate (VN dong per Singapore dollar)

(c) Thailand

$$\ln(XMTHR)_t = -16.2 + 5.3 \ln(NYTLR)_t$$
(4.2)

$R^2 = 0.68$ DW = 1.1 Period: 1988-97

where XMTHR Exports to Thailand, in 1992 dollars
NYTLR GDP of Thailand, in 1992 dollars

(d) Australia

$$\ln(XMAUR)_t = -12.1 + 4.5 \ln(NYAUR)_{t-1} + 0.35 \ln(NYAUR)_{t-1}$$
(2.1) (0.3)

$R^2 = 0.80$ DW = 2.1 Period: 1992-97

where XMAUR Exports to Australis, in 1992 dollars
NYAUR GDP of Australia, in 1992 dollars

(e) China

$$\ln(XMCHR)_t = -10.5 + 3.4 \ln(NYCHR)_{t-1} + 0.79 \ln(ECHDR)_{t-1}$$
(42.1) (8.8)

$R^2 = 0.99$ DW = 1.3 Period: 1992-97

where XMCHR Exports to China, in 1992 dollars

NYCHR GDP of Thailand, in 1992 dollars
ECHDR Real exchange rate (VN dong per Chinese yuan)

(f) European Union

$$\ln(XMEUR)_t = \underset{(104.2)}{2.98}\ \ln(XMEUR)_{t-1}$$

$R^2 = 0.44$ DW = 1.0 Period: 1994-97

where XMEUR Exports to the European Union, in 1992 dollars
NYEUR GDP of the European Union, in 1992 dollars
EEUDR Real exchange rate (VN dong per EU basket of currencies)

(f) United States

$$\ln(XMUSR)_t = \underset{(104.2)}{2.68}\ \ln(XMUSR)_{t-1}$$

$R^2 = 0.19$ DW = 1.4 Period: 1995-97

where XMUSR Exports to the United States, in 1992 dollars
NYUSR GDP of the United States, in 1992 dollars
EUSDR Real exchange rate (VN dong per US dollar)

(g) Canada

$$\ln(XMCNR)_t = -62.7 + \underset{(8.7)}{15.4}\ \ln(NYCNR)_{t-1} + \underset{(2.0)}{0.11}\ \ln(ECNDR)_{t-1}$$

$R^2 = 0.99$ DW = 3.3 Period: 1992-97

where XMCNR Exports to Canada, in 1992 dollars
NYCNR GDP of Canada, in 1992 dollar
ECNDR Real exchange rate (VN dong per Canadian dollar)

Table 9.2 summarizes the long-term, or steady-state, equilibrium solutions of the estimated export demand equations.

Table 9.2
Steady-State Solution of Export Demand Equations

	Income Elasticity	Cross-Rate Elasticity
Japan	2.4	0.21
Singapore	3.2	0.94
Thailand	5.4	-
Australia	4.5	0.35
China	3.4	0.79
European Union	3.0	-
United States	2.7	-
Canada	15.4	0.11

Non-factor service receipts are related to the current real value of world GDP, but were not found to be related to either the current or lagged value of the real effective exchange rate. The final equation is as follows:

$$\ln(CSRVD)_t = -27.7 + \underset{(9.7)}{7.45}\ \ln(NYWDR)_t$$

$R^2 = 0.97$ DW = 2.8 Period: 1992-97

where CSRVD Non-factor service receipts, US dollars, nominal value
NYWDR Real GDP of the world

The tests of randomness of disturbances based on the Durbin-Watson statistic indicate the possibility of serial correlation. However, correction for serial correlation should not be undertaken before other tests related to left-out variables are performed. Given the parsimonious nature of the present model, such tests were left for future extensions and disaggregation of the model.

9.5 Aggregate Supply

Output of the secondary and tertiary sectors depend on primarily on investment and consumption levels respectively. The final equation for the secondary sector is as follows:

$$\ln(NISVR)_t = -3.7 + \underset{(81.0)}{1.21}\ \ln(NYVNR)_t$$

$R^2 = 0.99$ DW = 3.4 Period: 1993-97

where NISVRValue added of secondary sector, real
NYVNR GDP, real

The final equation for the tertiary sector is as follows:

$$\ln(NSSVR)_t = -5.4 + 1.41 \underset{(7.7)}{\ln(NCTVR)_t}$$

$R^2 = 0.92$ DW = 2.0 Period: 1991-97

where NSSVR Value added of tertiary sector, real
NCTVR Total consumption, real

Output of the primary sector is calculated as a residual from the equilibrium condition for aggregate supply and demand:

$$NASVR = NYVNR - NISVR - NSSVR$$

9.6 Interest Rates and Prices

The ***real rate of interest*** depends on real money balances, *M/P*, and the level of income, *Y*. The final equation for the rate of interest has the expected signs:[10]

$$\ln(VIBOR)_t = 13.75 + - \underset{(1.8)}{1.92 \ln(FM2VL/NYVNP)_t}$$

$R^2 = 0.44$ DW = 2.3 Period: 1992-97

where VIBOR Real interest rate
FM2VL M2 or total liquidity
NYVNP GDP deflator

The ***price level*** is derived from the aggregate supply of output and total expenditures, and the price level is positively related to the money supply and output, and negatively related to the interest rate. The final form of the estimated equation is as follows:

$$\ln(NYVNP)_t = -0.34 + \underset{(11.3)}{0.50 \ln(FM2VL)_{t-1}}$$

$R^2 = 0.97$ DW = 1.4 Period: 1992-97

where FM2VL M2 or total liquidity
NYVNP GDP deflator

[10] Includes a binary variable in 1996 (1 in 1996; zero otherwise).

9.7 Structural Changes

Estimates of behavioral equations in the macroeconomic model are based on time series data from 1988 to 1997. The economic reforms during this period are likely to have produced significant changes in the responsiveness of economic agents in the public, private, financial, and external sectors of the economy to key economic variables. These changes translate into possibly unstable coefficients in the model that could invalidate policy simulations or predictions based on post-sample data.

If parameter changes have indeed occurred during 1988-97, then problems would arise in the use of conventional estimation techniques for building a time-invariant model. The alternative formulation would be to use time-varying parameters in the model. Essentially this involves an abandonment of key assumptions such as normality in the distribution of observations, and the stationarity of cointegrated variables.[11] The procedure for the re-estimation of the model would then involve the identification of structural changes which occur at each time period in the historical period, and the introduction of coefficient matrices that are endogenous in the model (for details, see Harvey, 1990: 341-44). The major drawback of utilizing this approach in the model for Viet Nam is that information about how parameters might change in each projected time period is rarely available. As a result, additional subjectivity would be introduced into the forecasts. The post-sample predictive test is then a test of parameter constancy.

In order to test for parameter constancy in the model, a Chow test has been performed for a time period before and after 1992. Since the number of observations in one of the two sub-periods in the sample period is less than or equal to the number of constraints plus one, the Chow test is based on the following *F*-test:

$$F = \frac{(RSS_o - RSS_1) / n_2}{RSS_1 / (n_1 - k)}$$

where

RSS_o	Residual sum of squares of sample period 1988-97.
RSS_1	Residual sum of squares of sample from 1988-95 period.
n_1	Number of observations in sample from 1988-95 period.
n_2	Number of observations in sample from 1996-97 period.
k	Number of constraints.

[11] Variables are said to be cointegrated when there exists a stationary linear combination of their series. Suppose that the first difference of two variables, *x* and *y*, grow over time in such a way that the linear combination of these two variables, given by $d_t = x_t - \alpha y_t$, is stationary. If α is unique, then *x* and *y* are said to be cointegrated (for details, see Engle and Granger, 1987). The existence of long-run relationships in the behavioral equations of the model suggests that future extensions of the model should test for cointegrating relationships and use an error-correction form to describe the behavioral relationships in the model.

Formally, the F-statistic tests the null hypothesis that the behavioral equations estimated by the sample including the period 1996-97 come from the sample for the period 1988-95. Basic structural reforms are still incomplete in Viet Nam, and their eventual implementation could produce parameter changes in the present model. In this context, structural changes can be viewed as part of the transition process, without a clear demarcation of change points. The work of Andrews (1993) suggests that, when change points are unknown, alternative tests consisting of Wald, Lagrange multiplier, and likelihood ratio-like tests for parameter instability be used for both unknown change points or within restricted intervals. Further work on the present macroeconomic model for Viet Nam could adopt these test procedures to examine structural changes.

10. MACROECONOMIC PROJECTIONS AND POLICY ASSESSMENTS

10.1 Baseline Forecast

The baseline projections of the model incorporate key assumptions about exogenous and policy-related variables. The principal policy variables for the Vietnamese economy are the exchange rate, the fiscal budget, and a change in the net domestic assets component of the money supply that can be used to influence the interest rate. The principal exogenous variables are the economic growth rates, inflation and exchange rates of Viet Nam's foreign markets and investors. The forecasts generated by the model are indicative of the direction of the economy and should be interpreted with caution since the model results depend on key assumptions and are demand driven, insofar as they exclude details about the production-side of the economy. Nevertheless, the results provide a parsimonious representation of the Vietnamese economy that yield an internally consistent set of estimates about the likely outcome of events over the next few years. They therefore point to important issues about the near-term prospects of the economy.

The baseline assumptions for Viet Nam's major export markets and investors assume that the global economy will gradually recover in the course of 1999, and maintain that trend growth in 2000-2001 (see Table 10.1). Larger than anticipated contractions in economic activity have been experienced in a number of countries, especially Malaysia, Indonesia and Japan. The contractions have developed during 1998 because of large declines in consumption and investment associated with a loss of confidence, the widespread deflation of asset values in the region, substantial corporate debt burdens, and large reversals of capital flows (IMF, 1998). These domestic demand declines have translated into lower demand for Viet Nam's exports, which rely heavily on Asian markets. Japan is likely to stagnate in both 1998 and 1999, after growing only 1 percent in 1997. The baseline projections assume that Japan's recession will experience a 2.5 percent contraction of GDP growth in 1998. The risk to this assumption is predominantly on the downside and a significantly worse outcome is

Table 10.1
Baseline Assumption for Foreign GDP Growth

	1998	1999	2000	2001
World	2.0	2.1	2.9	2.9
Australia	1.4	2.3	2.3	2.3
Canada	3.0	2.5	2.5	2.5
China	6.0	5.0	5.0	5.0
Hong Kong	0.7	1.8	1.8	1.8
Indonesia	-2.9	0.7	0.7	0.7
Japan	1.0	1.5	1.5	1.5
Korea	1.8	0.6	0.6	0.6
Malaysia	-4.8	1.0	1.0	1.0
Singapore	1.8	0.7	0.7	0.7
Thailand	0.0	0.5	0.5	0.5
United Kingdom	2.3	1.2	1.2	1.2
USA	2.0	1.9	1.9	1.9
EU	2.7	2.3	2.1	2.1
France	3.1	2.8	2.8	2.8

Source: Individual country forecasts for 1998-99 from IMF, Economic Outlook (August 1998); world economic growth in 1998-2000 from OECD, Economic Outlook (November 1998). Growth is assumed to remain unchanged thereafter.

clearly possible in this important market for Viet Nam. The other risk factor is the possibility that China's economic growth could decelerate further in 1999. The potential for a broader and deeper economic downturn in Japan and China would severely impact on Viet Nam's exports and its overall economic growth in 1998-99. In the European Union there is likely to be a deceleration of growth from 2.7 percent in 1997 to 2.4 percent in 1998 and 2.1 percent in 1999 as the region focuses on meeting the EMU requirements. In the United States economic growth is unlikely to surpass 2.0 percent in 1998 and 1.9 percent in 1999, following a robust 3.8 percent growth in 1997.

Table 10.2
Baseline Assumptions for Foreign Prices and Exchange Rates (Percentage)

	1998	1999	2000	2001
Inflation:				
Australia	2.5	1.5	1.5	1.5
Canada	0.0	1.0	1.0	1.0
China	6.0	1.5	1.5	1.5
Hong Kong	1.5	1.5	1.5	1.5
Indonesia	6.0	7.0	7.0	7.0
Japan	0.4	-1.0	-1.0	-1.0
Korea	5.7	1.5	1.5	1.5
Malaysia	5.7	7.0	7.0	7.0
Singapore	5.7	1.5	1.5	1.5
Thailand	6.0	7.0	7.0	7.0
United Kingdom	2.6	2.5	2.5	2.5
USA	1.2	2.0	2.0	2.0
EU	1.8	1.7	1.7	1.7
France	0.4	1.4	1.4	1.4
World Trade Prices:				
Manufactures 1/	-3.9	0.6	0.6	0.6
Primary Commodities	-4.9	0.4	0.4	0.4

Source: IMF, Economic Outlook (August 1998) for 1998-99.Thereafter, growth is assumed to remain unchanged.

The exchange rate projections are based on actual changes that have already taken place as of October 1998 and, in the base forecast, they are assumed to generally maintain that trend in real terms (see Table 10.3). Among Viet Nam's major Asian markets the currencies of Thailand, Indonesia, Malaysia, and Korea have all depreciated substantially since mid-1997. Although the Indonesian rupiah remains deeply depreciated, it has recovered significantly from its low in June 1998. In Malaysia exchange and capital controls were introduced in early September to support a renewed peg of the ringgit to the U.S. dollar. In China a sharp slowdown of economic growth could lead to a devaluation of the Chinese yuan in an effort to expand export revenue. Although Chinese foreign exchange reserves are large due to the required repatriation of 85 percent of overseas earnings, the fall in 1998 export earnings following a 21 percent surge in 1997 point to the possible devaluation of the yuan. Such a devaluation could trigger another round of region-wide currency depreciation that could further exacerbate Viet Nam's international competitive position. In Viet Nam, itself, the authorities have devalued the exchange rate and

Table 10.3
Baseline Assumptions for Nominal Exchange Rates (percent changes)

	1998	1999	2000	2001
Vietnam	13.5	6.0	6.0	6.0
Australia	8.1	-0.5	-0.5	-0.5
Canada	-0.2	-1.0	-1.0	-1.0
China	8.1	-0.5	-0.5	-0.5
Hongkong	0.0	-0.5	-0.5	-0.5
Indonesia	13.1	5.0	5.0	5.0
Japan	3.0	-3.0	-3.0	-3.0
Korea	0.0	-0.5	-0.5	-0.5
Malaysia	12.7	5.0	5.0	5.0
Singapore	3.5	-0.5	-0.5	-0.5
Thailand	8.3	5.0	5.0	5.0
U. Kingdom	2.6	0.5	0.5	0.5
USA	0.0	0.0	0.0	0.0
EU	-2.0	-0.3	-0.3	-0.3
France	-1.9	-0.6	-0.6	-0.6

Source: IMF, Economic Outlook (August 1998) for 1998-99.

the current rate towards the end of 1998 has been 13.5 percent higher than at the start of the year.

Finally, although world non-fuel commodity prices are projected to decline significantly in 1998, commodity export prices of Viet Nam are expected to fare better because of price advances in coffee and rice. The present forecast therefore assumes unchanged commodity export prices for Viet Nam in 1998 and a gradual recovery thereafter. On the import side, prices are expected to follow the manufactured unit price index of industrialized countries' exports, and they are

Table 10.4
Projections of Key Macroeconomic Variables

	Units	Actual 1997	1998	1999	2000	2001
GDP	Bill.1992 dong	172,175	178,188	183,490	192,617	203,129
Agriculture	Bill.1992 dong	45,138	45,407	46,057	47,301	48,688
Industry	Bill.1992 dong	53,777	56,161	58,188	61,707	65,803
Services	Bill.1992 dong	73,261	76,620	79,245	83,608	88,638
Savings and Investment						
Gross Domestic Investment	Bill.1992 dong	49,984	38,785	40,046	42,026	44,299
Gross Domestic Savings	Bill.1992 dong	37,644	39,010	41,005	44,658	48,979
Fiscal Indicators						
Total Revenue	Bill.1992 dong	37,665	37,939	38,528	39,304	40,251
Total Expenditures	Bill.1992 dong	40,208	40,878	41,564	42,266	42,985
Deficit (before grants)	Bill.1992 dong	(2,543)	(2,939)	(3,036)	(2,962)	(2,734)
Money and Prices						
Broad Money (M2)	Bill. Dong	75,680	84,280	95,292	110,994	133,143
GDP Deflator	Bill. Dong	172	189	199	212	230
Balance of Payments						
Exports	Mill US$	8,955	9,178	9,786	10,428	11,197
Imports	Mill US$	10,313	9,370	10,148	10,947	11,891
Current Account Balance	Mill US$	(1,639)	162	268	518	833
Capital Account	Mill US$	2,064	876	924	968	1,017
Percentage Changes:						
GDP	Percent	10.5	3.5	3.0	5.0	5.5
Agriculture	Percent	6.5	0.6	1.4	2.7	2.9
Industry	Percent	12.2	4.4	3.6	6.0	6.6
Services	Percent	11.8	4.6	3.4	5.5	6.0
Savings and Investment						
Gross Domestic Investment	Percent	15.0	(22.4)	3.3	4.9	5.4
Gross Domestic Savings	Percent	41.9	3.6	5.1	8.9	9.7
Fiscal Indicators						
Total Revenue	Percent	5.4	0.7	1.6	2.0	2.4
Total Expenditures	Percent	3.8	1.7	1.7	1.7	1.7
Deficit (before grants)	Percent	(14.7)	15.6	3.3	(2.4)	(7.7)
Money and Prices						
Broad Money (M2)	Percent	17.0	11.4	13.1	16.5	20.0
GDP Deflator	Percent	3.5	9.8	5.7	6.6	8.2
Balance of Payments						
Exports	Percent	22.2	2.5	6.6	6.6	7.4
Imports	Percent	(1.6)	(9.1)	8.3	7.9	8.6
Current Account Balance	Percent	(31.6)	(109.9)	65.8	92.8	60.9
Capital Account	Percent	-	(57.6)	5.4	4.8	5.0

therefore expected to fall by nearly 4 percent in 1998 and thereafter recover at a somewhat faster rate that those of primary commodities.

The results for the baseline forecasts are presented in Table 10.4. In 1998 Vietnam's economic growth is expected to decelerate sharply from the 10 9 percent rate achieved in 1997. Given the dramatic slowdown of economic growth in its major export markets and investors from Asia, the model predicts a growth rate for Viet Nam of 3.5 percent for the current year. Production growth of all sectors is expected to decelerate, particularly that of agriculture. The unconstrained model projects an inflation rate of 13 percent but since actual figures suggest a somewhat smaller price rise of 10 percent, that figure was used in the model by introducing an add-factor that forced inflation to equal 10 percent in 1998 but thereafter inflation was endogenous in the model.

Table 10.5
Trade Indicators of Viet Nam, 1988-97

	Terms of Trade (TOT)	Purchasing Power of Exports 1/	Cost of of TOT Deterioration 2/
1992	100.0	100.0	-1.6%
1993	103.6	124.8	1.0%
1994	109.9	167.2	1.9%
1995	121.8	219.6	4.1%
1996	99.9	264.0	-8.0%
1997	96.5	320.5	-1.4%
1998	99.0	334.7	0.9%
1999	100.0	358.4	0.4%
2000	100.0	383.2	0.0%
2001	100.0	413.4	0.0%

1/ TOT x export volume.
2/ Percent change in TOT x Imports/GDP ratio

In the balance of payments, the 1998 trade balance is projected to improve as a result of a sharp decline in the volume of imports, coupled with lower import prices. Export growth is expected to decelerate sharply as a result of slower economic growth and import demand of foreign markets, especially those of Japan, Indonesia and Malaysia. The effects of Viet Nam's terms of trade deterioration are shown in Table 10.5. Since imports represent more than one-third of GDP, the moderate term of trade improvement has a significant impact in terms of the country's overall production in both 1998 and 1999. Moreover, those terms of trade improvements and modest increases in the volume of exports during the forecast period lead to substantial improvements in Viet Nam's import potential.

Exchange rate movements are also likely to have a large impact on Viet Nam's trade balance. Notwithstanding the devaluation of the Vietnamese dong during 1998, the real exchange rate of Viet Nam relative to Indonesia, Malaysia and Australia appreciated and reduced the country's competitiveness in those markets. These movements have been offset by the real exchange rate devaluation of the Vietnamese dong relative to the US dollar and the currencies of the European Union, China and Hong Kong, Japan, Korea and Singapore. Improved conditions in most Asian markets are expected to renew demand for Viet Nam's exports in 1999-2001 and, coupled with modest domestic import demand growth, lead to further improvements in Viet Nam's current account during those years.

Foreign investment has largely originated from Asian investors in Viet Nam, and the Asian financial crisis has severely curtailed inflows. Viet Nam's decline in competitiveness is also

likely to have sharply dampened incentives for further investment. Under these conditions, the growth of foreign direct investment is projected to drop to around US$600 in 1998. Thereafter inflows are expected to increase at a modest rate. Although these developments will significantly affect the ability of the capital account to sustain Viet Nam's current account deficit, the gradual improvements in the current account should relieve the pressure on Viet Nam's external financing requirements.

10.2 Effects of an Accelerated Asian Recovery

Although the baseline forecasts explicitly incorporate a modest recovery of the Asian economies in 1999 and thereafter, it is possible that the recovery could either be delayed or accelerated. Table 10.6 shows two possible scenarios. The first one shows the results of an accelerated recovery in 1999 in Asia and elsewhere; the second demonstrates the effects of an accelerated recovery, though it is delayed to 2000. In both cases, the economic growth of the Asian countries in the base forecasts is increased by two percentage points; for countries outside the region, the economic growth rate is increased by one percentage point.

The results for these optimistic scenarios underscore the importance of events in the Asian region for Viet Nam. That country's economic growth could accelerate from the baseline projection of 3 percent in 1999 to around 4.5 percent. A delay of the accelerated recovery would augment the country's baseline growth of 5 percent in 2000 to around 6.5 percent. Improvements in the current account are likely to be twice as great as the improvements in the capital account associated with large FDI inflows. Nevertheless, the effects on both accounts are substantial.

Changes in net foreign assets would raise increase the economy's total liquidity and the stock of M2. This increase would be translated into higher prices but it is assumed that the SBV would maintain the real exchange rate of the economy unchanged by a commensurate devaluation in the nominal exchange rate of the Vietnamese dong relative to the US dollar. In the fiscal accounts, the government's revenue from taxes on trade would increase and, if expenditures remain unchanged, the fiscal deficit would be reduced.

A pessimist scenario for the Asian region would have symmetrical effect on Viet Nam. Thus, growth rates of two percentage points below those used in the baseline forecast for Asia, and rates that would be one percentage point below those for North America and Europe would have the opposite effect. For example, a deceleration of economic growth in 1999 would lower the baseline forecast for GDP growth of Viet Nam from 3 percent to 1.5 percent. As mentioned earlier, the risk of the baseline assumptions is predominantly on the downside and a significantly worse outcome is therefore clearly possible for Viet Nam from a broader and deeper economic downturn in Japan and China. Moreover, a slowdown of economic growth in China could lead that country's monetary authorities to devalue the yuan in an effort to expand export revenue. As mentioned earlier, such a devaluation could trigger another round of region-wide currency depreciation that would further exacerbate Viet Nam's international competitive position unless the SBV took aggressive steps to not only maintain the value of the dong, but to improve the

country's international competitiveness.

Table 10.6
Projections of Key Macroeconomic Variables with Accelerated Recovery in Foreign Markets and Investors

	Units	1998	1999	2000	2001	Cumulative Difference
GDP						
Base	Percent	3.5%	3.0%	5.0%	5.5%	-
1999 Accelerated Recovery	Percent	3.5%	4.6%	7.9%	8.8%	8%
2000 Accelerated Recovery	Percent	3.5%	3.0%	6.7%	8.5%	5%
Balance of Payments						
Current Acct Balance						
Base	Mill. USD	162	268	518	833	-
1999 Accelerated Recovery	Mill. USD	162	345	734	1,255	716
2000 Accelerated Recovery	Mill. USD	162	268	606	1,086	342
Capital Acct Balance						
Base	Mill. USD	876	924	968	1,017	-
1999 Accelerated Recovery	Mill. USD	876	947	1,065	1,206	309
2000 Accelerated Recovery	Mill. USD	876	924	994	1,122	132
Fiscal Indicators						
Total Revenue						
Base	Bill.1992 dong	0.7%	1.6%	2.0%	2.4%	-
1999 Accelerated Recovery	Bill.1992 dong	0.7%	2.3%	3.6%	4.5%	4%
2000 Accelerated Recovery	Bill.1992 dong	0.7%	1.6%	2.9%	4.2%	3%
Expenditures						
Base	Bill.1992 dong	40,878	41,564	42,266	42,985	-
1999 Accelerated Recovery	Bill.1992 dong	40,878	41,564	42,266	42,985	-
2000 Accelerated Recovery	Bill.1992 dong	40,878	41,564	42,266	42,985	-
Deficit (before grants)						
Base	Bill.1992 dong	(2,939)	(3,036)	(2,962)	(2,734)	-
1999 Accelerated Recovery	Bill.1992 dong	(2,939)	(2,741)	(2,053)	(958)	2,980
2000 Accelerated Recovery	Bill.1992 dong	(2,939)	(3,036)	(2,629)	(1,696)	1,371
Money and Prices						
Total Liquidity (M2)						
Base	Percent	11.4%	13.1%	16.5%	20.0%	-
1999 Accelerated Recovery	Percent	11.4%	14.7%	21.0%	27.6%	14%
2000 Accelerated Recovery	Percent	11.4%	13.1%	18.2%	24.7%	6%
Inflation						
Base	Percent	9.8%	5.7%	6.6%	8.2%	-
1999 Accelerated Recovery	Percent	9.8%	5.7%	7.3%	10.3%	3%
2000 Accelerated Recovery	Percent	9.8%	5.7%	6.6%	9.0%	1%

10.3 Evaluation Policy Effects and External Shocks to the System

The magnitude of the influence of policy variables on real economic activity (GDP, consumption, investment, imports and exports) and price-related variables (interest rates, real exchange rates, and the prices) are calculated through multiplier analysis. This type of analysis provides an opportunity to evaluate the dynamic properties of the system of equations describing the economy of View Nam in terms of the adjustment process of the system from one steady-state growth path to another when changes in policy variables take place. Dynamic multipliers

measure the effects on the activity and price-related variables of an increase or decrease in the values assigned to the policy variable by some constant amount which is then either maintained or returned to its original level in all subsequent periods. Dynamics are introduced when calculated, rather than actual, values are used for lagged endogenous variables in the system, and they show the time path of the economic activity variables generated by changes in the policy variables. The first-period effect is the impact multiplier; the interim multiplier measures the effect after *n* years; the cumulative multiplier measures the total response.

In the calculation of the multipliers, two solutions are obtained from the dynamic simulations of the macroeconomic model.[1] The difference between the two simulations in their predetermined variables occurs in the value assumed by the policy variable. The first set of values for the policy variable generates the control solution. The second set of values incorporates an increase in the policy variable whose unit increase is sustained throughout the remainder of the simulated period. For purposes of cross-policy comparisons, it is often convenient to alter the policy variable in the control solution by one percent. Comparison of the two solution paths then provides information about the contemporaneous response (impact multiplier), the interim response (interim multiplier) and the total response (total multiplier).[2]

Table 10.6 illustrates a range of policy applications for the macroeconomic model for View Nam. These applications are by no means exhaustive of the types of policy analyses that are possible with the present model structure, but rather are intended to serve as illustrations of the types of policy issues that can be examined, notwithstanding the limited data set currently available for the country.

In general, the results are consistent with expectations about the operation and effect of an economy operating under a fixed exchange rate system and with limited capital mobility. Changes in the real exchange rate have a strong impact on the current and capital accounts through both exports and imports, as well as FDI movements. The cumulative effect of a one-time one percent devaluation is to increase exports by 5.3 percent over a four-year period. These results are in line with other recent studies reported by the World Bank (1998, Chapter 3), which found that a 10 percent exchange rate depreciation in the East Asian countries is associated with a 4 to 6 percent expansion in their volume of exports (see also Dasgupta, Hulu and Dastgupta (1995)).

Other policy instruments are inefficient under the fixed exchange rate system. Monetary policy is

[1]When systems of equations are simulated, the term *dynamic* refers to the use of simulated, rather than actual, values for the endogenous variables. Thus, after the first-period simulation when actual startup values are used for the lagged endogenous variables, the model uses the simulated values of the variables to calculate the values of the endogenous variables in all subsequent periods.

[2]This type of analysis measures real value differences between base and alternative simulations and is often used to evaluate the response characteristics of macroeconomic models. For a discussion of conventional multiplier analysis, the classic references are Goldberg (1964: 373-76), Klein (1974: 240-48), and Theil (1971: 465-68).

ineffective since changes in net domestic assets do not influence real GDP growth, and fiscal policy is also ineffective since an expansion in government consumption only causes a proportional reduction in private consumption, leaving GDP unchanged in the medium an long run.

Table 10.6
Multiplier Analysis

		Multiplier (%)	
	Units/Concept	**Impact**	**Total**
Real Devaluation of 1%			
Nominal Exchange Rate	1992=100	1.0	1.6
Exports of Goods & NFS	Bill.92dong	1.0	1.2
Imports of Goods & NFS	Bill.92dong	0.6	0.8
Foreign Direct Investment	Mill. Dollars	(1.2)	(0.8)
GDP	Bill.92dong	0.9	1.0
Foreign GDP of Trading Partners and Investors: 1% one-time increase			
Exports of Goods & NFS	Bill.92dong	3.2	2.1
Foreign Direct Investment	Mill. Dollars	0.9	4.8
GDP	Bill.92dong	1.6	0.4
Foreign GDP of Trading Partners and Investors: 1% sustained increase			
Exports of Goods & NFS	Bill.92dong	3.2	8.6
Foreign Direct Investment	Mill. Dollars	0.9	10.1
GDP	Bill.92dong	1.6	3.2
Trade Taxes Reduced by 50%			
Imports of Goods	Mill. Dollars	1.8	1.9
Tax on trade	Bill.92dong	(48.9)	(49.4)
Total Revenue	Bill.92dong	(11.4)	(12.5)
GDP	Bill.92dong	(1.2)	(1.2)
Change in Net Domestic Assets by 1%			
Broad Money (M2)	Bill.dong	0.6	1.4
GDP Deflator	1992=100	-	0.5
GDP	Bill.92dong	-	-
Government Expenditure Increase by 1%			
Private Consumption	Bill.92dong	2.0	(1.0)
GDP	Bill.92dong	0.1	0.2

Structural reforms are generally more difficult to measure in a model that aims to represent the underlying data generating process of macroeconomic stabilization policies. The present model could, however, be extended to incorporate detailed real and financial sectors that would permit such measures. The present model does, nevertheless, permit the analysis of trade policy reforms in the form of tariff reductions. Table 10.6 shows the effects of a 50 percent reduction in tariffs

from their trade-weighted level of 10 percent. The tariff cut would have an immediate impact on fiscal revenue as a result of the lower tax receipts. The cut would also reduce government revenue as a result of the contraction in overall economic activity, since lower import prices would shift demand from domestic to foreign goods.

11. SUMMARY AND CONCLUSION

The present macroeconomic model for Viet Nam provides a parsimonious representation of the emerging market economy and it emphasizes the external sector. It aims to serves a dual purpose. First, it provides a framework for making rational and consistent predictions about Viet Nam's overall economic activity, the standard components of the balance of payments, and the production and expenditure concepts of the national accounts. Secondly, it offers a means of quantitatively evaluating the impact of alternative exchange rate policies on the economy, and assessing the feedback effects that changes in key macroeconomic variables of the economy produce in other sectors. These two objectives are closely related since the capacity to make successful predictions depends on the model's ability to capture the interrelationships of the real and financial components of the economy.

The modeling procedure described in this study has sought to account for the structure of the Viet Nam economy, the availability of data, and the degree of stability of time-series estimates of parameters during the country's transition process. The nature of the transition process of the Vietnamese economy has motivated the design of a model that can grow and evolve with the economy. The present version of the model incorporates both the real and financial sectors of the economy within the fixed exchange rate system that characterizes the present economy. The objective is to provide a mechanism to link policies and targets while, at the same time, providing an easy and adaptable means of both forecasting key macroeconomic variables and simulating the interrelationships between economic policy initiatives. The present form of the model therefore provides a representation of the Vietnamese economy that allows for considerable flexibility in its usage for forecasting, selection of the policy mix and instruments for the targets of a program, and determination of the appropriate sequencing of policy changes.

The present model applies a conventional IS-LM framework to the fixed exchange rate system and, as a policy-oriented system, it incorporates key parameters for policy formulation. At the onset, the model is designed as a parsimonious representation of the underlying data generating system for key behavior relationships. The conceptual approach to the present model is based on conventional economic theory, although the empirical specification of the conventional theory is not well established since there are numerous approaches to the specification, estimation and testing procedures in standard macro models.

The fixed exchange rate system has important implications for the economic policy mechanisms of Viet Nam, and the system of equations used to characterize the data-generating process of the economy. In the model formulated in this study, the channels through which economic policies operate are explicitly introduced into the system of equations. The parsimonious nature of the model makes it tractable from an operational point of view, and it provides the basis for subsequent extensions of the public and financial sectors, as well as the domestic and external sectors of the economy.