Macroeconomic Dynamics of Egypt: An Integrated Approach to Trade and Exchange Rate Policy Reforms

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September 2000

The Economic Analysis of Tariff Reform in Egypt

Annex IV:

Macroeconomic Dynamics of Egypt
An Integrated Approach to Trade and Exchange Rate Policy Reforms

Prepared for

Ministry of Economy and Foreign Trade
and
Ministry of Finance

Submitted to

USAID
Economic Growth/Sector Policy
Cairo, Egypt

Submitted by

Nathan Associates Inc.

September 2000

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Acronyms

ADF	Augmented Dickey-Fuller (test)
CBE	Central Bank of Egypt

CES	Constant elasticity of substitution
DEPRA	Development Economic Policy Reform Analysis Project
DF	Dickey-Fuller (test)
DW	Durbin-Watson (test)
ECM	Error-correction mechanism
ERP	Effective rate of protection
EU	European Union
FDI	Foreign direct investment
FE	Foreign exchange
FEER	Fundamental equilibrium exchange rate
GDP	Gross domestic product
GOE	Government of Egypt
GRG	Generalized reduced gradient
HS	Harmonized system
IMF	International Monetary Fund
IS	Investment-Savings (curve)
LE	Egyptian pounds
MPI	Marginal propensity to invest
MPM	Marginal propensity to import
NRP	Nominal rate of protection
NTBs	Non-tariff barriers
REER	Real effective exchange rate
SITC	Standard International Trade Classification (system)
UN	United Nations
USAID	United States Agency for International Development
VAR	Vector autoregressive
WEO	World Economic Outlook

Executive Summary

Introduction

Since the beginning of the last decade, the Government of Egypt's macroeconomic stabilization efforts have been supported by policies aimed at establishing the fundamental conditions needed for internal and external balance, anchoring the nominal exchange rate, and removing price distortions through economic reforms encompassing trade liberalization, fiscal reform, privatization and deregulation. Fiscal stabilization has been one of the key ingredients for the establishment of the fundamental conditions needed for macroeconomic stability, while the nominal exchange rate anchor has been used to facilitate disinflation. Since taxes on international trade represent one-fifth of the Government's total tax revenue, any discussion about trade liberalization must weigh the fiscal revenue implications against efforts to further integrate the Egyptian economy into the global economy. Moreover, a new round of trade liberalization under the current nominal exchange rate anchor could aggravate the trade deficit and thereby undermine the external balance. It is in the context of the need to coordinate this broad set of macroeconomic stabilization and economic reform policies that the present macroeconomic model has been developed.

The model is designed to support the formulation and sequencing of a new round of trade policy reforms in a manner that is economically and technically viable, acceptable to the Government, and responsive to private sector needs. By its very nature, however, it also provides a broad analytical framework for the Government of Egypt to examine the macroeconomic stabilization and economic reform policies needed to move the country into a higher growth trajectory. By offering both real and financial sector forecasting and policy simulation capabilities for quantifying the effects of trade reforms under alternative exchange rate system, it provides a means to analyze the inter-relationships and feedback effects of policy-determined economic variables.

The present study forms part of a large-scale study entitled *The Economic Analysis of Tariff Reform in Egypt* undertaken by the Development Policy Reform Analysis Project (DEPRA) for the Ministry of Economy and Trade and the Ministry of Finance. The macro-model design and estimation, as well as its documentation in the present study, has been undertaken by Dr. Montague Lord, Nathan Associates Inc. consultant, under the direction of Dr. James Walker, DEPRA/Trade Liberalization Advisor, Dr. John Suomela, DEPRA/Senior Trade Policy Advisor, and Dr. Hafiz Shaltout, USAID/COTR. Greta Boye, Nathan Associates Inc. consultant, applied of the model to alternative tariff reforms and the results of that analysis are presented in a separate annex entitled *Quantifying Trade Liberalization: Direct versus Macroeconomic Consequences*, which also forms part of the aforementioned study entitled *The Economic Analysis of Tariff Reform in Egypt*. The present study benefited greatly from extensive data and economic information provided by Dr. Suzanne Messiha and the Comp Team of DEPRA.

Macroeconomic Context of Trade Policy Reforms

The Egyptian economy has undergone large and fundamental reforms during the last decade. Macroeconomic stability and the liberalization of markets have supported the economy's favorable growth rates and the population's improved living standards by attracting domestic and foreign private investment and encouraging greater trade. The Government of Egypt's (GOE) strategy for stabilization has been rooted in policies aimed at (a) establishing the fundamental conditions needed for internal and external balance, (b) pegging the exchange rate, and (c) removing price distortions through economic reforms encompassing trade liberalization, fiscal reform, privatization and deregulation.

Internal balance in output and inflation has been achieved through fiscal stabilization and monetary restraints. The successful reduction in the fiscal deficit from 20 percent of GDP in 1990/91 to around 1 percent in 1998/99 reflected both revenue increases and expenditure cutbacks. The earlier fiscal deficits and large liquidity expansion needed to finance those deficits had helped to maintain annual inflation rates of around 20 percent in the 1980s, but with fiscal austerity, inflation eventually decelerated to around 4 percent after 1997. The Government has opted to use the exchange rate as a nominal anchor, and that disinflation strategy has been supplemented by strict monetary and credit controls. Since the unification of the exchange rate in 1991 and liberalization of interest rates in 1993, the Egyptian pound has moved in a narrow range vis-à-vis the dollar and any upward or downward pressure on the exchange rate has been absorbed through passive intervention.

External balance was initially achieved through a series of nominal depreciations between 1989 and 1991 that helped to reverse the large current account deficits during the first part of the 1990s. Adjustments of the trade balance did not, however, contribute as much to the improvement as did those of the services balance. Merchandise exports contracted in the early part of the decade and remained sluggish until the middle of the decade. Although those exports grew by 11 percent annually in that period, they fell sharply in 1998 as a result of the Asian crisis-induced global trade recession. Under these conditions, the value of goods exported at the end of the 1990s only reached about two-thirds of its existing value at the beginning of the decade and, consequently, Egypt's share of world trade fell from 0.14 to 0.06 percent during the decade. In contrast, merchandise imports expanded by nearly 50 percent during the decade, notwithstanding sharp cutbacks in 1991-92. The effect of these developments on the economy have been large since the combined value of exports and imports of goods and non-factor services currently represents 40 percent of gross domestic product (GDP).

The resulting trade deficit has been only partly compensated by income from invisible transactions in the form of tourism receipts, Suez Canal dues and, to a lesser extent, workers' remittances, and these revenue sources tend to be unstable. Capital inflows have increasingly been relied upon to finance the growing current account deficit, but these inflows have required aggressive sterilization on the part of the Central Bank of Egypt (CBE) to offset the increase in foreign capital. The initial impact of sterilization on lowering interest rates lent support to rising investor confidence in the pegged exchange rate system, but foreign direct investment (FDI) and other net capital inflows have fallen short of the current account deficit. The inability to service

external debt obligations through capital inflows during this period led to exceptional financing, including accumulation of arrears on external debt service.

Notwithstanding these difficulties, there is no doubt that Egypt has prospered under its macroeconomic policies. The benefits of the Government's strategy have included low inflation, disciplined financial policy, and a stable external environment. Capital inflows have bolstered the country's long-term growth prospects by increasing investment and confidence. Trade conditions have also improved from a decade ago. The GOE has successfully moved from import substitution policies to an export-led strategy based on a series of trade policy reforms instituted that have aimed at liberalizing trade through three types of measures. First, import tariffs have been reduced; second, quantitative import measures have been replaced with tariffs and non-tariff barriers (NTBs) to trade have been greatly reduced; and third, exports have been promoted through the easing of administrative procedures. While these measures have gradually opened trading activities to the private sector, the Government recognizes that high levels of import restrictions remain that, despite offering domestic industries substantial protection from foreign competition, give rise to inefficiencies in the economy and reduce the international competitiveness of firms.

Fiscal Revenue Context of Trade and Exchange Rate Reforms

The efficiency gains from further trade liberalization need to be weighed against the Government's strategy for achieving internal balance, largely through fiscal austerity and the maintenance of fiscal revenues. While total tax revenue since the start of the reforms has remained fairly stable relative to GDP, non-tax revenue has contracted from 14 to less than 9 percent of GDP between the start and end of the last decade. Tax revenue has therefore had to support an increasingly larger portion of fiscal expenditures, and since taxes on international trade currently represent about one-fifth of the Government's total tax revenue, the fiscal revenue implications of such an initiative are especially important to the GOE.

Without an exchange rate realignment, a new round of trade liberalization under the existing nominal exchange rate anchor could aggravate the trade deficit and further undermine the external imbalance. Although the pegged exchange rate system has been successfully used as part of the Government's disinflation strategy, it has also resulted in large and pervasive deterioration in Egypt's international competitiveness. In the last decade alone, Egypt's real effective exchange rate (REER) appreciated by 66 percent, partly as a result of the nominal exchange rate appreciation, but mainly as a consequence of substantial inflation differentials with partner countries. A reversal in that trend would ideally come about through an equilibrium exchange rate that would not only yield a current account balance that was consistent with capital inflows, but one that would also generate an internal balance in terms of output, inflation and employment.

Measuring the Macroeconomic Impact of Economic Policy Reforms

An earlier study by DEPRA (Lord, 1999) examined the conditions needed to determine the fundamental equilibrium exchange rate (FEER) for Egypt's balance of payments. Based on the elasticities approach to the balance of payments, the study developed a partial equilibrium model to address the effects of changes in the exchange rate on the current and capital accounts. By focusing on the direct linkages between exchange rates and the balance of payments, however, the elasticities approach disregards the effect of the exchange rate adjustment process on the GOE's simultaneous pursuit of internal and external balances in the economy. Nevertheless, the approach provides a useful means of calculating the optimal real effective exchange rate needed to achieve overall equilibrium in the balance of payments.

The present study extends the earlier elasticities-absorption approach to the balance of payments to the analysis of the consequences of tariff reforms on the Egyptian macro-economy, particularly as it relates to fiscal revenue implications. From an analytical perspective, we use the Mundell-Fleming model to examine the effects of trade liberalization and exchange rate changes in an open macro-economy. The model is of an open economy in the familiar IS-LM framework that includes the determination of the trade and capital accounts of the balance of payments.

Since capital movements and the extent of their mobility play a critical role in the analysis of economic policies, we also consider alternative assumptions about policies impacting on their mobility. These extensions permits us to move from a partial equilibrium perspective to one that examines trade and exchange rate policies in the context of Egypt's macroeconomic fundamentals. Furthermore, while trade liberalization by itself is likely to improve the efficiency of the economy and therefore impact on output and employment, it may also aggravate the current account imbalance. We therefore include in the analysis complementary exchange rate adjustments that would help to produce a sustainable balance of payments and move the Egyptian economy closer to overall equilibrium.

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 resulting model allows for considerable flexibility 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 Egypt's overall economic activity, and the standard components of the production and expenditure concepts of the national accounts. It also offers a means to quantitatively evaluate the impact of trade liberalization and other economic policy reforms on the country, and assess the feedback effects that changes in key macroeconomic variables of the economy produce in other sectors.

The conceptual approach to the present model is based on conventional economic theory. The empirical specification of the conventional theory, however, is not well established since there are numerous approaches to 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, and it measures the feedback effects that changes in key macroeconomic variables of the economy produce in other sectors. 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 in both the domestic and external sectors of the economy.

Policy Impact Assessment

The macroeconomic model incorporates key assumptions about exogenous and policy-related variables. The principal policy variables for the Egyptian economy are the tariff structure, the exchange rate, 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 Egypt's foreign markets and investors.

Three sets of simulations have been performed with the model. The first provides the benchmark against which policy impact assessments are measured. The second set assesses the impact of alternative trade liberalization policies that include free trade, concertina, two-tier, a uniform, and a combination of two-tier and uniform rate tariffs. The final set evaluates the impact of a real effective exchange rate devaluation to neutralize the initial effects of trade policy reforms on the balance of payments, the national income accounts on the expenditure-side, and the money supply, prices and real exchange rate. Such a realignment in the exchange rate often accompanies trade liberalization to bring the exchange rate more in line with a level that is consistent with a sustainable medium-term external position under a situation in which there are lower trade barriers.

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 Egyptian economy that yield an internally consistent set of estimates about the likely outcome of events over the next few years. For the baseline forecast, they therefore point to important issues about the near-term prospects of the economy.

Baseline Forecasts

The baseline assumptions for Egypt's major export markets and foreign investors are that the global economy will continue its recovery and maintain a trend growth rate of 4 percent in 2000-2020. The assumptions underlying our baseline projections represent a fairly benign scenario of moderate and sustainable growth. The risk to this assumption is predominantly on the downside and a significantly worse outcome is clearly possible in the important North American and Western European markets for Egypt. The potential for a broad and deep economic downturn in the US and EU markets would severely impact on Egypt's exports and its overall economic growth.

The results for the baseline forecasts are presented in Table ES1. Egypt’s economic growth is expected to accelerate moderately from 5 to 6 percent over the forecast period.

Table ES1
Baseline Projections of Key Macroeconomic Variables
(Annual percentage changes)

	2000-2004	2005-2009	2010-2014
Gross Domestic Product (constant LE)			
Exports of Goods and NFS	4.3%	3.8%	3.9%
Imports of Goods and NFS	3.3%	4.0%	4.7%
Gross Fixed Capital Formation	3.8%	5.1%	5.4%
Foreign direct investment	0.7%	0.6%	0.6%
Other investment	4.2%	5.5%	5.7%
Total Consumption	4.9%	5.9%	6.1%
Government Consumption	4.2%	4.7%	5.1%
Private Consumption	5.0%	6.1%	6.2%
Gross Domestic Product	4.9%	5.8%	5.9%
Savings and Investment (constant LE)			
Gross Domestic Investment	3.8%	5.1%	5.4%
Gross Domestic Savings	3.5%	3.9%	3.9%
Fiscal Indicators (constant LE)			
Total Revenue, of which	5.2%	5.4%	5.7%
Trade taxes	4.0%	4.6%	5.4%
Other taxes	5.5%	5.5%	5.8%
Total Expenditures, or which	4.8%	5.1%	5.4%
Current expenditures	4.5%	4.9%	5.3%
Capital expenditures	6.0%	6.0%	6.0%
Money and Prices (nominal LE)			
Broad Money (M2)	3.0%	3.0%	3.0%
Inflation	3.0%	3.0%	3.0%
Nominal Exchange Rate	0.0%	0.0%	0.0%
Real Exchange Rate	0.0%	0.0%	0.0%
Balance of Payments (US dollars)			
Merchandise Exports	6.8%	4.7%	4.8%
Merchandise Imports	7.1%	7.7%	8.6%
Service Receipts	7.6%	7.8%	7.8%
Service Payments	4.9%	5.8%	5.9%
Direct Investment in Egypt	3.7%	3.6%	3.6%

Exports of goods and non-factor services are expected to outpace imports of goods and non-factor at the beginning of the decade, but lag behind those imports in 2005-2015. As is to be expected, the forecast is for the growth of private consumption to exceed that of government consumption, and as in other countries, that private consumption is projected to grow faster than investment. Growth of the service sector is expected to outpace that of industry, and that of industry is expected to outpace that of agriculture. The unconstrained model projects an inflation rate of 3 percent as a direct result of a similar growth rate for broad money.

Fiscal Impact of Trade Liberalization

The magnitude of the influence of trade policy reform on fiscal revenue, real economic activity (GDP, consumption, investment, imports and exports) and price-related variables (interest rates and the prices) are calculated through multiplier analysis. The first-period effect is the impact multiplier; the interim multiplier measures the effect after 5 years, when full implementation of the new tariff structure takes place, and the cumulative multiplier is measured at year 20, a period of time that is sufficient for all dynamic adjustments to the new tariff structure to occur.

Table ES2 illustrates the effect of alternative tariff strategies on imports, fiscal revenue, investment, and the overall economy activity of Egypt. The strategies cover those of concertina, two-tier, uniform and a combination of two-tier and uniform methods. A free trade strategy is also included. In general, the results are consistent with expectations about the operation and effect on the Egyptian economy from trade liberalization. In all cases, the tariff cuts have an immediate impact on the overall import value, fiscal revenue and investment activity. The interim response after 5 years is about two-thirds that of the total long-run response, suggesting a fairly quick response to the tariff changes. In all but the free-trade strategy, the reduction in tariffs leads to an increase in the value of imports. In the case of free trade, the high degree of restrictiveness of the trade regime for important products having little, if any price responsiveness associated with tariff cuts. Since there are a number of important imported products having high tariffs and a price-inelastic demand schedule, their effect tends to dominate the overall results.

The concertina tariff structure generally impacts the Egyptian economy somewhat more than the other three strategies (not including the free trade strategy). The reason is less related to the tariff structure than the fact that the concertina method lowers the average tariff rate by substantially more than the two-tier or uniform tariff structures. Were the overall tariff rate in the two-tier and uniform tariff structures to be lowered to the same rate as the concertina method, the results would undoubtedly be similar. A lower overall tariff rate stimulates gross capital formation through domestic investment, which in turn stimulates overall growth of the economy. The increased national income further stimulates private consumption, while current expenditures of the Government contract in response to the lower trade tax revenue. The GOE nevertheless receives some compensation for the reduced trade tax revenue from increased tax revenue from other sources as a result of the private sector's expanded economic activity. While the results apply particularly to the concertina method, they are equally valid for the two-tier, uniform, and combination of two-tier and uniform methods when their average tariff rates are lowered to the same average rate as that for the concertina method.

Table ES2
Multiplier Analysis of Alternative Tariff Structures on Key Macroeconomic Variables (Annual percent change and average annual US dollars)

	Unit of Account	Multiplier (%) Impact (1 year)	Interim (5 yrs)	Total (20 years)
Imports of goods				
Free Trade	Nominal US$	-0.4%	-0.4%	1.7%
Concertina	Nominal US$	0.3%	0.5%	1.0%
Two-Tier	Nominal US$	0.5%	1.1%	1.5%
Uniform	Nominal US$	0.6%	1.2%	1.5%
Combination	Nominal US$	0.2%	1.2%	1.5%
Imports of goods and nfs				
Free Trade	Constant LE	0.0%	0.5%	2.1%
Concertina	Constant LE	0.3%	0.6%	0.9%
Two-Tier	Constant LE	0.4%	0.8%	0.9%
Uniform	Constant LE	0.4%	0.8%	1.0%
Combination	Constant LE	0.3%	0.9%	1.0%
Trade tax revenue				
Free Trade	Constant LE	-32.2%	-66.7%	-93.7%
Concertina	Constant LE	-19.3%	-28.3%	-35.3%
Two-Tier	Constant LE	-15.7%	-18.6%	-20.7%
Uniform	Constant LE	-16.2%	-19.1%	-21.5%
Combination	Constant LE	-17.0%	-20.5%	-21.8%
Other tax revenue				
Free Trade	Constant LE	0.1%	1.0%	3.1%
Concertina	Constant LE	0.1%	0.4%	0.7%
Two-Tier	Constant LE	0.0%	0.0%	-0.4%
Uniform	Constant LE	0.0%	0.0%	-0.4%
Combination	Constant LE	0.1%	0.2%	-0.4%
Gross capital formation				
Free Trade	Constant LE	1.9%	5.8%	10.0%
Concertina	Constant LE	1.3%	2.4%	3.3%
Two-Tier	Constant LE	0.8%	1.4%	1.4%
Uniform	Constant LE	0.8%	1.4%	1.5%
Combination	Constant LE	1.2%	1.8%	1.6%
Real GDP				
Free Trade	Constant LE	1.1%	2.7%	3.4%
Concertina	Constant LE	0.4%	0.7%	0.7%
Two-Tier	Constant LE	0.1%	0.0%	-0.6%
Uniform	Constant LE	0.1%	0.0%	-0.6%
Combination	Constant LE	0.4%	0.1%	-0.5%

Table ES3 Impact of Alternative Tariff Structures on Key Macroeconomic Variables (Annual percent change and average annual US dollars)		
	2000-2004	2005-2009
Trade Balance (average annual US dollars)		
Current Tariff Structure	(11,937)	(15,694)
Free Trade	(11,864)	(16,196)
Concertina	(12,027)	(15,951)
Two-Tier	(12,141)	(16,063)
Uniform	(12,151)	(16,074)
Combination	(12,154)	(16,091)
Import Duties / Total Tax Revenue (percent)		
Current Tariff Structure	19.7%	17.9%
Free Trade	6.8%	0.0%
Concertina	14.9%	12.0%
Two-Tier	16.7%	14.7%
Uniform	16.6%	14.5%
Combination	16.3%	14.5%
Trade tax collection rate (duties/imports)		
Current Tariff Structure	17.9%	17.9%
Free Trade	7.2%	0.0%
Concertina	15.0%	13.1%
Two-Tier	16.9%	16.3%
Uniform	16.8%	16.1%
Combination	16.5%	16.1%
Import duties / GDP (percent)		
Current Tariff Structure	3.5%	3.2%
Free Trade	1.1%	0.0%
Concertina	2.5%	2.0%
Two-Tier	2.9%	2.5%
Uniform	2.8%	2.5%
Combination	2.8%	2.5%
Fiscal deficit / GDP (percent)		
Current Tariff Structure	-1.5%	-2.5%
Free Trade	-3.0%	-3.9%
Concertina	-2.1%	-3.1%
Two-Tier	-1.9%	-2.9%
Uniform	-1.9%	-2.9%
Combination	-1.9%	-2.9%

Table ES3 provides some additional indicators of the alternative tariff strategies. As expected, the smaller expansion of imports under the concertina method generates a lower trade deficit than under the other strategies. The concertina's lower average tariff rate, however, has a less favorable impact on the Government's overall tax

revenue and, as a consequence, it generates a larger fiscal deficit during the forecast period. Given the similarity in the average tariff rates between the two-tier and uniform tariff strategies, these two strategies and their combined form produce little, if any, differences in their fiscal impact.

Exchange Rate Adjustments during Trade Liberalization

A devaluation is often needed to counter the trade balance effect of trade liberalization. In the present model, the overall results of the estimated import and export demand functions, as well as foreign direct investment, support generalizations to the effect that the exchange rate significantly impacts on Egypt's balance of payments. For the Government's fiscal position, the devaluation increases the domestic currency value of imports and the associated trade tax revenue. On the expenditure side, the fall in the relative price of tradables and rise in that of wages and non-tradables produces a less than proportional response of the exchange rate devaluation to that of trade liberalization because of the substitution in production or consumption of tradables and non-tradables. Trade liberalization will cause the private sector price of non-tradables to rise. Since the Government is either exempt from tariffs or pays the tariff to itself, the liberalization of trade does not impact on the pubic sector's cost of tradables. But in the case of a devaluation, the relative cost of tradables to the public sector rises, thereby worsening the fiscal deficit and requiring overall expenditure cutbacks. The experience of other countries suggests that these fiscal deficit effects need to be corrected early in the trade and exchange rate reform processes.

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Table ES4
Effect of 10% Devaluation on Egypt's Economy
(Percentages)

	Unit of Account	Multiplier (%) Impact	Total
Balance of Payments			
Goods: Exports f.o.b.	Nominal US$	6.7%	7.0%
Goods: Imports f.o.b.	Nominal US$	-2.8%	4.1%
Services: Credit	Nominal US$	1.2%	2.7%
Services: Debit	Nominal US$	-2.5%	3.1%
Direct Investment in Egypt	Nominal US$	-7.9%	-8.5%
National Income Accounts			
Exports of Goods and NFS	Constant LE	1.6%	3.6%
Imports of Goods and NFS	Constant LE	-2.7%	3.9%
Total Investment	Constant LE	-0.7%	2.8%
Total Consumption	Constant LE	1.9%	3.2%
Government Consumption	Constant LE	0.0%	2.9%
Private Consumption	Constant LE	2.2%	3.3%
Gross Domestic Product	Constant LE	1.7%	3.1%
Government Revenue and Expenditures			
Total Revenue	Constant LE	-0.5%	2.7%
Tax Revenue	Constant LE	-0.7%	3.4%
Tax on trade	Constant LE	-2.8%	4.1%
Others	Constant LE	-0.2%	3.2%
Total Expenditures	Constant LE	0.0%	2.1%
Current Expenditure	Constant LE	0.0%	2.9%
Wages	Constant LE	-0.2%	3.2%
Other expenditures	Constant LE	0.1%	2.7%

expand by more than their level under a constant exchange rate. Initially, the value of imports would decline, but the expansion in real GDP associated with the improved balance of trade on goods and non-factor services eventually leads to an increase in imports, albeit by a substantially smaller growth rate than that of exports. A similar situation to that of merchandise trade occurs with trade in services. In the capital account, the devaluation leads to a substantial contraction in foreign direct investment. The reason is that the real effective exchange rate devaluation increases the cost of imported material inputs and thereby lowers the incentive to expand cross-border production facilities in Egypt. It is likely, however, that with lower costs of imported material inputs under reduced trade barriers and an unprotected market, foreign direct investment will shift from inward-oriented production to outward-oriented production. These structural shifts are not considered in the present model, but could be introduced were more details FDI information available for industries.

With the 10 percent devaluation, the fiscal situation improves in the medium run, notwithstanding an initial contraction in trade taxes of 2.8 percent below the equivalent revenue with a constant exchange rate. However, trade taxes expand by over 4 percent above the constant exchange rate solution in the medium term because of the economic growth induced expansion in imports. Real GDP grows by nearly 2 percent more than without a change in the real exchange rate, and it expands by over 3 percent in the medium term. In the short run, the expansion is driven by private consumption, and in the medium term it is private consumption, gross capital investment and exports that generate the economic expansion.

These results point to the effectiveness of exchange rate changes in Egypt as an equilibrating instrument for the current account and one that can be used to replace trade restrictions as an instrument with which to achieve a sustainable medium-term external position. For fiscal revenue the results show that the elimination of the overvaluation of the Egyptian pound expands the share of trade taxes following the initial contraction and, because of the positive tax revenue effect, the devaluation leads to a medium-term improvement in the fiscal balance. Moreover, the elimination of the overvalued currency substantially expands the real value of imports measured in domestic prices. As a result, there are positive medium-term effects on the fiscal balance from the larger domestically priced tax base and the larger tax revenue generated from increased investment and consumption by the private sector.

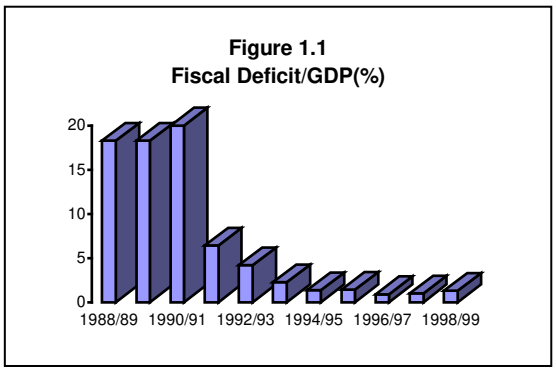
While issues of public finance are beyond the scope of the present analysis, it is clear from the present fiscal impact assessment of trade liberalization in Egypt that tax reform needs to be an integral part of tariff reforms. Tariff reform should be viewed as part of a broader program of tax reform that supports the transition from a large dependence on trade taxes for fiscal revenue to a broad tax revenue base that ensures revenue growth and stability and increases productivity at the firm level from the more efficient use of existing resources under freer trade.

1.0 Introduction

II. 1.1 Transformation of the Economy

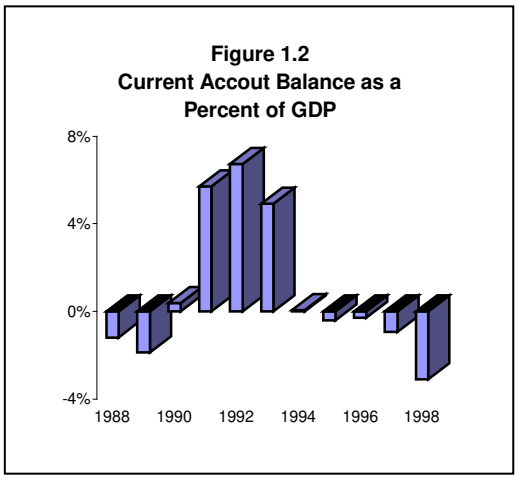
The Egyptian economy has undergone large and fundamental reforms during the last decade. Macroeconomic stability and the liberalization of markets have supported the economy's favorable growth rates and the population's improved living standards by attracting domestic and foreign private investment and encouraging greater trade. The Government of Egypt's (GOE) strategy for stabilization has been rooted in policies aimed at (a) establishing the fundamental conditions needed for internal and external balance, (b) pegging the exchange rate, and (c) removing price distortions through economic reforms encompassing trade liberalization, fiscal reform, privatization and deregulation.

Internal balance in output and inflation has been achieved through fiscal stabilization and monetary restraints. The successful reduction in the fiscal deficit from 20 percent of gross domestic product (GDP) in 1990/91 to around 1 percent in 1998/99 reflected both revenue increases and expenditure cutbacks. The earlier fiscal deficits and large liquidity expansion need to finance those deficits had helped to maintain annual inflation rates of around 20 percent in the 1980s. With fiscal austerity, inflation decelerated to 7 percent by 1996, eventually averaging 4 percent after 1997. The Government opted to use the exchange rate as a nominal anchor, and that disinflation strategy was supplemented by strict monetary and credit controls. As Subramanian (1997) points out, "exchange rate stability was a consummation devoutly to be pursued and not just a means to achieving broader price stability. Moreover, contemporaneous movements in the nominal rate in the late 1980s and inflation meant that the pass-through effect to domestic prices was perceived as important and an exchange rate anchor was seen as having merit in containing this source of inflationary pressure." The exchange rate was unified in 1991, and in 1993 interest rates were liberalized and lending limits to the public and private sector eliminated. During this period of stabilization, the Egyptian pound moved in a narrow range vis-à-vis the dollar and any upward or downward pressure on the exchange rate was absorbed through passive intervention.



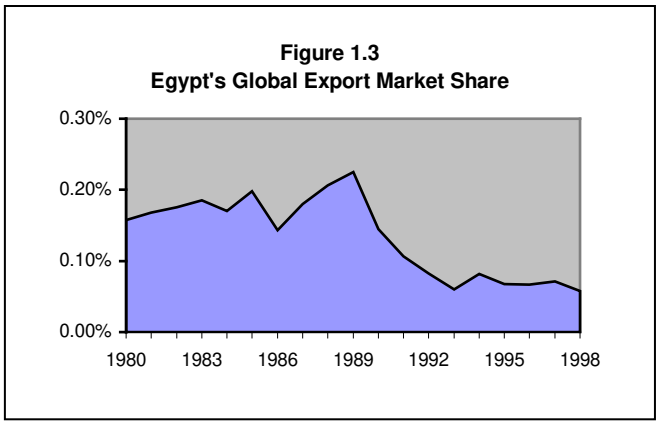
The Central Bank of Egypt's (CBE) monetary controls were effective under a stable exchange rate system with limited capital mobility. However, as we shall see in later chapters, those monetary controls became more difficult to implement under an open capital market and pegged exchange rate. Nevertheless, the Government succeeded in reversing the earlier dollarization of the economy in response to expectations of an exchange rate depreciation occasioned by weak external balances and inflationary pressures. Initially, the reversal occurred because of real interest rate differentials of

around 6 percentage points between Egyptian and dollar-denominated assets starting in 1992 and, except for a brief period in 1995, continuing through 1998. Once capital inflows and foreign exchange reserves began to expand in response to the stable exchange rate and control over inflation, investor confidence returned and demand for foreign currency holdings abated.[1]



External balance was initially achieved through a series of nominal depreciations between 1989 and 1991 that helped to reverse the large current account deficits during 1991-93. Adjustments of the trade balance did not, however, contribute as much to the improvement as did those of the services balance. Merchandise exports contracted in the early part of the decade and remained sluggish until 1995. Although those exports grew by 11 percent annually in 1995-97, they fell sharply in 1998 as a result of the Asian crisis-induced global trade recession.

Under these conditions, the value of goods exported at the end of the 1990s only reached about two-thirds of its existing value at the beginning of the decade and, consequently, Egypt's share of world trade fell from 0.14 to 0.06 percent during the decade (Figure 1.3). In contrast, merchandise imports expanded by nearly 50 percent during the decade, notwithstanding cutbacks in 1991-92. The trade deficit has been only partly compensated by income from invisible transactions in the form of tourism receipts, Suez Canal dues and, to a lesser extent, workers' remittances, and these revenue sources tend to be unstable. Tourism revenue was affected by the Gulf War in the early part of the decade and subsequent acts of domestic terrorism. Oil revenue tends to vary with world petroleum prices, remittances depend largely on petroleum prices movements since most workers are in oil-producing countries, and canal dues have stagnated (Licari, 1997).



Much of the growing current account deficit has increasingly had to be financed from capital inflows. Foreign direct investment (FDI) in Egypt amounted to nearly 1 percent of GDP in 1991-93 and 2.4 percent of GDP in 1994. While this inflow helped to finance the growing current account deficit, it also required aggressive sterilization on the part of the CBE to offset the increase in foreign capital. The initial impact of sterilization on lowering interest rates lent support to rising investor confidence in the pegged exchange rate system (Subramanian, 1997), but FDI and other net capital inflows fell short of the current account deficit and, as a result, the

[1] For an analysis of the Egyptian stabilization experience in the 1990s, see Subramanian (1997).

deficit averaged $1.3 billion annually between 1994 and 1998. The inability to service external debt obligations through capital inflows during this period led to exceptional financing, including accumulation of arrears on external debt service, totaling over $10 billion in 1994-98.

Notwithstanding these difficulties, there is no doubt that Egypt has prospered under its macroeconomic policies. The benefits of the Government's strategy have included low inflation, disciplined financial policy, and a stable external environment. Capital inflows have bolstered the country's long-term growth prospects by increasing investment and confidence. Trade conditions have also improved from a decade ago. The GOE has successfully moved from import substitution policies to an export-led strategy based on a series of trade policy reforms instituted since 1993 that have aimed at liberalizing trade through three types of measures. First, import tariffs have been reduced; second, quantitative import measures have been replaced with replacement with tariffs and non-tariff barriers (NTBs) to trade have been greatly reduced; and third, exports have been promoted through the easing of administrative or 'red tape' procedures. While these measures have gradually opened trading activities to the private sector, the Government recognizes high levels of import restrictions remain that, despite offering domestic industries substantial protection from foreign competition, give rise to inefficiencies in the economy and reduce Egypt's international competitiveness. The effect of these external sector developments on the economy are large since the combined value of exports and imports of goods and nonfactor services represents 40 percent of GDP.

The efficiency gains from further trade liberalization, however, have to be weighed against the Government's strategy for achieving internal balance, largely through fiscal austerity and the maintenance of fiscal revenues. While total tax revenue since the start of the reforms has remained fairly stable relative to GDP, non-tax revenue has contracted from 14 percent of GDP in 1990/91 to less than 9 percent in 1998/99. Tax revenue has therefore had to support an increasingly larger portion of fiscal expenditures, and since taxes on international trade currently represent about one-fifth of the Government's total tax revenue, the fiscal revenue implications of such an initiative are especially important to the GOE.

Moreover, a new round of trade liberalization under the current nominal exchange rate anchor could aggravate the trade deficit and further undermine the external imbalance. Although the pegged exchange rate system was successfully used as part of the Government's disinflation strategy and the stability that it provided helped to attract foreign investment throughout the last decade, it also resulted in large and pervasive deterioration in Egypt's international competitiveness. Between 1991 and 1998 Egypt's real effective exchange rate (REER) appreciated by 66 percent, partly as a result of the nominal exchange rate appreciation, but mainly as a consequence of its substantial inflation differentials with partner countries. A reversal in that trend would ideally come about through an equilibrium exchange rate that not only would yield a current account balance that were consistent with capital inflows, but one that would also generate an internal balance in terms of output, inflation and employment.

In an earlier study, we examined the conditions needed to determine the fundamental equilibrium exchange rate (FEER) for Egypt's balance of payments. Based on the elasticities approach to the balance of payments, the study developed a partial

equilibrium model to address the effects of changes in the exchange rate on the current and capital accounts. By focusing on the direct linkages between exchange rates and the balance of payments, the elasticities approach disregards the effect of the exchange rate adjustment process on the GOE's simultaneous pursuit of internal and external balances in the economy. Nevertheless, we were able to solve the model for the optimal real effective exchange rate (and associated nominal exchange rate that yielded the desired solution) needed to achieve overall equilibrium in the balance of payments.

The present study extends the earlier elasticities-absorption approach to the balance of payments to the analysis of the consequences of tariff reforms on the Egyptian macro-economy, particularly as it relates to the fiscal revenue and balance of payments implications. From an analytical perspective, we use the Mundell-Fleming model to examine the effects of trade liberalization and exchange rate changes in an open macro-economy. The model is of an open economy in the familiar IS-LM framework that includes the determination of the trade and capital accounts of the balance of payments. Since capital movements and the extent of their mobility play a critical role in the analysis of economic policies, we also consider alternative assumptions about policies impacting on their mobility. These extensions permits us to move from a partial equilibrium perspective to one that examines trade and exchange rate policies in the context of Egypt's macroeconomic fundamentals. Furthermore, while trade liberalization by itself is likely to improve the efficiency of the economy and therefore impact on output and employment, it may also aggravate the current account imbalance. We therefore include in the analysis complementary exchange rate adjustments that would help to produce a sustainable balance of payments and move the Egyptian economy closer to overall equilibrium.

III. 1.2 Modeling Trade and Exchange Rate Policies

The major characteristics that need to be considered in the design and implementation of a macroeconomic model for Egypt concern the transmission of economic changes in the economy. The transition process accompanying Egypt's transformation from a centrally planned to market economy to the introduction of fundamental reforms in the socio-economic system that altered the role of prices in the economy, changed institutional structures, developed the private sector, restructured industries, created an autonomous banking system, and liberalized financial markets. Modeling these processes requires the explicit recognition of how the transmission mechanism affects development in the real and financial sectors 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.

Egypt's adoption of a fixed exchange rate system, while at the same time retaining controls over capital movements, also has important implications for the policy instruments that are available to the GOE. 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 economic 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 Egyptian 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.[2] 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 Egypt concerns household and business adjustments to fundamental changes in operating procedures. The introduction of tariff reforms, for example, can create assimilation difficulties for many enterprises, particularly in terms of product and service pricing. These adjustment difficulties reflect the decades of operation under import-substitution policies. It is therefore important that the analytical framework be developed in such a way as to reflect changes in trade policy measures associated with adjustment programs, including those associated with further tariff reforms.

The opening up of the economy and the ability to attract capital inflows, especially in the form of foreign direct investment, have been critical to Egypt's economy. Modeling the reform process in Egypt 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 trade policy 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.

[2] 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).

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, especially when the equations take the form of the error-correction mechanism (ECM).[3] Following this methodology, the present macroeconomic model aims to provide a theory-consistent representation of the general structure of the Egypt economy and, as such, it offers real and financial sector forecasting and policy simulation capabilities targeted to the needs of the GOE. The model serves a dual purpose. First, it provides a framework for making rational and consistent predictions about Egypt'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 to quantitatively evaluate the impact of trade and exchange rate policies and other initiatives on the Egyptian economy, and assess the feedback effects that changes in key macroeconomic variables of the economy produce in other sectors. These two objectives are, of course, closely 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 Egyptian economy, the availability of data, and the degree of stability of time-series estimates of parameters during the country's transition process.[4] The nature of the transition process of the Egyptian economy during the last decade 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 Egyptian 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.

IV. 1.3 Scope of the Study

This report is organized as follows:

- Chapter 1 provides a general introduction to the macroeconomic framework of the Egyptian economy during the last decade and the motivation for the construction of the model.

- Chapter 2 examines key time series of the Egyptian economy and dynamic specification used to characterize economic relationships.

- Chapter 3 describes the modeling framework for the real sectors of the economy.

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

[4] 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 4 presents the modeling framework for the money market and fiscal sector.

- Chapter 5 sets forth the modeling framework for the balance of payments and the foreign exchange market.

- Chapter 6 examines the effectiveness of trade policy reforms and macroeconomic policy instruments under alternative exchange rate regimes, and it describes the major blocks of the model and explains the system of equations as a whole.

- Chapter 7 describes the solution of the system of equations as a whole, and charts the fiscal revenue implications of trade liberalization and exchange rate reforms.

- Chapter 8 provides a summary and sets forth some of the major conclusions.

- The Annex lists the model specification in the Eviews econometric software program used to estimate and simulate the macroeconomic model.

- The Statistical Appendix contains the data used in the construction of the model.

- References lists the citations in the study.

2.0 Characterization of the Egyptian Economy

The present 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 over the last decade 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 economy's principal relationships, which are highlighted in this and subsequent chapters.

V. 2.1 National Income Accounts and the Balance of Payments

The present model is based on data classified according to the United Nations (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 non-factor services
= GDP	=	GDP

To arrive at overall GDP, the model derives solutions for expenditure concepts and uses those results to solve for 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 information about 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 financial links to the real and financial sectors. It also incorporates information about 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 foreign direct investment, and it yields solutions for the balance of goods and non-factor services and foreign investment that are used in the national income accounts. Changes in net foreign assets are used in the monetary sector bloc, and changes in international trade taxes are linked to the fiscal sector bloc.

VI. 2.2 Structure of Trade

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.

For imports, the selection of the products to be modeled has been based on the contribution of the most important products imported to the total value of imports in 1997. There is a high degree of concentration in imports: the top 10 products together account for nearly 40 percent of Egypt's total expenditures on imports. Those products consist of unmilled wheat, products of polymerizing, sawn lumber, unmilled maize, iron and steel, raw beet and cane sugar, sunflower seed oil, excavating and leveling machines, other non-electric machines, and passenger motor vehicles. The next ten products contribute another 15 percentage points, and the top 24 imports account for over 60 percent of the total value of imports.

For exports, the selection of the products to be modeled has been based on the contribution of the most important products exported in 1997. Table 2.1 shows the contribution of the top 24 products to total exports. The top two products (residual fuel oils and crude oil) together account for 40 percent of export earnings. Cotton and textile-related products account for another 20 percentage points, and fruits and vegetables contribute little over 3 percentage points.

These export data are disaggregated by country of destination to measure the effect of bilateral real effective exchange rate changes on Egypt's balance of payments. Based on Egypt's dominant geographic distribution, exports are aggregated into the three major regional markets:

- North America (composed of Canada and United States)

- European Union (composed of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom)

- Middle East (composed of Israel, Kuwait, Lebanon, Qatar, Saudi Arabia, and the United Arab Emirates)

The Statistical Appendix contains details of the traded products by country of origin and destination. In modeling these flows, only the most important import and export flows were estimated to limit the number of equations in the model. Despite efforts to limit the number of equations in the model, the total number of products and geographic markets covered yielded a total of 70 equations.

VII. 2.3 Capital Movements and the Monetary Sector

Table 2.1
Composition of Trade by Selected Products, 1997

EXPORTS			IMPORTS		
SITC Rev1	**Product Description**	**Percent**	**SITC Rev1**	**Product Description**	**Percent**
3324	Residual fuel oils	22.7%	0410	Wheat unmilled	9.3%
33101	Crude petroleum	17.1%	5812	Products of polymerizing	5.3%
6513	Grey cotton yarn in bulk	7.2%	24321	Lumber sawn conifer	4.7%
2631	Raw cotton	2.8%	0440	Maize unmilled	4.4%
65213	Grey woven cotton	2.5%	67251	Iron	3.3%
84143	Underwear knit	2.4%	0611	Raw beet and cane sugar	3.0%
5214	Coal, petrol distillates	2.1%	4216	Sunflower seed oil	2.4%
84113	Men's underwear	1.6%	7198	Other machines non-electric	2.4%
84112	Women's outerwear	1.4%	71842	Excavating and leveling mach	2.2%
5417	Medicaments	1.3%	7321	Passenger motor vehicles	2.1%
84111	Men's outerwear	1.1%	4222	Palm oil	2.0%
541	Potatoes fresh	1.1%	6415	Paper, in bulk	1.9%
3218	Coke of coal	1.0%	7221	Electric power machinery	1.9%
3323	Distillate fuels	0.6%	0111	Bovine meat fresh, frozen	1.8%
6576	Carpets, unknotted	0.6%	73289	Other motor vehicle parts	1.8%
545	Other fresh vegetables	0.5%	0813	Vegetable oil residues	1.8%
2924	Veg used in pharmacy	0.5%	7222	Switchgear	1.7%
5461	Vegetables, frozen	0.5%	1210	Tobacco	1.5%
82109	Furniture parts	0.4%	72491	Line telephone equipment	1.4%
511	Oranges, tangerines	0.4%	6291	Rubber tires and tubes	1.4%
68421	Aluminum bars, wire	0.3%	67321	Iron and steel bars	1.2%
551	Vegetables, dried	0.3%	71921	Pumps for liquids	1.2%
84144	Outerwear knit	0.3%	5811	Products of condensation	1.2%
5530	Perfume and cosmetics	0.3%	0741	Tea	1.2%
	Total	**68.8%**		**Total**	**60.9%**

Source: Lord (1999) based on information from UN, COMTRADE database.

The interrelations between the current account and the capital account in developing and emerging market economies such as Egypt have changed dramatically since the beginning of the rapid globalization of capital markets in the late 1980s. Wong and Carranza (1998) have provided a concise analysis of these changes. According to the authors, domestic macroeconomic and external sector policies before globalization generally focused on the stabilization of the current account. Capital movements were regarded as a means of financing current account deficits and therefore reflected the country's current account position. Since the early 1990s, however, capital movements have increasingly become the cause of current account instability, so that stabilization of the balance of payments has come to include both the current and capital accounts.

Table 2.2

Egypt's Balance of Payments, 1980-98
(millions of US dollars)

	Current Account	Capital Account[1/]	Overall Balance
1980	-438	1,048	610
1981	-2,136	2,189	53
1982	-1,851	1,606	-245
1983	-330	417	87
1984	-1,988	1,741	-247
1985	-2,166	1,966	-200
1986	-1,811	1,780	-31
1987	-246	560	315
1988	-1,048	946	-102
1989	-1,309	775	-533
1990	185	-10,409	-10,224
1991	1,903	-3,976	-2,073
1992	2,812	548	3,360
1993	2,299	-2,281	18
1994	31	-1,195	-1,164
1995	-254	-1,573	-1,827
1996	-192	-1,533	-1,725
1997	-711	75	-635
1998	-2566	1179	-1387

[1/] Includes errors and omissions.

In Egypt foreign capital movements have shifted from a net annual average inflow of $1.1 billion in the 1980s to a net annual average outflow of –$2 billion in 1990-98. This reversal has not only prevented the financing of the recent current account deficits, but also brought about significant decreases in the level of international reserves (Table 2.2). As a result, Egypt's ability to channel external resources to supplement domestic savings in the financing of investment and to reduce or eliminate the external gap has been severely limited. If residents were to anticipate a devaluation in view of the worsening reserve position, they could start to have an increasingly positive financial position with the rest of the world, in which case deficits in the current account could create future deficits in the capital account. Eventually, if net capital outflows were not reversed, then overall equilibrium would need to be established through a reduction in domestic absorption.

Recent capital inflows into Egypt and other developing and emerging countries have generally helped economic growth, but they have also caused serious problems in macroeconomic management. Sterilization efforts to offset the monetary effects of balance of payments surpluses or deficits on the domestic money supply have often resulted in a combination of real exchange rates and real interest rates that are inconsistent with the external environment. In this situation, countries have often opted for nominal appreciation to reduce the pressure of capital inflows on the monetary base, despite high current account deficits.

Feedback between the current and capital accounts depend on the composition of capital inflows. In the case of Egypt, recent capital inflows have been about evenly divided between portfolio investment and FDI (Table 2.3). For portfolio investment or other short-term inflows, the equilibrium real exchange rate will probably depreciate if these capital flows are used to finance consumption or unproductive activities, and it will probably appreciate if these capital inflows are channeled into productive capital formation. With FDI the effects on the current account are less clear. If cross-border production activities are directed towards exports and they rely on domestic inputs, then increased FDI inflows will improve the current account. In contrast, if cross-border production activities are oriented to the domestic market and they use foreign inputs, then the current account balance will be negatively related to FDI inflows.

On the monetary policy side, the CBE has consistently aimed to stabilize prices and the exchange rate. 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 central bank refinancing credit. Domestic bank financing of the fiscal budget has been avoided and the rate of growth of credit to state enterprises has been somewhat curbed. Real interest rates on household deposits have been positive since the early 1990s.

Table 2.3
Capital Inflows by Type, 1990-98
(millions of US dollars)

	Foreign Direct Investment	Net Portfolio Investment	Other Investment Liabilities
1990	734	n.a.	-9,855
1991	253	n.a.	-2,620
1992	459	n.a.	-1,812
1993	493	4	-1,578
1994	1256	3	-1,761
1995	598	20	-1,974
1996	636	545	-2,070
1997	891	816	381
1998	1076	-600	1470

Source: IMF, *International Financial Statistics* (June 2000).

The major monetary instruments are credit ceilings, reserve requirements, and refinancing facilities. The GOE uses instruments to achieve targets for the growth of monetary aggregates and credit. Ceilings initially were imposed only on 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. Treasury bills are auctioned and mostly bought by the commercial banks.

VIII. 2.4 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. There exist 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 early 1990s; 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 consistent 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 cointegrated. 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 the economy. Instead, the economy has a transient response to changes in these variables, and it is appropriate to constrain their long-

term effects to zero.[5] 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 exist few, 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 2.4 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 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 range 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 distributions 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.

[5]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.

Table 2.4
Descriptive Statistics of Key Macroeconomic Variables
(Calculated for percentage changes in real value data of annual periodicity)

	GDP	Invest-ment	Consum-ption	Exports	Imports	World GDP	Interest Rate	Real Exchange Rate
Mean	11.26	12.5	5.1	9.42	9.23	4.48	-17.1	-0.02
Median	11.46	12.2	5.6	9.44	9.21	4.48	-12.7	0.05
Maximum	11.81	34.5	15.7	9.94	9.92	4.82	216.7	0.23
Minimum	9.98	-24.0	-3.5	8.90	8.57	4.15	-146.4	-0.64
Std. Dev.	0.57	16.0	6.3	0.26	0.27	0.20	111.9	0.24
Skewness	-1.11	-1.2	0.2	-0.15	0.13	0.04	0.9	-1.57
Kurtosis	2.84	4.4	2.1	2.70	3.95	2.84	3.1	4.36
Order of Integration *	I(2)	I(2)	I(2)	I(1)	I(2)	I(1)	I(1)	I(1)
Augmented Dickey-Fuller (ADF) Test:								
ADF t-statistic	-4.37	-2.31	-5.03	-5.15	-2.07	-3.92	-9.08	-4.66
Critical value **	1%=-2.66	5%=-2.01	1%=3.36	5%=-3.04	5%=-2.00	1%=-3.72	1%=6.76	1%=-3.73
Durbin-Watson Statistic	2.10	1.75	1.49	1.98	1.67	2.03	2.13	2.19

Note: The sample period is 1988-98.
* Order of integration on log levels of corresponding variables.
** MacKinnon critical values. A negative ADF 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.

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.[6]

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.[7] For trending variables

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

[7]A series is said to be integrated of order k, denoted I(k), if the series needs to be

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.

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:

$$y_t = a + by_{t-1} + d \tag{2.1}$$

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

$$\Delta y_t = a + (b-1)y_{t-1} + d \tag{2.2}$$

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

$$DW = 2(1-r) \tag{2.3}$$

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

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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.

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	-4.28
The critical values for rejection of hypothesis of non-stationarity are as follows:	
1% Critical Value*	-3.73
5% Critical Value	-2.99
10% Critical Value	-2.63

The test therefore failed to reject the test in levels and first differences but rejects the test in second differences, which indicated that the series is of integrated order I(2).

The results of the ADF test and the DW test are presented in the bottom of Table 2.4. 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, imports, and GDP are all of integrated order 2, while exports, prices, interest rates, exchange rates, and foreign GDP are of integrated order 1.

To facilitate the presentation of the IS-LM framework used for policy analysis in Egypt, the behavioral equations have been presented in the levels form of the variables. However, empirical estimates in the levels form of the behavioral 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 Egyptian model are therefore based on log-linear relationships.

IX. 2.5 Dynamic Specification

The dynamic processes underlying Egypt'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 Z_i is:

$$Y_t = \Sigma^m_{i=1}\ \alpha_i\ Y_{t-i} + \Sigma^n_{i=0}\ \beta_i\ Z_{it} + \varepsilon_t \qquad (2.4)$$

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 Egypt'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 Egypt 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 Egypt, 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. Engle and Granger (1987) have demonstrated that a data-generating process of the form known as the error-correction mechanism (ECM) adjusts for any disequilibrium between variables that are cointegrated. The ECM specification thus provides the means by which the short-run observed behavior of variables is associated with their long-run equilibrium growth paths. Davidson *et al.* (1978) established a closely related specification know as the "equilibrium-correcting mechanism" (also having the acronym ECM) that models both the short and long-run relationships between variables.
Rearranging the terms of a first-order stochastic difference equation yields the following ECM:

$$\Delta y_t = \alpha_o + \alpha_1(y - z)_{t-1} + \alpha_2 \Delta z_t + \alpha_3 z_{t-1} + v_t \qquad (2.5)$$

where $-1 < \alpha_1 < 0$, $\alpha_2 > 0$ and $\alpha_3 > -1$, and where all variables are measured in logarithmic terms.

The second term, $\alpha_1(y - z)_{t-1}$, is the mechanism for adjusting any disequilibrium in the previous period. When the rate of growth of the dependent variable y_t falls below its steady-state path, the value of the ratio of variables in the second term decreases in the subsequent period. That decrease, combined with the negative coefficient of the term, has a positive influence on the growth rate of the dependent variable. Conversely, when the growth rate of the dependent variable increases above its steady-state path, the adjustment mechanism embodied in the second term generates downward pressure on the growth rate of the dependent variable until it reaches that of its steady-state path. The speed with which the system approaches its steady-state path depends on the proximity of the coefficient to minus one. If the coefficient is close to minus one, the system converges to its steady-state path quickly; if it is near to zero, the approach of the system to the steady-state path is slow. Since the variables are measured in logarithms, Δy and Δz can be interpreted as the rate of change of the variables. Thus the third term, $\alpha_2 \Delta z_t$, expresses the steady-state growth in *Y* associated with *Z*. Finally, the fourth term, $\alpha_3 z_{t-1}$, shows that the steady-state response of the dependent variable *Y* to the variable *Z* is non-proportional when the coefficient has non-zero significance.

Open economies, such as Egypt's, have a long-term relationship with one or more series in the global economy after transient effects from all other series have disappeared. That part of the response of real GDP that never decays to zero is the steady-state response, while that part that decays to zero in the long run is the transient response. Examples of relationships in which steady-state responses occur are those between the real domestic private consumption and real GDP. An example of a transient response is exchange rate movements, since if relative price changes were not transient, the disparity between prices of the home country and the foreign market would continuously widen. In that case, consumers would eventually switch entirely to the supplier with the lower priced products. Hence, it is important to distinguish the short-run adjustment component from the long-run equilibrium component.

The equilibrium solution of equation (2.5) is a constant value if there is convergence. Since the solution is unrelated to time, the rate of change over time of the dependent variable *Y* (given by Δy_t) and the explanatory variable *Z* (given by Δz_t) are equal to zero. However, in dynamic equilibrium, equation (2.5) generates a steady-state response in which growth occurs at a constant rate, say *g*. For the dynamic specification of the relationship in (A.4), if g_1 is defined as the steady-state growth rate of the dependent variable *Y,* and g_2 corresponds to the steady-state growth rate of the explanatory variable *Z,* then, since lower-case letters denote the logarithms of variables, $g_1 = \Delta y$ and $g_2 = \Delta z$ in dynamic equilibrium. In equilibrium the systematic dynamics of equation (2.5) are expressed as:

$$g_1 = \alpha_o + \alpha_1(y - z) + \alpha_2 g_2 + \alpha_3 z \qquad (2.6)$$

or, in terms of the original (anti-logarithmic) values of the variables:

$$Y = k_0 Z^{\beta} \tag{2.7}$$

where $k_0 = \exp\{(-\alpha_o/\alpha_1) + [(\alpha_1 - \alpha_2\alpha_1 - \alpha_3)/ \alpha_1^2]g_2\}$, and where $\beta = 1 - \alpha_3/\alpha_1$.

The dynamic solution of equation (2.7) therefore shows *Y* to be influenced by changes in the rate of growth of *Z*, as well as the long-run elasticity of *Y* with respect to *Z*. For example, were the rate of growth of the explanatory variable accelerate, say from g_2 to g'_2, the value of the variable *Y* would increase. However, it is important to reiterate that the response to each explanatory variable can be either transient or steady-state. When theoretical considerations suggest that an explanatory variable generates a transient, rather than steady-state, response, it is appropriate to constrain its long-run effect to zero.

3.0 Modeling the Output Market

X. 3.1 Overview

The present model represents an application of the conventional Mundell-Fleming model using the IS-LM framework for the open economy of Egypt and, as a policy-oriented system, it incorporates key parameters for the formulation of economic decisions. 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 International Monetary Fund (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).[8] 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 Egyptian 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.

XI. 3.2 Output Determination

To simplify the exposition that follows, Box 1 summarizes the notations used in the model. The present section describes the components for aggregate demand, and the output market in terms of the relationships for consumption, investment, government expenditures, exports and imports. Together these make up the Investment-Savings (IS)-curve. The following section examines factors effecting movements along the curve and those bringing about a shift in the curve.

[8]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, 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 consumption expenditures
C^g	=	real government consumption expenditures
C^p	=	real private consumption expenditures
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 government
E^n	=	nominal exchange rate
E^r	=	real effective exchange rate
F	=	external debt of public sector, denominated in foreign currencies
G	=	government expenditures
G^r	=	government expenditures on other
G^w	=	government expenditures on wages
H	=	nominal debt of government
I	=	real gross domestic investment expenditure
I^f	=	foreign direct investment
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 GOE
R^g	=	net foreign assets of government
R^p	=	net foreign assets of private sector
T^t	=	taxes from trade
T^r	=	taxes from other sources
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
Y^g	=	real government revenue
Z^m	=	real imports of merchandise
Z^s	=	real imports of merchandise

3.2.1 Aggregate Demand

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

$$Y = A + B \tag{3.1}$$

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

$$A = C + I + G \tag{3.2}$$

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:

$$B = X - Z \tag{3.3}$$

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

Conventional IS-LM curves offer a useful analytical tool for examining the effects of policy initiatives or shocks on the Egyptian economy. These curves, along with that for foreign exchange (FE), provide a framework within which to show the equilibrium output solution of the Egyptian economy under different predetermined variables, including those representing policy instruments. We begin with the derivation of the IS curve, and in the next chapter derive the LM curve. After examining the fiscal component of the model in chapter 5, we derive the FE curve, and consider the effect of current account imbalances on capital flows, national savings and investment, and the Government's budget deficit.

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).*

In Egypt consumption by the private sector depends on income. 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. Nevertheless, the real interest rate measured in this form was not significant and of the right sign.

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 Egypt. 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 using the ECM specification described in equation (2.5) is as follows:

$$\Delta \ln C_t = \underset{(2.9)}{-0.43 - 0.46 \ln(C/Y)_{t-1}} + \underset{(12.8)}{0.92 \, \Delta \ln Y_t} + \underset{(2.3)}{0.02 \ln Y_{t-1}} \tag{3.5}$$

$$R^2 = 0.90 \qquad DW = 1.8 \qquad \text{Period: } 1971\text{-}98$$

and the long-run, or steady-state solution, of the estimated equation is as follows:

$$C = e^{0.93} Y^{1.04} \tag{3.6}$$

Hence the long-run elasticity of consumption with respect to income is 0.92 in the short run and 1.04 in the long run.

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

$$I = k_2 + \beta_{21} Y + \beta_{22} r + \beta_{23} T \tag{3.7}$$

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

Egypt's investment is composed of fixed investment and changes in stocks. Given the importance of FDI, the component has been calculated separately from other investment activity and the results are reported under the balance of payments analysis in Chapter 5. For other investment, domestic economic activity in Egypt and

the real domestic interest rates (lending rate) were included as explanatory variables. Because real interest rates were 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:

$$\Delta \ln I_t = 1.58 - \underset{(2.1)}{0.43} \ln(I/Y)_{t-1} - 0.22 \ln(T)_t \qquad (3.8)$$

$R^2 = 0.48$ DW = 1.7 Period: 1992-98

The long-run elasticity of other investment with respect to income is 0.67 in the short run and 1.0 in the long run, and with respect to taxes it is 0.22 in the short run and 0.52 in the long run.

Stock changes are normally inversely related to the general level of economic activity. An increase in economic activity leads to a drawdown of stocks, and conversely, a cutback in economic activity often results in an accumulation of stocks. However, industry studies do not always support this expected negative relationship.[9] We found stocks in Egypt to generally not have a negative relationship to economic activity. We also considered the influence of real interest rates on inventory holdings but did not find a significant relationship or one with the expected sign. Contrary to expectations, stock changes in Egypt were found to be positively related to economic activity:

$$\Delta \ln K_t = -13.7 - \underset{(3.9)}{0.82} \ln(K/Y)_{t-1} + \underset{(0.4)}{0.88} \ln Y_t \qquad (3.9)$$

$R^2 = 0.69$ DW = 2.3 Period: 1980-98

which yields an elasticity of stock changes with respect to income of 0.82 in the short run and 2.0 in the long run.

Exports are positively related to foreign market income and negatively related to both the price of exports and the real exchange rate.

$$X = k_4 + \beta_{41} Y^f + \beta_{42} P^d + \beta_{43} e^r \qquad (3.10)$$

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

The price effect in equation (3.10) is decomposed into the own-price effect, measured in terms of the domestic currency, and the real exchange rate (REER) effect. The REER takes into account changes in the price of domestic goods, P^d, relative to that of foreign goods, P^f, and the nominal exchange rate, R^n. At the bilateral trade level, the real exchange rate is measured by the 'real cross-rate', which takes into account changes in the nominal exchange rate of Egypt with the foreign country and the

[9] See, for example, the case study on inventories by industries in *Eviews: User's Guide* (Chapter 17).

relative price levels between Egypt and that country. The decomposition allows us to separate the own-price (transmitted through their effect on the domestic-currency-denominated price level) and cross-rate effects since our interest in this study is the measurement of the impact of changes in both trade taxes and the exchange rate on the balance of trade and the macro-economy. The equation estimates for exports are presented in Chapter 6.

Imports are positively related to domestic income and the real exchange rate, and they are negatively related to the price of imports.

$$Z_t = k_5 + \beta_{51} Y + \beta_{52} P^f + \beta_{53} e^r \qquad (3.11)$$

The coefficient β_{51} is the *marginal propensity to import out of domestic income (MPM)*. The price effect in equation (3.7) is decomposed into the foreign currency denominated import price, P, and the real effective exchange rate, R.[10] The equation estimates for exports are presented in Chapter 6.

The real exchange rate in equations (3.10) and (3.11) 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.[11] Variations in e^r influence the quantity of Egypt's goods demanded by foreign markets relative to competing foreign and domestic suppliers to those markets.

XII. 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):

$$Y = C + I + G + X - Z \qquad (3.12)$$

Substitution of the individual relationships in equations (3.4) through (3.11) into the absorption and trade balance components yields the aggregate demand relationship in its explicit function form:

$$Y = \theta_o + \theta_1 r + \theta_2 P^d + \theta_3 P^f + \theta_4 e^r + \theta_5 G + \theta_6 Y^f \qquad (3.13)$$

II. **[10] Note that the demand for imports is determined by the local currency price (in Egyptian pounds) of imports. As such, we can define the price variable into the US dollar prices and the real effective exchange rate as $P^e = P/R$, where P^e is the Egyptian pound price of the imported product, P is the US dollar price of the imported product, and R is the real effective exchange rate. Since the REER takes into account changes in the price of domestic goods, P^e, relative to foreign goods, P^f, and the nominal exchange rate, R^n, and is defined as $R = P^e/(R^n P^f)$, then the demand for imports in Egypt is directly affected by the real exchange rate, as well as the foreign currency denominated import price.**

[11] This definition is the one used by the IMF, while the more traditional definition is $R = R^n P^f / P^e$. To facilitate the interpretation of the results for readers, we have adopted the IMF definition. See Edwards (1988: Appendix) for alternative definitions of the real exchange rate.

where $\theta_1 < 0$, $\theta_2 < 0$, $\theta_3 < 0$, $\theta_4 > 0$, $\theta_5 > 0$, $\theta_6 > 0$. Aggregate demand is therefore negatively related to the real interest rate and domestic and foreign trade prices, 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 (3.13). 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, domestic and foreign trade prices, 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 Egypt, 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). Edwards has summarized the theoretical reasons for contractionary devaluations (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, low price elasticities of demand for exports and imports, or supply-side rigidities.

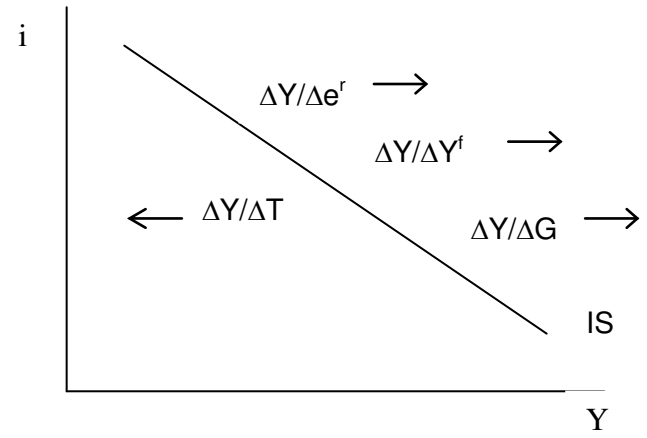
The IS (investment-savings) curve relates the level of output of a country like Egypt to its real interest rate. The IS curve is obtained from the relationship between the level of aggregate demand and the level of the interest rate in equation (3.13):

$$\Delta r/\Delta Y = 1/\theta_1 < 0 \qquad (3.14)$$

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 in domestic and foreign trade prices, 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 Egyptian goods, causing aggregate demand

Figure 3.1
The IS Curve



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 $\Delta Y/\Delta T = \theta_5 < 0$.

XIII. 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.

Table 3.1
Egypt: Value Added by Sector (percent contribution)

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Value Added: Primary Sector	21%	20%	19%	20%	19%	18%	17%	17%	17%	17%	17%
Value Added: Secondary Sector	27%	27%	29%	28%	29%	33%	33%	33%	33%	33%	32%
of which: manufacturing	13%	23%	24%	25%	24%	23%	23%	24%	25%	25%	24%
Value Added: Tertiary Sector	52%	52%	52%	52%	52%	49%	50%	50%	50%	50%	51%
GDP at factor costs	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Sources: Central Bank of Egypt and IMF.

In Egypt the service sector is dominated by tourism, Suez Canal activities, transportation, communication, finance and insurance. Agricultural remains important to the country's economy, and almost half of the country's industrial production is based on agricultural output. Cotton production, for example, remains one of its major economic activities and foreign exchange sources. In modeling the value added of these three sectors, we determine the output level of primary sector by the economy's overall expenditure level and the activity of the other two sectors. Output of the secondary sector, measured in 1991 Egyptian pounds, is a positive function of aggregate investment, *I*, and the real exchange rate:

$$Y^b_t = \alpha_{60} + \alpha_{61} I_t + \alpha_{62} e^r_t + \mu_6 \qquad (3.15)$$

The final equation in log linear form is as follows[12]:

$$\Delta \ln Y^b_t = 0.79 - \underset{(5.3)}{0.22} \ln(Y^b/I)_{t-1} + \underset{(3.2)}{0.19} \ln e^r_t \qquad (3.16)$$

$R^2 = 0.95$ DW = 2.7 Period: 1992-98

The elasticity of secondary sector activity with respect to gross fixed capital formation is 0.22 in the short run and 1.0 in the long run. With respect to the real exchange rate, it is 0.19 in the short run and 1.86 in the long run.

Similarly, the output of the tertiary sector is a positive function of aggregate consumption, *C*, and the real exchange rate:

$$Y^c_t = \alpha_{63} + \alpha_{64} C_t + \alpha_{65} e^r_t + \mu_6 \qquad (3.16)$$

and the estimated equation is[13]:

$$\Delta \ln Y^c_t = -5.2 - 0.55 \ln(Y^c/C)_{t-1} + 1.41 \Delta \ln C_t + 0.4 \ln C_{t-1} + 0.06 \ln e^r_t \qquad (3.16)$$

[12] A binary variable was included for 1996 (1 in 1996; 0 otherwise).
[13] A binary variable was also included for 1996 (1 in 1996; 0 otherwise).

(5.5) (17.3) (9.2) (4.5)

$R^2 = 0.98$ DW = 2.6 Period: 1987-98

The elasticity of tertiary sector activity with respect to total consumption is 1.4 in the short run and 1.7 in the long run. With respect to the real exchange rate, it is 0.06 in the short run and 0.11 in the long run.

4.0 Modeling the Monetary and Fiscal Sectors

XIV. 4.1 The Supply and Demand for Money

The banking system of Egypt is composed of the CBE as the central bank and a commercial banking system that is regulated by the CBE. The CBE 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 imply 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 CBE 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 CBE.
- *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 Egyptian pounds (LE) 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:

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

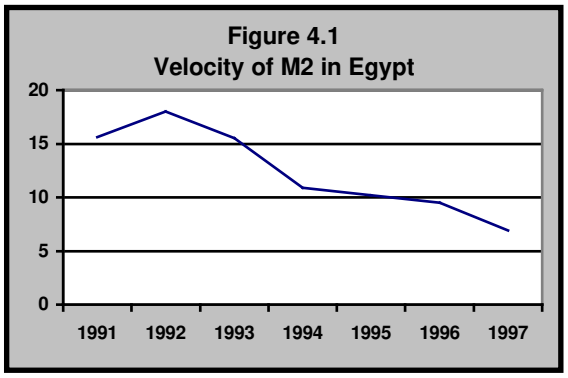
and net foreign assets is made up of net foreign assets of the CBE, denoted R^c, net foreign assets of commercial banks, denoted R^b, net foreign assets of the private sector, denoted R^p, and net foreign assets of the government, denoted R^g:

$$R_t = R^c_t + R^b_t + R^p_t + R^g_t \tag{4.3}$$

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:

$$V_2 = YP / M_2 \tag{4.4}$$

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 (4.4) 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 Egypt, 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 and associated with foregone earnings from holding interest-bearing financial assets 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*:

$$M/P = k_{70} + \beta_{71} r + \beta_{72} Y \tag{4.5}$$

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.

4.1.3. Interest Rate and Price Relationships

In Egypt, the official rate of inflation has decelerated from over 20 percent a year in the early 1990s to around 4 percent by the end of the decade. However, the rate is affected by rigidity of prices in subsidized goods and fixed rents that enter into the consumer basket.

XV. 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 (4.5) in terms of interest rate:

$$r = \kappa_0 - \kappa_1 Y + \kappa_2(e^n R+D)/P \tag{4.6}$$

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:

$$\Delta r/\Delta Y = - \kappa_1 \tag{4.7}$$

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.

XVI. 4.3 Government Revenue and Expenditures

The Government of Egypt's revenue collection has been hindered by the large informal sector and dependence on foreign trade taxes. As a result, the real value of tax revenue collections has grown by less than 1 percent on average since 1992. In order to reduce the overall budget deficit, government expenditures have had to be cut, especially on non-wage expenditures. While the burden of the budget deficit as a percentage of GDP has been reduced from 18 percent in 1990/91 to 5 percent in 1998/99, government investment activities, particularly in public infrastructure, have suffered. In addition to public sector wage payments, there has been a drain on government budget from the need to finance public sector programs.

Taxes from trade, denoted T^t, are calculated from the level of imports and the average tariff rate.

Other taxes, denoted T^o, is related to private consumption:

$$\Delta \ln T^o_t = -1.11 - \underset{(3.0)}{0.67} \ln(T^o/Y)_{t-1} \qquad (4.8)$$

$R^2 = 0.65$ DW = 1.2 Period: 1992-98

Current government expenditures are separated into wages and other expenditures. Expenditures on wages, denoted G^w, are related to private consumption:

$$\Delta \ln G^w_t = -1.26 - \underset{(4.1)}{0.50} \ln(G^w/C^p)_{t-1} \qquad (4.9)$$

$R^2 = 0.85$ DW = 3.2 Period: 1994-98

Other government expenditures, denoted G^r, are related to total government revenue:

$$\Delta \ln G^r_t = -0.28 - \underset{(1.6)}{0.51} \ln(G^r/Y^g)_{t-1} \qquad (4.10)$$

$R^2 = 0.55$ DW = 2.1 Period: 1994-98

XVII. 4.4 Monetarization of the Fiscal Deficit

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:

$$\Delta D^g_t = PG + i_t D^g_{t-1} + i_t F_{t-1} - PT - PN \tag{4.11}$$

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):

$$\Delta D^g_t = \Delta M_t - e^n_t \Delta R_t - \Delta D^p_t - \Delta D^{gr}_t \tag{4.12}$$

The government budget relates the sources of the deficit in equation (4.12) to the financing of the deficit in equation (4.11):

$$PG + i_t D^g_{t-1} + i_t F^g_{t-1} - PT - PN = \Delta M_t - e^n_t \Delta R_t - \Delta D^p_t - \Delta D^{gr}_t \tag{4.13}$$

The *budget constraint* in equation (4.14) states that the government can finance its deficit by increasing the money supply, borrowing from the public sector, or reducing its foreign exchange holdings.

5.0 Modeling the External Sector

XVIII. 5.1 Balance of Payments Components and Derivation of the Foreign Exchange Curve

The principal components of Egypt's current account balance are made up of the individual balances on goods and non-factor services[14], income[15] and transfers[16]. Any deficit arising in the current account represents an imbalance between national savings and investment that needs to be financed by a capital inflow or the accumulation of debt.

Offsetting financial cash flows in the capital account arise from foreign direct investment, portfolio investment and other investments, and any imbalance between the current and capital accounts of the balance of payments must be financed through changes in the official foreign reserves of Egypt. Traditionally, interest in the capital account has focused on FDI flows, which comprise capital transactions such as equity capital, earnings reinvestment, and other short and long-term capital that is used to acquire management interest in an enterprise operating in Egypt. Portfolio investments comprising long-term bonds and corporate equities other than direct investment and reserves have become important to Egypt since the mid-1990s. Financing of the current account deficit with portfolio investment tends to be less sustainable than a deficit financed by FDI flows since these so-called hot money flows are more sustainable to reversals when market conditions and sentiments change.

[14]Non-factor services comprise shipment, passenger and other transport services, and travel, as well as current account transactions not separately reported. These include transactions with nonresidents by government agencies and their personnel abroad, and also transactions by private residents with foreign governments and government personnel stationed in Egypt.

[15]This balance comprises income from (a) factor (labor and capital) services in the form of income from direct investment abroad, interest, dividends, and property and labor income; and (b) long-term interest on the disbursed portion of outstanding public and private loans repayable in foreign currencies, goods or services.

[16]Transfers include (a) private net transfer payments between private persons and nonofficial organizations of the reporting country and the rest of the world that carry no provisions for repayments and that include workers' remittances, transfers by migrants, gifts, dowries, and inheritances, and alimony and other support remittances; and (b) official net transfers in the form of payments between the GOE and governments of the rest of the world.

5.1.1 Balance of Payments Equilibrium

Overall equilibrium in the balance of payments is the sum of the 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 mainly associated with movements in FDI, which in turn depend on interest rates and foreign and domestic incomes. Using equation (3.10) for exports and equation (3.11) for imports in the trade balance component, and the implicit relationship of FDI for the capital account component, we can specify the relationship for the balance of payments as follows:

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

5.1.2 Derivation of the FE Curve

The foreign exchange (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 $\omega_3 = -(\beta_{83}/\beta_{84})$.

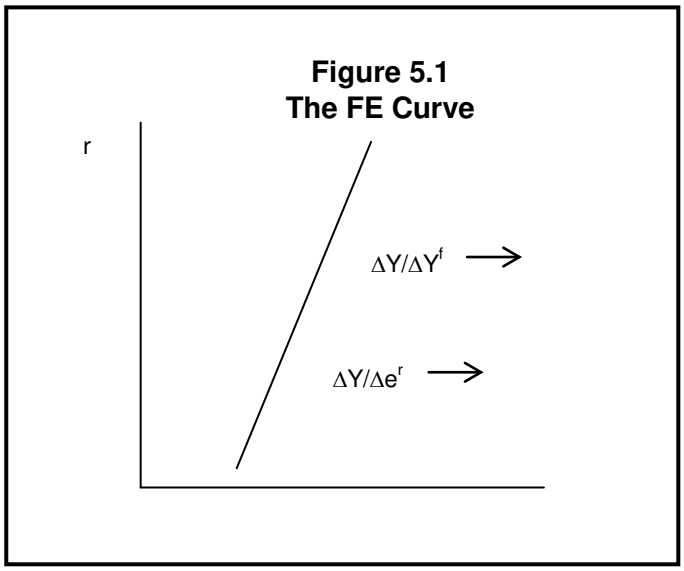
The slope of the FE curve is given by:

$$\Delta r/\Delta Y = \omega_1 \tag{5.4}$$

Since $\omega_1 = -\beta_{82}/\beta_{84}$, and $\beta_{82} > 0$ and $\beta_{84} < 0$, the slope of the FE curve is positive. When capital is highly immobile, the curve is vertical. Shifts in the FE 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 FE curve also occurs when there is an increase in foreign market income, and the amount by which aggregate demand increases equals $\Delta Y/\Delta Y^f = \omega_2 > 0$. Figure 5.1 demonstrates the effects.

5.1.3 Balance of Payments Relation to 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:



$$\Delta R_t = B^c = \Delta R^c_t + \Delta R^b_t + \Delta R^p_t + \Delta R^g_t \quad (5.5)$$

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 CBE. Hence,

$$B^k = \Delta R^b_t + \Delta R^p_t + \Delta R^g_t \quad (5.6)$$

Finally, the overall balance of payments is the sum of the current and capital accounts. That difference equals the change in foreign exchange reserves of the CBE:

$$B^b = \Delta R^c_t \quad (5.7)$$

5.1.4 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 Egypt. 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):

$$B_t = Y_t - A_t \quad (5.8)$$

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:

$$S_t = Y_t - C_t - G_t \quad (5.9)$$

Substituting equation (5.9) into equation (5.8) gives the expression for the trade balance in terms of savings and investment:

$$B_t = S_t - I_t \quad (5.10)$$

Hence the balance on trade in goods and non-factor services is the difference between savings and investment.[17] If Egypt 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 Egypt has a trade deficit.

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

$$B_t = \Delta R_t \quad (5.11)$$

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

XIX. 5.2 Demand for Imports

5.2.1 Merchandise Imports

The demand for imports of Egypt is postulated to have a steady-state response to domestic economic activity, and a transient response to the constant local currency price of imports. The life-cycle approach to consumption emphasizes income as a determinant of intertemporal consumption planning and provides theoretical justification for the existence of the dynamic effect on import demand of changes in the rate of growth of domestic income (see Deaton and Muellbauer, 1980: Chap. 12). In contrast, there is no logical explanation for any dynamic effects of the price of imports. Were the import price of a product to change continually relative to the general price deflator, consumers would soon cease to purchase the product as the spread between the product price and the general price level widened.

An important characteristic of the import demand for any one product is that its long-term response to the growth of domestic income is not necessarily proportional, and in fact has historically exceeded unity. Moreover, among individual countries the marginal propensity to import has varied greatly (see Houthakker and Magee, 1969). This characterization suggests that the dynamic specification of the import demand

[17] 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.

equation should not introduce any restrictions that would impose long-run unitary elasticity with respect to income. Nevertheless, the model should encompass long-term proportionality responses when they exist.

A second feature of the present modeling approach is that the dynamics for import demand relationships can be restricted to one period since the adjustment of imports to price and income changes tends to decline exponentially over time. Accordingly, in terms of the general stochastic difference specification, the expression for imports, M, in terms of income, Y, the price of the product, P, in foreign currency terms, and the real effective exchange rate, R, can be expressed as:

$$\ln(M)_t = \alpha_{10} + \alpha_{11}\ln(M)_{t-1} + \alpha_{12}\ln(Y)_t + \alpha_{13}\ln(Y)_{t-1} + \alpha_{14}\ln(P)_t + \alpha_{15}\ln(P)_{t-1} + \alpha_{16}\ln(e^r)_t + \alpha_{17}\ln(e^r)_{t-1} + u_{1t} \quad (5.12)$$

where the expected signs of the coefficients are $0 < \alpha_{11} < 1$; α_{12} and $\alpha_{13} > 0$; α_{14} and $\alpha_{15} < 0$; α_{16} and $\alpha_{17} > 0$. Income is treated as (weakly) exogenous for the parameters of interest. The use of the logarithmic specification in equation (5.12) provides a means by which the elasticity can be calculated directly from the estimated equation; the results are consistent when the elasticities remain constant over time. Tests of parameter constancy provide a means of validating that hypothesis.

The third characteristic is that the observed price for the Egyptian importer incorporates the tariff of the product. Expenditure-switch policies in the form of tariffs create a 'price wedge' between the domestic price to the consumer and the world market price of the product. This measure effectively imposes a tax on the consumer. The effective tax rate, denoted t, raises the price of the product to $(1+t)P^b$, where P^b is the border price of the product. The observed price of the domestic good, P^e, is therefore defined as:

$$P^e = (1 + t)P^b \quad (5.13)$$

Changes in the tariff rate will be fully passed on to the importer when the foreign market export supply to small markets like that of Egypt is perfectly price elastic.[18]

The fourth important characteristic is that the demand for imports is determined by the local currency price (in Egyptian pounds) of imports. As such, we can decompose the price variable into the US dollar prices and the real effective exchange rate in equation (5.13) as follows:

[18]The 'small market' assumption is important for the calculations that follow. In calculating the effects of a tariff reduction, the Egypt market is assumed to represent a fairly small proportion of its trading partners' total exports and, hence, that the import supply schedule is infinite with respect to prices. Prices of each of Egypt's imported products are therefore changed by the full amount of any tariff reduction on the products. Were the import supply schedule to be less than perfectly elastic with respect to prices, a change in tariffs would lead to less than proportional changes in prices and smaller increases in the volume of imports than would otherwise occur under a perfectly price elastic import supply schedule.

$$P^e = P/e^r \tag{5.14}$$

where P^e is the Egyptian pound price of the imported product, P is the US dollar price of the imported product, and e^r is the real effective exchange rate.

The real effective exchange rate takes into account changes in the price of domestic goods, P^e, relative to foreign goods, P^f, and the nominal exchange rate, R^n. It is defined as follows:[19]

$$R = P^e/(R^nP^f) \tag{5.15}$$

As such, the demand for imports in Egypt is directly affected by the real exchange rate.

The final characteristic is that if the import supply elasticity were to be less than infinite, then the pass-through of exchange rate changes from import price changes in foreign currency terms to import prices in local currency terms would be less than complete (see Branson, 1972, and the summary by Goldstein and Khan, 1985). Consequently, the estimated price and exchange rate coefficients in equation (5.15) could differ from one another.[20]

Since the growth rate of Egypt's imports in equation (5.12) depends on the expansion path of economic activity, it is appropriate to apply the error-correction-model (ECM) to the relationship between imports and domestic economic activity. The disequilibrium adjustment term in the ECM will then rectify any previous disequilibrium between the two variables. Rearranging the terms of the first-order stochastic difference equation (5.12) yields the following ECM:[21]

$$\Delta\ln(M)_t = \alpha_{20} + \alpha_{21}\ln(M/Y)_{t-1} + \alpha_{22}\Delta\ln(Y)_t + \alpha_{23}\ln(Y)_{t-1} + \alpha_{24}\Delta\ln(P)_t + \alpha_{25}\ln(P)_{t-1} + \alpha_{26}\Delta\ln(e^r)_t + \alpha_{27}\ln(e^r)_{t-1} + u_{2t} \tag{5.16}$$

where $-1 < \alpha_{21} < 0$; $\alpha_{22} > 0$; $\alpha_{23} > \alpha_{21}$; α_{24} and $\alpha_{25} < 0$; α_{26} and $\alpha_{27} > 0$.

The import price and exchange rate terms in the foregoing specification have been so transformed as to nest the 'differences' formulation of the variables in the levels form of the equation. This transformation reduces the possibility of the occurrence of the spurious correlation typically associated with time-series data when the relationship between import demand and import prices is estimated.

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[19]This definition is the one used by the IMF, while the more traditional definition is $R = R^nP^f/P^e$. To facilitate the interpretation of the results for readers, we have adopted the IMF definition. See Edwards (1988: Appendix) for alternative definitions of the real exchange rate.

[20]For a derivation of the import supply schedule, see Lord (1991a: Annex D).

[21] For the derivation of the equation, see Lord (1991a: Annex D).

On a steady-state growth path, the long-run dynamic equilibrium relationship implicit in equation (5.16) is:

$$M = kY^{\varepsilon y}P^{\varepsilon p}e^{r\,\varepsilon r} \quad \text{.....(5.17)}$$

The income elasticity of import demand is expressed as:

$$\varepsilon_y = 1 - (\alpha_{23}/\alpha_{21}) \quad (5.18)$$

Its value is positive since the expected sign of α_{21} is negative and $\alpha_{23} > \alpha_{21.}$ When $\alpha_{21} < \alpha_{23} < 0$, import demand is inelastic with respect to income; when $\alpha_{23} = 0$ it has a unitary elasticity; and when $\alpha_{23} > 0$ import demand is elastic.

The price elasticity of import demand is expressed as:

$$\varepsilon_p = - \alpha_{25}/\alpha_{21} \quad (5.19)$$

It has a negative value since the expected signs of both α_{25} and α_{21} are negative.

The real effective exchange rate elasticity of import demand is expressed as:

$$\varepsilon_r = - \alpha_{27}/\alpha_{21} \quad (5.20)$$

It has a positive value since the expected signs of α_{21} is negative and that of α_{27} is positive.

The import demand functions of the principal products have been derived from estimates of the dynamic specification of the relationship in equation (5.16) (see Table 5.1). As was to be expected, income has always been found to be statistically significant in explaining the demand for imports. In most cases, estimates of the income coefficients have 99 percent confidence intervals. The real effective exchange rate coefficients are statistically different from zero in the short run in 29 of the 41 product imports, and they are statistically different from zero in the long run in 21 of the 41 product imports. Prices are statistically significant in explaining import demand in about one-half of the products in both the short run and the long run.

The coefficients of the error-correcting term in the import demand relationships measure the speed of response of imports to changes in income, exchange rates and prices. About one-half of the import demand equations have an error-correcting term that is near unity in absolute terms. This fact reflects the relatively quick response of importers to changes in the explanatory variables. Major disturbances in import demand occurred largely in the latter part of the 1980s. Binary variables were used to eliminate those observations from the estimates. These disturbances were transitory shifts. A test of parameter constancy based on the Chow test showed the coefficients to be stable at the 5 percent level of significance in all the estimated relationships.

Table 5.1
Regression Results of Import Demand Equation

$$\Delta \ln(M)_t = \alpha_{20} + \alpha_{21}\ln(M/Y)_{t-1} + \alpha_{22}\Delta\ln(Y)_t + \alpha_{23}\ln(Y)_{t-1} + \alpha_{24}\Delta\ln(P)_t + \alpha_{25}\ln(P)_{t-1} + \alpha_{26}\Delta\ln(e^r)_t + \alpha_{27}\ln(e^r)_{t-1}$$

										Summary Statistics		
Description	**SITC**	**ln(M)–ln(Y)t-1**	**Dln(Y)t**	**ln(Y)t-1**	**Dln(P)t**	**ln(P)t-1**	**Dln(R)t**	**ln(R)t-1**	**Const**	**R2**	**dw**	**Yrs**
Wheat etc unmilled	**0410**	-0.95							10.63	0.74	1.80	1972-97
		(5.6)										
Prod of polymerizing etc	581 2	**-0.82**	1.80	1.41			0.64	0.31	-0.51	0.78	2.16	1980-97
		(2.7)	(0.8)	(2.3)			(1.6)	(1.6)				
Lumber sawn etc conifer	243 21	-0.48		0.34				0.12	2.51	0.90	2.33	1986-97
		(3.4)		(1.0)				(1.7)				
Maize unmilled	0440	-0.72	5.90	0.82			0.37		3.78	0.94	2.50	1985-97
		(6.1)	(4.7)	(3.8)			(3.1)					
Iron,simple stl blooms,etc	67251	-0.68		1.39	-2.61	-2.15			-3.16	0.97	2.32	1972-97
		(7.3)		(3.7)	(17.1)	(7.3)						
Raw beet and cane sugar	0611	-0.33		5.18			1.28	1.63	-27.34	0.68	2.77	1984-97
		(0.8)		(1.5)			(1.1)	(2.2)				
Sunflower seed oil	4216	-0.17			-4.28				1.49	0.78	2.28	1985-97
		(1.2)			(4.8)							
Oth machines nonelectric	7198	-0.85			-1.21	-1.37	0.96		7.73	0.81	2.43	1981-97
		(4.5)			(4.0)	(3.6)	(3.3)					
Excavtng,levling etc mac	71842	**-0.86**			-1.12	-1.94	0.52		7.83	0.91	1.43	1985-97
		(6.0)			(7.3)	(6.5)	(2.3)					
Pass motor veh exc buses	7321	-0.40			-1.17		1.11	0.75	-1.35	0.98	2.69	1990-97
		(6.0)			(10.1)		(3.9)	(3.4)				
Palm oil	4222	-0.93		5.42			6.24		-16.24	0.74	2.47	1980-97
		(3.5)		(2.4)			(2.8)					
Paper etc in bulk nes	6415	-0.28				-1.01	1.37	2.11	-8.57	1.00	2.41	1990-97
		(7.9)				(7.2)	(16.9)	(15.9)				
Electric power machinery	7221	-0.85		2.43			0.30	0.55	-8.18	0.96	2.83	1988-97
		(5.3)		(6.0)			(2.1)	(4.8)				
Bovine meat fresh,frozen	0111	-0.21		0.89	-3.85	-1.11	2.16	1.19	-7.77	0.95	2.30	1971-97
		(2.1)		(1.8)	(11.9)	(2.6)	(3.2)	(2.7)				
Other motor vehcl parts	73289	-0.67					1.48	1.32	-2.24	0.64	1.57	1990-97
		(2.3)					(2.3)	(2.1)				
Vegetable oil residues	0813	-0.79		1.46			3.04	0.47	-1.78	0.91	2.67	1978-97
		(6.2)		(3.5)			(9.1)	(2.3)				
Switchgear etc	7222	-0.89			-1.01	-1.01	0.48	0.17	6.28	0.96	2.19	1981-97
		(6.0)			(9.9)	(7.8)	(2.5)	(1.7)				
Tobacco unmfd	1210	-0.93	3.09	-0.49					8.06	0.83	2.46	1981-97
		(6.9)	(4.3)	(5.4)								
Line telephone,etc equip	72491	-0.81	4.50		-0.90	-0.60			4.93	0.75	2.15	1976-97
		(3.1)	(1.4)		(4.7)	(1.6)						
Rubber tyres,tubes	6291	-0.81	2.33	0.54			0.71	0.25	1.43	0.79	2.31	1971-97
		(5.8)	(1.4)	(3.2)			(2.4)	(1.5)				
Irn,simple stl bars etc	67321	-0.39						0.66	-0.25	0.96	2.21	1987-97
		(3.1)						(2.8)				
Pumps for liquids	71921	-0.84	1.41				0.44	0.33	2.44	0.96	2.22	1986-97
		(6.8)	(1.3)				(3.5)	(2.9)				
Prod of condensation etc	5811	-0.70	1.18	1.83					-3.07	0.86	2.25	1987-97
		(3.5)	(1.3)	(3.3)								

Table 5.1
Regression Results of Import Demand Equation

$\Delta \ln(M)_t = \alpha_{20} + \alpha_{21}\ln(M/Y)_{t-1} + \alpha_{22}\Delta\ln(Y)_t + \alpha_{23}\ln(Y)_{t-1} + \alpha_{24}\Delta\ln(P)_t + \alpha_{25}\ln(P)_{t-1} + \alpha_{26}\Delta\ln(e^r)_t + \alpha_{27}\ln(e^r)_{t-1}$

										Summary Statistics		
Description	**SITC**	**ln(M)–ln(Y)t-1**	**Dln(Y)t**	**ln(Y)t-1**	**Dln(P)t**	**ln(P)t-1**	**Dln(R)t**	**ln(R)t-1**	**Const**	**R2**	**dw**	**Yrs**
Tea	**0741**	-0.85							5.89	0.61	1.90	1982-97
		(3.8)										
Refined sugar etc	0612	-0.58						0.61	1.83	0.78	2.68	1983-97
		(4.6)						(2.5)				
Pesticides,disinfectants	5992	-0.19					0.65	0.32	-0.68	0.64	1.90	1982-97
		(2.1)					(3.2)	(2.5)				
Cement	6612	-0.17			-2.47	-0.88			-0.89	0.72	1.51	1981-97
		(1.2)			(5.3)	(1.2)						
Buses	7322	-0.88		1.16	-0.87				-0.79	0.95	2.77	1985-97
		(8.6)		(3.2)	(6.4)							
Piston engines non-air	7115	-0.40			-0.30				2.20	0.62	2.06	1976-97
		(2.9)			(2.7)							
Lorries,trucks	7323	-0.98			-0.91		2.23	1.64	-3.73	0.78	2.62	1985-97
		(4.1)			(2.1)		(2.5)	(2.3)				
Discn synth fibre uncmbd	26621	-0.10			-1.51	-1.46		0.43	-0.46	0.75	2.40	1986-97
		(1.3)			(3.0)	(2.1)		(2.3)				
Cont synth fibre yarn	65161	-0.29		0.56					-0.48	0.82	2.73	1973-97
		(3.2)		(1.7)								
Special purpose vessels	73592	-0.86		5.72	-1.18	-1.58	1.56	0.65	-22.89	1.00	2.04	1986-97
		(14.1)		(3.9)	(9.6)	(7.5)	(2.2)	(1.8)				
Coated etc paper nes blk	64195	-0.61		0.35	-0.68		1.44	0.21	1.92	0.84	2.25	1977-98
		(4.2)		(1.5)	(4.4)		(4.3)	(1.3)				
Insulated wire,cable	7231	-0.83			-1.42	-0.86	0.76		5.83	0.97	2.40	1986-97
		(6.6)			(10.6)	(5.8)	(4.5)					
Mach parts nonelec nes	71999	-0.19			-1.28	-0.22			1.44	0.95	1.43	1982-97
		(1.01)			(10.6)	(1.5)						
Fish fresh,chilled,frozn	0311	-0.95	4.07	0.80			0.43		3.69	0.89	2.57	1973-97
		(9.5)	(2.2)	(3.9)			(1.9)					
Pumps for gases etc	71922	-0.67		0.42	-0.35	-0.29	0.49	0.20	1.26	0.90	1.58	1975-97
		(6.3)		(3.0)	(4.2)	(2.6)	(3.7)	(1.9)				
Plywood,veneers inlaid	63121	-0.86		0.31			0.50	0.26	3.92	0.74	2.55	1975-97
		(6.1)		(1.6)			(2.3)	(1.7)				
Grey cotton yarn in bulk	6513	-0.24			-0.81		1.64		1.46	0.89	3.13	1988-97
		(3.9)			(2.8)		(3.4)					
Lifting,loading mach nes	71931	-0.41					0.78	0.31	0.72	0.58	1.54	1975-97
		(3.6)					(3.1)	(1.7)				

Source: Estimates reported in Annex 2 of the present study (Boye, 2000).

Table 5.2 shows the income, price and exchange rate elasticities of Egypt's principal product imports estimated by Boye (2000) and reported in Annex 2 of the present overall study on tariff reforms in Egypt. For income, the unweighted average elasticity is 0.95 in the short run and 2.24 in the long run. The 1997 trade-weighted income elasticities are substantial: 1.12 in the short run and 2.49 in the long run. These elasticities conform to other estimates of import demand functions for developing and transition economies (Lord, 1991: Chapter 13). As expected, import demand is income inelastic for most products in the short run, but income elastic for most products in the long run. Only two products have a long-run income elasticity of less than unity.

The average real effective exchange rate elasticities are relatively high. For those product imports whose coefficients were statistically significant, the unweighted

elasticity is 1.15 in the short run and 1.7 in the long run. For all products, including those whose coefficients were not statistically significant and therefore the elasticities are set equal to zero, the 1997 trade-weighted average elasticity is 0.74 in the short run and 0.87 in the long run. These exchange rate elasticities are high but are below those for US dollar import prices. The unweighted average price elasticity is –1.4 in the short run and –3.2 in the long run, while the 1997 trade-weighted price elasticity is –0.65 in the short run and –0.8 in the long run. Overall, the absolute values of the price and exchange rate elasticities of Egypt's import demand are similar to one another, though there are differences in the individual products.

Table 5.2
Price, Income and Exchange Rate Elasticities of Import Demand

Description	SITC	ST/LT	Income	Price	Exch. Rate
Wheat etc unmilled	0410	ST	0.16a/	-	-a/
		LT	1.00	-	-
Prod of polymerizing etc	5812	ST	1.80	0.64	0.64
		LT	2.71	-	0.37
Lumber sawn etc conifer	24321	ST	0.34a/	-	0.12a/
		LT	1.71	-	0.25
Maize unmilled	0440	ST	5.90	-	0.37
		LT	2.14	-	-
Iron,smple stl blooms,etc	67251	ST	0.68	-2.61	-
		LT	3.05	-3.18	-
Raw beet and cane sugar	0611	ST	0.33	-	1.28
		LT	16.91	-	5.01
Sunflower seed oil	4216	ST	0.17	-4.28	-
		LT	1.00	-	-
Oth machines nonelectric	7198	ST	0.85	-1.21	0.96
		LT	1.00	-1.61	-
Excavtng,levling etc mac	71842	ST	0.86	-1.12	0.52
		LT	1.00	-2.25	-
Pass motor veh exc buses	7321	ST	0.40	-1.17	1.11
		LT	1.00	-	1.86
Palm oil	4222	ST	0.93	-	6.24
		LT	6.85	-	-
Paper etc in bulk nes	6415	ST	0.28	-1.01	1.37
		LT	1.00	-3.61	7.52
Electric power machinery	7221	ST	0.85	-	0.30
		LT	3.87	-	0.65
Bovine meat fresh,frozen	0111	ST	0.21	-3.85	2.16
		LT	5.22	-5.24	5.62
Other motor vehcl parts	73289	ST	0.67	-	1.48
		LT	1.00	-	1.99
Vegetable oil residues	0813	ST	0.79	-	3.04
		LT	2.84	-	0.59
Switchgear etc	7222	ST	0.89	-1.01	0.48
		LT	1.00	-1.13	0.19
Tobacco unmfd	1210	ST	3.09	-	-
		LT	0.47	-	-

Table 5.2
Price, Income and Exchange Rate Elasticities of Import Demand

Description	SITC	ST/LT	Income	Price	Exch. Rate
Line telephone,etc equip	72491	ST	4.50	-0.90	-
		LT	1.00	-0.75	-
Rubber tyres,tubes	6291	ST	2.33	-	0.71
		LT	1.66	-	0.31
Irn,simple stl bars etc	67321	ST	0.39	-	0.66a/
		LT	1.00	-	1.67
Pumps for liquids	71921	ST	1.41	-	0.44
		LT	1.00	-	0.39
Prod of condensation etc	5811	ST	1.18	-	-
		LT	3.63	-	-
Tea	0741	ST	0.85	-	-
		LT	1.00	-	-
Refined sugar etc	0612	ST	0.58	-	0.61a/
		LT	1.00	-	1.05
Pesticides,disinfectants	5992	ST	0.19	-	0.65
		LT	1.00	-	1.71
Cement	6612	ST	0.17	-2.47	-
		LT	1.00	-5.29	-
Buses	7322	ST	0.88	-0.87	-
		LT	2.33	-	-
Piston engines non-air	7115	ST	0.40	-0.30	-
		LT	1.00	-	-
Lorries,trucks	7323	ST	0.88	-0.91	2.23
		LT	1.00	-	1.67
Discn synth fibre uncmbd	26621	ST	0.10	-1.51	0.43a/
		LT	1.00	-14.90	4.41
Cont synth fibre yarn	65161	ST	0.29	-	-
		LT	2.94	-	-
Special purpose vessels	73592	ST	0.86	-1.18	1.56
		LT	7.66	-1.84	0.76
Coated etc paper nes blk	64195	ST	-2.76	-0.68	1.44
		LT	1.57	-	0.35
Insulated wire,cable	7231	ST	0.83	-1.42	0.76
		LT	1.00	-1.03	-
Mach parts nonelec nes	71999	ST	0.19	-1.28	-
		LT	1.00	0.15	-
Fish fresh,chilled,frozn	0311	ST	4.07	-	0.43
		LT	1.85	-	-
Pumps for gases etc	71922	ST	0.19	-0.35	0.49
		LT	1.62	-0.43	0.29
Plywood,veneers inlaid	63121	ST	0.86	-	0.50
		LT	0.92	-	0.30
Grey cotton yarn in bulk	6513	ST	0.24	-0.81	1.64

Table 5.2
Price, Income and Exchange Rate Elasticities of Import Demand

Description	SITC	ST/LT	Income	Price	Exch. Rate
		LT	1.00	-	-
Lifting,loading mach nes	71931	ST	0.41	-	0.78
		LT	1.00	-	0.76

a/ One-period lag.

Source: Estimates reported in Annex 2 of the present study (Boye, 2000).

5.2.2 Import Expenditures on Services

Egypt's import expenditures on services are dominated by transportation-related activities such as freight, insurance and other distributive services. These activities are, in turn, related to merchandise imports and exports. It is common practice to model these types of service transactions with current value data. While real value data are preferred, the difficulty of obtaining price indices for services that would allow us to express the time series in real terms makes it preferable to use the current value variable and avoid possible error introduced from a crude price variable. Moreover, it has been argued that the ultimate objective of modeling import expenses from services is the determination of the current account in the balance of payments. A single equation estimate for the value of these import expenses is likely to provide a better estimate than two separate estimates for the real value of these imports and for the corresponding price index (Leamer and Stern, 1970).

Since year-to-year variations in the value of import expenses from services reflect price and volume changes, the own-price variable is not included in the explanatory variables of the estimated relationship. Import expenses from services are, nevertheless, affected by movements in Egypt's REER since the receipts are measures in US dollar terms and changes in the REER will affect the cost of transportation and other services to domestic residents. Accordingly, the specification for service expenditures, denoted M^s, with an ECM driven by domestic real income, Y, and with a 'differences' formulation of the real effective exchange rate, e^r, term nested in the levels form of the equation is:

$$\Delta\ln(M^s)_t = \beta_{30} + \beta_{31}\ln(M^s/Y)_{t-1} + \beta_{32}\Delta\ln(Y)_t + \beta_{33}\ln(Y)_{t-1} + \beta_{34}\Delta\ln(e^r)_t + \beta_{35}\ln(e^r)_{t-1} + u_{3t} \quad (5.21)$$

where $-1 < \beta_{31} < 0$; $\beta_{32} > 0$; $\beta_{33} > \beta_{31;}$ and β_{34} and $\beta_{35} > 0$; and where all variables are measured in logarithmic terms.

The following are the results of the equation estimate by Lord (1999):

$$\Delta\ln(M^s)_t = \underset{(6.7)}{3.8} - \underset{(2.3)}{0.90}\ln(M^s/Y)_{t-1} + \underset{(2.7)}{0.88}\Delta\ln(Y)_t + 0.47\Delta\ln(e^r)_t \quad (5.22)$$

$R^2 = 0.85$ dw = 2.24 Period: 1990-98

where figures in parenthesis are t-statistics.

Table 5.3
Income and Exchange Rate Elasticities of Demand for Service Imports

	Elasticity with respect to: Exch. Rate	Income
Short-term	0.43	3.3
Long-term	0.00	1.0

Source: Lord (1999).

The income elasticity is relatively high in the short run (3.3) but it becomes unity in the long run. The real effective exchange rate is high in the short run (0.43), but it is not statistically significant in the long run (see Table 5.3). The lack of significance of this variable may be due to the concentration of Egypt's expenditures on shipping services, which are related to merchandise exports and imports. As a result, while shipping services has a short-term response to changes in the real effective exchange rate, in the long run offsetting movements in merchandise exports and imports caused by exchange rate variations neutralize those effects.

XX. 5.3 Demand for Exports[22]

5.3.1 Merchandise Exports

The demand for exports of Egypt has a steady-state response to the import demand of its geographic markets, and a transient response to its relative export price. The justification for these long-run dynamic properties is similar to that for the import demand of Egypt discussed in the previous chapter. The demand for exports of a product from all foreign suppliers is equivalent to the import demand for the product from that market. Thus the life-cycle model of consumption provides the same theoretical justification for the existence of a long-run dynamic effect associated with import demand in foreign markets as it did for the import demand function of Egypt. In contrast, unless relative-price movements generate only transient responses, a continuous change in the price of exports from one country relative to that of exports from competing suppliers would eventually cause importers to purchase the product from the lower-priced supplier(s). Thus it is appropriate to constrain the long-run effect from relative prices to zero.

Consider the general first-order stochastic difference expression for export demand, *X*, of a geographic market *j* of Egypt's products as a function of real GDP of the geographic market, Y^f, and the price of Egypt's exports measured in US dollar terms that has been double deflated, *P*:

$$\ln(X)_t = \beta_{40} + \beta_{41}\ln(X)_{t-1} + \beta_{42}\ln(Y^f)_t + \beta_{43}\ln(Y^f)_{t-1} + \beta_{44}\ln(P)_t + \beta_{45}\Delta\ln(P)_{t-1} + v_{1t} \quad (5.23)$$

where the expected signs of the coefficients are $0 < \beta_{41} < 1$; β_{42} and $\beta_{43} > 0$; β_{44} and $\beta_{45} < 0$.

The price variable in equation (5.23) is defined in the previous chapter. Recall that $P_t = P^e_t/e^r_t$, where P is the US dollar price of the imported product, P^e is the Egyptian pound price of the imported product, and e^r is the real effective exchange rate (REER).

At the bilateral trade level, the real exchange rate is measured by the 'real cross-rate', which takes into account changes in the nominal exchange rate of Egypt with the foreign country and the relative price levels between Egypt and that country. It measures changes in the purchasing power between the domestic and the foreign economy, and it provides an indicator of changes in the international competitiveness of the domestic economy in its ability to purchase more (or less) goods and services per unit of foreign currency.[23]

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[22]The material in this section is drawn from Lord (1999).

[23]As an extension, the REER measures the average relative strength of the local currency, and it is calculated as the weighted average of REERs, where the weights are the value of imports from and exports to a given partner country *i* divided by total imports and total exports of Egypt.

Transformation of (5.23) as described in the previous section for import demand results in an export demand specification with an ECM driven by foreign income and with a 'differences' formulation of the current price and exchange rate terms nested in the levels form of the equation:[24]

$$\Delta\ln(X)_t = \beta_{50} + \beta_{51}\ln(X/Y^f)_{t-1} + \beta_{52}\Delta\ln(Y^f)_t + \beta_{53}\ln(Y^f)_{t-1} + \beta_{54}\Delta\ln(P^e)_t + \beta_{55}\ln(P^e)_{t-1} + \beta_{56}\Delta\ln(e^r)_t + \beta_{57}\ln(e^r)_{t-1} + v_{2t} \quad (5.24)$$

where $-1 < \beta_{51} < 0$; $\beta_{52} > 0$; $\beta_{53} > \beta_{51}$; β_{54} and $\beta_{55} < 0$; and β_{56} and $\beta_{57} < 0$.

The second term, $\beta_{51}\ln(X/Y^f)$, is the mechanism for adjusting any disequilibrium in the previous period. When the rate of growth of the dependent variable x falls below its steady-state path, the value of the ratio of variables in the second term decreases in the subsequent period. That decrease, combined with the negative coefficient of the term, has a positive influence on the growth rate of the dependent variable. Conversely, when the growth rate of the dependent variable increases above its steady-state path, the adjustment mechanism embodied in the second term generates downward pressure on the growth rate of the dependent variable until it reaches that of its steady-state path. The speed with which the system approaches its steady-state path depends on the proximity of the coefficient to minus one. If the coefficient is close to minus one, the system converges to its steady-state path quickly; if it is near to zero, the approach of the system to the steady-state path is slow.

The price effect in equation (5.24) is decomposed into the own-price variable measured in terms of the domestic currency and the real cross-rate of each of Egypt's export markets. The decomposition allows us to separate the own-price and cross-rate effects since our interest in this study is the measurement of the effects of changes in the exchange rate on the balance of trade.

The equilibrium solution of equation (5.24) is a constant value if there is convergence. Since the solution is unrelated to time, the rate of change over time of the dependent variable *X* (given by Δx_t) and the explanatory variables Y^f (given by Δy_t) and *P* (given by Δp_t) are equal to zero. However, in dynamic equilibrium, equation (5.24) generates a steady-state response in which growth occurs at a constant rate, say *g*. For the dynamic specification of the relationship in (5.24), if g_1 is defined as the steady-state growth rate of the dependent variable *X,* and g_2 corresponds to the steady-state growth rate of the explanatory variable Y^f, then, since lower-case letters denote the logarithms of variables, $g_1 = \Delta x$ and $g_2 = \Delta y^f$ in dynamic equilibrium. Note, however, that $\Delta p = \Delta r = 0$ since there is no long-term relationship between export growth and price or exchange rate changes.

In equilibrium the systematic dynamics of equation (5.24) are expressed as:

$$g_1 = \beta_5 + \beta_{51}\ln(X/Y^f) + \beta_{52}g_2 + \beta_{53}\ln(Y^f) + \beta_{55}\ln(P) + \beta_{57}\ln(e^r) \quad (5.25)$$

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[24]For the derivation of the equation, see Lord (1991: Annex D).

or, in terms of the original (anti-logarithmic) values of the variables:

$$X = k_0 Y^{f\varphi y} P^{\varphi p} R^{\varphi r} \tag{5.26}$$

where $k_0 = \exp\{(-\beta_{50}/\beta_{51}) + [(\beta_{51} - \beta_{52}\beta_{51} - \beta_{53})/\beta_{51}^2]g_2$. The dynamic solution of equation (5.24) therefore shows *X* to be influenced by changes in the rate of growth of Y^f, as well as the long-run elasticity of *X* with respect to Y^f. For example, where the rate of growth of the explanatory variable accelerates, say from g_2 to g'_2, the value of the variable *X* would increase. However, it is important to reiterate that the response to each explanatory variable can be either transient or steady-state. When theoretical considerations suggest that an explanatory variable generates a transient, rather than steady-state, response, it is appropriate to constrain its long-run effect to zero.

The income elasticity of export demand is expressed as:

$$\varphi_y = 1 - (\beta_{53}/\beta_{51}) \tag{5.27}$$

Its value is positive since the expected sign of β_{51} is negative and $\beta_{53} > \beta_{51}$. When $\beta_{51} < \beta_{53} < 0$, import demand is inelastic with respect to income; when $\beta_{53} = 0$, it has a unitary elasticity; and when $\beta_{53} > 0$.

The price elasticity of export demand is expressed as:

$$\varphi_p = - \beta_{55}/\beta_{51} \tag{5.28}$$

It has a negative value since the expected signs of both β_{55} and β_{51} are negative.

The real exchange rate elasticity of export demand is expressed as:

$$\varphi_p = - \beta_{57}/\beta_{51} \tag{5.29}$$

It has a negative value since the expected signs of both β_{57} and β_{51} are negative.

The export demand functions of the principal products have been derived from estimates of the dynamic specification of the relationship in equation (5.24) (see Table 5.4). As was to be expected, foreign income has always been found to be statistically significant in explaining the demand for exports. As with import demand, the estimates of the income coefficients are non-zero with 99 percent confidence. The real effective exchange rate coefficients are statistically different from zero in the short run in 32 of the 38 combinations of product and export markets, and they are statistically different from zero in the long run in 28 of the 38 combinations of product and export markets. The effective exchange rate therefore has a greater impact on product and export markets than it does on import products. Prices are statistically significant in explaining export demand in about two-thirds of the product and export markets in both the short run and the long run, compared with only about one-half of the import products.

The coefficients of the error-correcting term in the export demand relationships measure the speed of response of exports to changes in foreign income, exchange

rates and prices. About one-half of the export demand equations have an error-correcting term that is near unity in absolute terms. As with imports, it reflects the relatively quick response of foreign markets to changes in the explanatory variables. Major disturbances in export demand occurred largely in the latter part of the 1970s and early 1980s. Binary variables were used to eliminate those observations from the estimates. These disturbances represented transitory influences on exports. A test of parameter constancy based on the Chow test showed the coefficients to be stable at the 5 percent level of significance in all the estimated relationships.

Table 5.4
Regression Results of Export Demand Equation

$$\Delta \ln(X)_t = \beta_{50} + \beta_{51}\ln(X/Y^f)_{t-1} + \beta_{52}\Delta\ln(Y^f)_t + \beta_{53}\ln(Y^f)_{t-1} + \beta_{54}\Delta\ln(P^e)_t + \beta_{55}\ln(P^e)_{t-1} + \beta_{56}\Delta\ln(e^r)_t + \beta_{57}\ln(e^r)_{t-1}$$

										Summary Statistics			
SITC	Description	Market	$\ln(X)-\ln(Y)_{t-1}$	$\Delta\ln(Y)_t$	$\ln(Y)_{t-1}$	$\Delta\ln(P)_t$	$\ln(P)_{t-1}$	$\Delta\ln(R)_t$	$\ln(R)_{t-1}$	Const	R^2	dw	Yrs
3324	Residual fuel oils	World	-0.36		1.18		-0.36			-1.31	0.66	2.4	1985-97
			(1.8)		(1.3)		(2.0)						
33101	Crude petroleum	Italy	-0.44					-1.71	-0.49	5.94	0.68	2.6	1978-97
			(2.3)					(2.6)	(1.4)				
33101	Crude petroleum	USA	-0.68						-1.01	8.52	0.75	2.8	1977-97
			(4.2)						(2.4)				
6513	Grey cotton yarn in bulk	Canada	-0.66	19.61	1.60		-1.52	-2.14	-3.19	7.06	0.85	1.7	1975-97
			(5.3)	(3.6)	(1.8)		(4.2)	(3.9)	(4.5)				
6513	Grey cotton yarn in bulk	France	-0.86				-0.25			1.13	0.72	2.2	1980-97
			(4.8)				(1.5)						
6513	Grey cotton yarn in bulk	U.Kingdom	-0.41		1.52	-0.44	-1.09	-0.60	-1.27	-3.07	0.82	2.1	1980-97
			(2.3)		(1.6)	(1.8)	(2.9)	(1.5)	(2.6)				
6513	Grey cotton yarn in bulk	World	-0.59			-0.78		-1.06		4.02	0.60	2.1	1988-97
			(1.3)			(1.3)		(1.7)					
2631	Raw cotton,excl linters	France	-0.18			-0.49	-0.69		-1.48	8.00	0.57	2.5	1977-97
			(1.7)			(1.7)	(157)		(2.3)				
2631	Raw cotton,excl linters	Greece	-0.42			-0.37	-0.45		-0.35	3.07	0.90	2.0	1971-97
			(4.8)			(4.7)	(3.7)		(4.3)				
65213	Grey woven cotton	Italy	-0.29	3.01		-0.51		-0.62	-0.26	1.64	0.72	2.4	1971-97
			(2.4)	(1.5)		(3.5)		(2.4)	(1.9)				
65213	Grey woven cotton	Netherlands	-0.74		1.97		-3.01		-2.36	3.50	0.92	2.2	1981-97
			(5.4)		(2.3)		(2.4)		(2.0)				
65213	Grey woven cotton	U.Kingdom	-0.91		3.12	-0.42	-0.65	-0.69	-0.61	-17.72	0.71	2.2	1971-97
			(4.6)		(3.7)	(1.8)	(2.2)	(1.8)	(1.5)				
65213	Grey woven cotton	USA	-0.64	6.62				-0.72		-0.44	0.84	2.2	1971-97
			(6.0)	(1.7)				(1.8)					
65213	Grey woven cotton	World	-0.93	7.26	0.90	-0.48	-0.32	-1.01		1.33	0.83	1.7	1971-97
			(6.4)	(1.7)	(3.3)	(3.8)	(2.3)	(3.5)					
84143	Underwear knit	World	-0.20		1.10	-0.75	-0.76			-2.73	0.90	1.6	1971-97
			(4.5)		(5.0)	(3.9)	(5.9)						
5214	Coal,petr distillates	World	-0.94		2.92		-0.76		-1.71	-1.58	0.94	1.9	1985-97
			(6.3)		(2.8)		(3.7)		(3.5)				
84113	Mens underwear not knit	France	-0.83		6.29	-0.81	-2.32	-1.84	-2.21	-31.51	0.75	2.2	1980-97
			(2.8)		(1.6)	(1.2)	(2.3)	(1.4)	(3.4)				
84113	Mens underwear not knit	USA	-0.52		6.89	-3.12	-6.06		-3.75	-32.58	0.91	2.0	1989-97
			(2.0)		(1.3)	(4.2)	(3.8)		(-4.0)				

Table 5.4
Regression Results of Export Demand Equation

$$\Delta \ln(X)_t = \beta_{50} + \beta_{51}\ln(X/Y^f)_{t-1} + \beta_{52}\Delta\ln(Y^f)_t + \beta_{53}\ln(Y^f)_{t-1} + \beta_{54}\Delta\ln(P^e)_t + \beta_{55}\ln(P^e)_{t-1} + \beta_{56}\Delta\ln(e^r)_t + \beta_{57}\ln(e^r)_{t-1}$$

										Summary Statistics			
SITC	Description	Market	$\ln(X)-\ln(Y)_{t-1}$	$\Delta\ln(Y)_t$	$\ln(Y)_{t-1}$	$\Delta\ln(P)_t$	$\ln(P)_{t-1}$	$\Delta\ln(R)_t$	$\ln(R)_{t-1}$	Const	R^2	dw	Yrs
84112	Womens outerwear	World	-0.20				-0.53			1.77	0.95	2.72	1987-97
			(3.4)				(2.6)						
84111	Mens outerwear not knit	Netherlands	-0.57		4.45	-2.55	-1.68	-5.14	-1.81	-14.10	0.89	2.46	1980-97
			(2.3)		(2.1)	(4.6)	(3.0)	(4.6)	(2.6)				
84111	Mens outerwear not knit	USA	-0.95		3.29			-1.30	-1.18	-24.48	0.82	2.49	1987-97
			-3.96		1.14			-1.72	-1.82				
84111	Mens outerwear not knit	World	-0.85		4.32	-2.81	-10.87	-8.63	-0.17	59.10	0.87	2.71	1988-97
			(2.7)		(1.4)	(1.2)	(2.1)	(2.3)	(2.5)				
0541	Potatoes frsh excl sweet	World	-0.91						-0.17	7.93	0.81	2.24	1977-97
			(5.1)						(1.3)				
6576	Carpets etc unknotted	USA	-0.58		8.75			-1.96	-2.16	-68.19	0.56	0.56	1982-97
			(2.6)		(2.6)			(1.5)	(1.9)				
0545	Other fresh vegetables	France	-0.41			-0.84	-0.63	-1.25	-0.87	4.11	0.79	2.35	1972-97
			(3.14)			(3.7)	(1.5)	(2.8)	(1.4)				
0545	Other fresh vegetables	Italy	-0.52							0.65	0.69	1.94	1981-97
			(3.8)										
0545	Other fresh vegetables	U.Kingdom	-0.56			-0.72	-0.98	-1.04	-1.69	7.65	0.63	2.09	1971-97
			(4.2)			(2.2)	(2.5)	(1.6)	(2.6)				
2924	Veg used in pharmacy	France	-0.89			-0.33	-0.58			-0.93	0.58	1.86	1980-97
			(4.2)			(2.4)	(2.8)						
2924	Veg used in pharmacy	U.Kingdom	-0.81		2.77	-0.39	-0.77		-0.85	-16.17	0.84	2.39	1979-97
			(6.2)		(6.5)	(5.1)	(4.7)		(4.9)				
05461	Vegetables frozen	Kuwait	-0.20	0.95		-0.49		-1.18	-0.75	4.58	0.74	2.17	1971-97
			(2.5)	(2.4)		(2.5)		(2.7)	(2.5)				
05461	Vegetables frozen	Qatar	-0.49	2.62	4.14		-1.12		-1.68	0.54	0.83	1.63	1975-97
			(6.4)	(2.0)	(2.2)		(2.5)		(2.9)				
82109	Furniture parts	Kuwait	-0.39			-0.93	-1.84	-4.28	-2.34	13.06	0.76	3.10	1983-97
			(2.0)			(1.4)	(1.9)	(2.8)	(1.6)				
82109	Furniture parts	Saudi Arabia	-0.98		8.83			-2.21	-0.47	-37.43	0.80	2.22	1979-97
			(6.3)		(6.4)			(4.6)	(1.9)				
82109	Furniture parts	USA	-0.80		4.15		-0.80		-1.86	-28.97	0.97	2.09	1987-97
			(8.9)		(3.1)		(4.3)		(-7.4)				
0511	Oranges, tangerines	Netherlands	-0.73	15.56			-0.28	-0.61		0.66	0.96	2.02	1977-97
			(10.1)	(4.0)			(1.4)	(1.4)					
0511	Oranges, tangerines	Saudi Arabia	-0.09						-0.27	1.81	0.80	2.73	1977-97
			(1.2)						(2.0)				
05551	Veg fruit in vinegar	World	-0.90		3.02	-1.15	-1.25	-2.17	-1.47	-4.59	0.81	2.34	1977-97
			(4.0)		(3.8)	(4.4)	(2.8)	(4.8)	(2.7)				
5530	Perfume, cosmetics,	World	-0.81			-0.57	-1.41	-1.73	-0.96	9.42	0.95	1.67	1978-97
			(9.3)			(2.1)	(5.2)	(2.7)	(2.1)				

Table 5.5 shows the income, price and exchange rate elasticities of Egypt's principal products and export markets. For foreign income, the unweighted average elasticity is 3.7 in the short run and 3.8 in the long run. The 1997 trade-weighted income elasticities are also substantial: 1.9 in the short run and 3.6 in the long run. These elasticities conform to other estimates of export demand functions for developing and transition economies (Lord, 1991: Chapter 14).

The average real effective exchange rate elasticities are relatively high. For those product exports whose coefficients were statistically significant, the unweighted elasticity is -1.9 in the short run and -3.1 in the long run. For all products and markets, including those whose coefficients were not statistically significant and therefore have elasticities equal to zero, the 1997 trade-weighted average elasticity is -0.89 in the short run and -0.81 in the long run. These exchange rate elasticities are high but are below those for domestic export prices. The unweighted average price elasticity is –0.95 in the short run and –2.7 in the long run, while the 1997 trade-weighted price elasticity is –0.6 in the short run and –1.3 in the long run. Overall, the absolute values of the price and exchange rate elasticities of Egypt's export demand differ considerably from one another, so care should be taken about generalizations concerning the effects of price and exchange rate changes on Egypt's exports.

Table 5.5

Price, Income and Exchange Rate Elasticities of Export Demand

SITC	Description	Market	ST/LT	Income		Price		Exch.Rate	
3324	Residual fuel oils	World	ST	1.18	a/	-0.36	a/	0.00	
			LT	4.26		-0.98		0.00	
33101	Crude petroleum	Italy	ST	0.44	a/	0.00		-1.71	
			LT	1.00		0.00		-1.12	
33101	Crude petroleum	USA	ST	0.68	a/	0.00		-1.01	a/
			LT	1.00		0.00		-1.50	
6513	Grey cotton yarn in bulk	Canada	ST	19.61		-1.52	a/	-2.14	
			LT	3.43		-2.31		-4.86	
6513	Grey cotton yarn in bulk	France	ST	0.86	a/	-0.25	a/	0.00	
			LT	1.00		-0.29		0.00	
6513	Grey cotton yarn in bulk	U.Kingdom	ST	2.52	a/	-0.44		-0.60	
			LT	4.73		-2.69		-3.12	
6513	Grey cotton yarn in bulk	World	ST	0.59	a/	-0.78		-1.06	
			LT	1.00		0.00		0.00	
2631	Raw cotton,excl linters	France	ST	0.18	a/	-0.49		-1.48	a/
			LT	1.00		-3.90		-8.36	
2631	Raw cotton,excl linters	Greece	ST	0.47	a/	-0.37		-0.35	a/
			LT	1.00		-1.05		-0.82	
65213	Grey woven cotton	Italy	ST	3.01		-0.51		-0.62	
			LT	1.00		0.00		-0.92	
65213	Grey woven cotton	Netherlands	ST	2.97	a/	-3.01	a/	-2.36	a/
			LT	3.68		-4.09		-3.21	
65213	Grey woven cotton	U.Kingdom	ST	4.12	a/	-0.42		-0.69	
			LT	4.43		-0.71		-0.68	
65213	Grey woven cotton	USA	ST	6.62		0.00		-0.72	
			LT	1.00		0.00		0.00	
65213	Grey woven cotton	World	ST	7.26		-0.48		-1.01	
			LT	1.97		-0.34		0.00	
84143	Underwear knit nonelastc	World	ST	2.20	a/	-0.75		0.00	
			LT	6.49		-3.79		0.00	
5214	Coal,petr distilates	World	ST	3.92	a/	-0.76	a/	-1.72	a/
			LT	4.10		-0.81		-1.82	
84113	Mens underwear not knit	France	ST	7.29	a/	-0.81		-1.84	
			LT	8.55		-2.79		-2.65	
84113	Mens underwear not knit	USA	ST	7.89	a/	-3.12		-6.06	a/
			LT	14.27		-11.67		-7.21	
84112	Womens outerwear nonknit	World	ST	0.20	a/	-0.53	a/	0.00	
			LT	1.00		-2.62		0.00	
84111	Mens outerwear not knit	Netherlands	ST	5.45	a/	-2.55		-5.14	
			LT	8.82		-2.95		-3.18	
84111	Mens outerwear not knit	USA	ST	4.29	a/	0.00		-1.30	
			LT	4.45		0.00		-1.23	
84111	Mens outerwear not knit	World	ST	4.45	a/	-2.81		-8.63	
			LT	6.10		-12.84		-12.94	
0541	Potatoes frsh excl sweet	World	ST	0.91	a/	0.00		-0.17	a/
			LT	1.00		0.00		-0.18	

Table 5.5

Price, Income and Exchange Rate Elasticities of Export Demand

6576	Carpets unknotted	USA	ST	9.75	a/	0.00		-1.96	
			LT	15.97		0.00		-3.70	
0545	Other fresh vegetables	France	ST	0.41	a/	-0.84		-1.25	
			LT	1.00		-1.54		-2.15	
0545	Other fresh vegetables	Italy	ST	0.52	a/	0.00		0.00	
			LT	1.00		0.00		0.00	
0545	Other fresh vegetables	U. Kingdom	ST	0.56	a/	-0.72		-1.04	
			LT	1.00		-1.75		-3.01	
2924	Veg used in pharmacy	France	ST	0.89	a/	-0.33		0.00	
			LT	1.00		-0.65		0.00	
2924	Veg used in pharmacy	U. Kingdom	ST	3.77	a/	-0.39		-0.85	a/
			LT	4.41		-0.95		-1.05	
05461	Vegetables frozen	Kuwait	ST	0.95		-0.49		-1.18	
			LT	1.00		0.00		-3.73	
05461	Vegetables frozen	Qatar	ST	2.62		-1.12	a/	-1.68	a/
			LT	9.48		-2.29		-3.43	
82109	Furniture,parts	Kuwait	ST	0.39	a/	-0.93		-4.28	
			LT	1.00		-4.71		-5.98	
82109	Furniture,parts	Saudi Arabia	ST	9.83	a/	0.00		-2.21	
			LT	10.03		0.00		-0.48	
82109	Furniture,parts	USA	ST	4.15	a/	-0.81	a/	-1.86	a/
			LT	6.19		-1.01		-2.32	
0511	Oranges,tangerines	Netherlands	ST	15.56		-0.28	a/	-0.61	
			LT	1.00		-0.38		0.00	
0511	Oranges,tangerines	Saudi Arabia	ST	0.09	a/	0.00		-0.27	a/
			LT	1.00		0.00		-3.03	
05551	Veg fruit in vinegar	World	ST	3.02	a/	-1.15		-2.17	
			LT	4.36		-1.39		-1.64	
5530	Perfume,cosmetics	World	ST	0.82	a/	-0.57		-1.73	
			LT	1.00		-1.74		-1.18	

a/ One-period lag.
Source: Lord (1999).

5.3.2 Export Earnings from Services

Egypt's export earnings from services are dominated by tourism, and it is common practice to model these types of service transactions with current value data. While real value data are preferred, the difficulty of obtaining price indices for services that would allow us to express the time series in real terms makes it preferable to use the current value variable and avoid possible error introduced from a crude price variable. Moreover, it has been argued that the ultimate objective of modeling export earnings from services is the determination of the current account in the balance of payments. A single equation estimate for the value of these export earnings is likely to provide a better estimate than two separate estimates for the real value of these exports and for the corresponding price index (Leamer and Stern, 1970).

Since year-to-year variations in the value of export earnings from services reflect price and volume changes, the own-price variable is not included in the explanatory variables of the estimated relationship. Export earnings from services are, nevertheless, affected by movements in Egypt's REER since the receipts are measured in US dollar terms and changes in the REER will affect the cost of tourism and other services to foreigners. Accordingly, the specification for export earnings from services, denoted X^s, with an ECM driven by foreign real income, Y^f, and with a 'differences' formulation of the real effective exchange rate, R, term nested in the levels form of the equation is:

$$\Delta \ln(X^s)_t = \beta_{60} + \beta_{61}\ln(X^s/Y^f)_{t-1} + \beta_{62}\Delta\ln(Y^f)_t + \beta_{63}\ln(Y^f)_{t-1} + \beta_{64}\Delta\ln(e^r)_t + \beta_{65}\ln(e^r)_{t-1} + v_{3t} \quad (5.30)$$

where $-1 < \beta_{61} < 0$; $\beta_{62} > 0$; $\beta_{63} > -1$; β_{64} and $\beta_{65} < 0$; and where all variables are measured in logarithmic terms.

The following are the results of the equation estimate:

$$\Delta \ln(X^s)_t = -9.1 - 0.43\ln(X^s/Y^f)_{t-1} + 1.01\ln(Y^f)_{t-1} - 0.18\ln(e^r)_{t-1} + v_{3t} \quad (5.31)$$

(3.7) (3.0) (6.3)

$R^2 = 0.80$ dw = 1.95 Period: 1978-97

where figures in parenthesis are t-statistics.

Table 5.6
Income and Exchange Rate Elasticities of Demand for Service Exports

	Elasticity with respect to:	
	Price	Income
Short-term	-0.18(-1)	1.0(-1)
Long-term	-0.42	3.4

Note: (-1) refers to a one-period lag.

The coefficients have the expected sign and magnitude (see Table 5.6). The short-term income elasticity is 1.0, which occurs after a one-period lag, and the long-term income elasticity is 3.4. For the real effective exchange rate, the short-term (one-period lag) elasticity is –0.18 and the long-term elasticity is –0.42. A 10 percent devaluation in the REER, for example, would lead to a 1.8 percent increase in export earnings from services after one year, and it could generate 4.2 percent greater export earnings from services after a few years had transpired. Note that the long-run effect is achieved within a relatively few number of years since the error correction term is equal to 0.42.

XXI. 5.4 Capital Flows[25]

The effects of real exchange rate movements on FDI depend on the sourcing of inputs and market distribution. If cross-border production activities are directed towards exports and they rely on domestic inputs, then increased FDI inflows will improve the current account. In contrast, if cross-border production activities are oriented to the domestic market and they use foreign inputs, then the current account balance will be negatively related to FDI inflows.

[25]This section is based on material presented in Lord (1999).

The specification for FDI inflows, denoted I^f, with an ECM driven by foreign real income, Y^f, and with a 'differences' formulation of the real effective exchange rate, *R*, term nested in the levels form of the equation is:

$$\Delta\ln(I^f)_t = \beta_{70} + \beta_{71}\ln(I^f/Y^f)_{t-1} + \beta_{72}\Delta\ln(Y^f)_t + \beta_{73}\ln(Y^f)_{t-1} + \beta_{74}\Delta\ln(e^r)_t + \beta_{75}\ln(e^r)_{t-1} + v_{3t} \quad (5.32)$$

where $-1 < \beta_{71} < 0$; $\beta_{72} > 0$; $\beta_{73} > \beta_{71}$; β_{74} and $\beta_{75} < 0$.

The following are the results of the equation estimate:

$$\Delta\ln(I^f)_t = \underset{}{-1.5} \underset{(3.8)}{- 0.85\ln(I^f/Y^f)_{t-1}} + \underset{(1.3)}{14.6\Delta\ln(Y^f)t} \underset{(1.2)}{- 0.13\ln(Y^f)_{t-1}} + \underset{(1.2)}{0.71\Delta\ln(e^r)_t}$$

$$+ \underset{(1.8)}{0.69\ln(e^r)_{t-1}} \quad (5.33)$$

$R^2 = 0.72$ dw = 2.34 Period: 1980-98

where figures in parenthesis are t-statistics.

Table 5.7
Income and Exchange Rate Elasticities of FDI Inflows

	Elasticity with respect to:	
	Exch. Rate	Income
Short-term	0.71	14.6
Long-term	0.80	0.8

There are a number of interesting observations that emerge from these results. First, FDI tends to have a very strong short-term response to changes in global economic growth. In the long run, however, cross-border investment conforms to the expectations, insofar as it has been declining over time in Egypt relative to its worldwide response to global income changes. This non-proportional growth in Egypt is reflected in an estimated income elasticity that is less than unity (see Table 5.1). Third, FDI growth is positively related to changes in the real effective exchange rate. This response reflects the domestic orientation of FDI in Egypt, and its reliance on foreign inputs. An appreciation of the real effective exchange rate, for example, reduces the cost of inputs to transnationals in Egypt and has a positive effect on cross-border production. That effect is relatively strong. A five percent appreciation of the real effective exchange rate leads to a 4 percent expansion in FDI inflows in Egypt. It is important to note, however, that the present elasticities approach to the balance of payments is based on existing levels of protection on production and trade in Egypt. It does not take into account new production activities from an efficient import substitution and export expansion that would be expected under a concurrent exchange rate depreciation and trade liberalization.

For portfolio investment, Chuhan, Perez-Quiros and Popper (1996) have offered empirical support for the conventional notion that short-term investment is "hot money" and direct investment is not. As a result, short-term investment appears to respond more dramatically to disturbances in other capital flows and in other countries than does direct investment. They examined the behavior of four major components of international capital flows in 15 developing and industrial countries

and found that large differences in the behavior of the component flows arise in general specifications that allow the flows to interact. For example, in each country, the behavior of international short-term investment appears to be sensitive to changes in all the other types of international capital flows, including direct investment, but direct investment appears to be insensitive to such changes. Among the links across countries, there is further evidence that short-term investment is more sensitive than direct investment.

6.0 Modeling Economic Policies

XXII. 6.1 Overview

The effectiveness of economic policy instruments, whether for achieving trade policy reforms or obtaining other macroeconomic objectives, 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. This chapter examines key macroeconomic relationships related to trade liberalization under Egypt's current fixed exchange rate system, and compares the operation of that system with one operating under a flexible exchange rate system.

In a small open economy such as Egypt, trade plays an important role in the basic macroeconomic adjustment process.[26] 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 induces a reduction in absorption by lowering the demand for both tradables and non-tradables. Often a real devaluation will also be needed 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 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 exchange rate adjustment is the policy instrument to bring about switching, then the real devaluation will need to occur through a nominal devaluation. If wages rise when the price of imports and the cost of living rise, or if the expenditure reduction has been inadequate 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.

The effectiveness of monetary policy partly depends on whether or not capital is allowed to move freely. With capital mobility, 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. In contrast, when controls

[26]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).

over capital movements exist, 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 the case of Egypt, approvals have been required on outward investments with the idea of slowing down the drainage of international reserves and capital outflows to give the authorities time to implement corrective policies. If the experience of other countries is valid for Egypt, this type of control has contributed significantly to the observed home-foreign interest rate differentials.[27]

XXIII. 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 (3.14) 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.

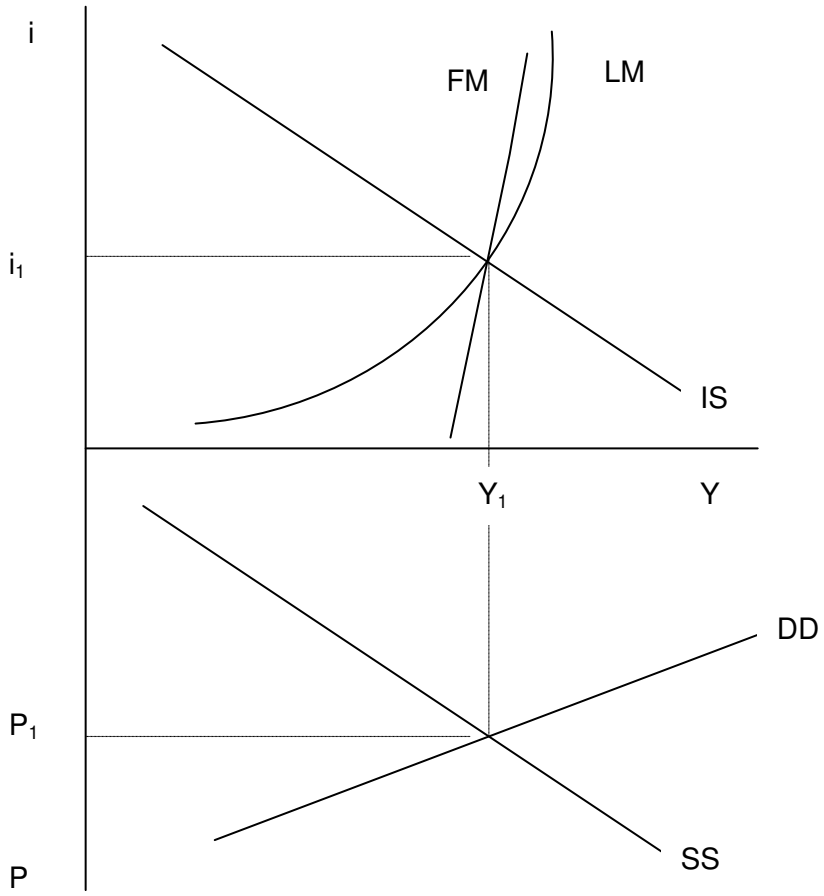
The effect on aggregate demand from changes in fiscal and exchange rate policy instruments, as well as exogenous foreign market demand are also shown in the final aggregate demand equation. Aggregate demand is negatively related to taxes since $\lambda_4 < 0$; it is positively related to the real exchange 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:

$$Y = Y^a + \phi_0 + \phi_1 I + \phi_2 P^b + Y^c \qquad (6.2)$$

[27]For evidence on Malaysia and Thailand after 1997 crisis, see Edison and Reinhart (2000).

Figure 6.1
Aggregate Demand and Output Equilibrium



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 Egyptian 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:[28]

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

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

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

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):[29]

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

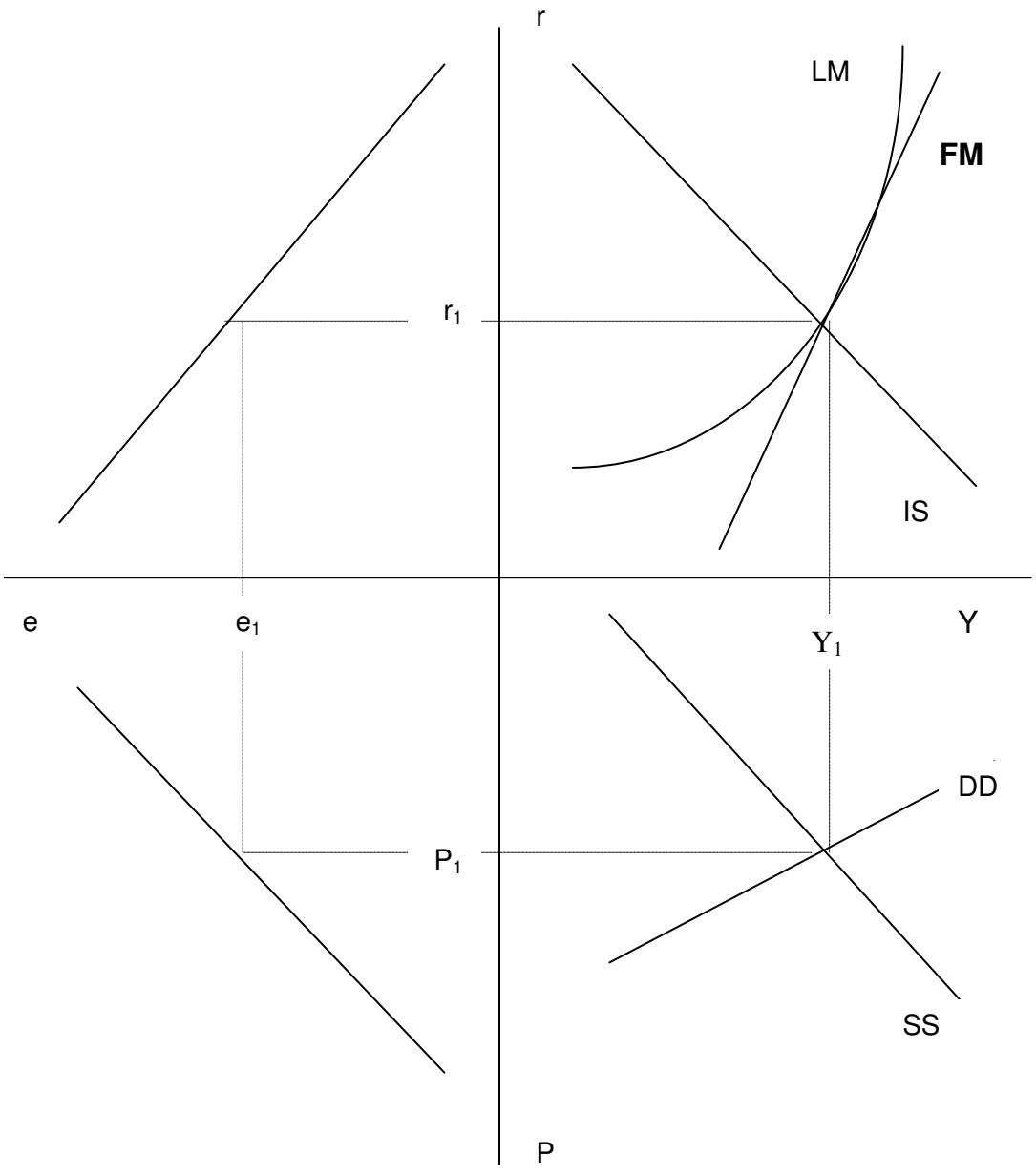
where $\omega_1 = \lambda_1 - \lambda_1\zeta_1 > 0$, $\omega_2 = \lambda_2 - \lambda_1\zeta_2 > 0$, $\omega_3 = \lambda_3 - \lambda_1\zeta_3 > 0$, $\omega_4 = \lambda_4 - \lambda_1\zeta_4 < 0$, $\omega_5 = \lambda_5 - \lambda_1\zeta_5 > 0$, and $\omega_6 = -\lambda_1\zeta_6 > 0$. Output is positively 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.

XXIV.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.

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

Figure 6.2
Aggregate Output, Prices and the Exchange Rate



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 6.2 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

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

XXV. 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 (3.13) 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 CBE to purchase foreign exchange and sell pounds (LE) 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 (3.10) and imports increase in equation (3.11), the trade balance in equation (3.3) 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.

XXVI.6.5 Exchange Rate Policy

Under a fixed exchange rate regime, the CBE has control of the official exchange rate. A devaluation by the CBE, for example, raises the real exchange rate and improves the trade balance in equation (3.1) through its effect on exports in equation (3.10) and imports in equation (3.11). 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 CBE's 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 Egypt 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 Egyptian economy.

XXVII. 6.6 Structure of the Model

The macroeconomic model for the Egypt economy aims to provide fairly detailed information on both Egypt's import structure and its international competitiveness; as such, a relatively high degree of disaggregation has been introduced into the trade structure. The model solves for GDP and its components, 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.

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 CBE'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.

6.6.1 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 prices 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.[30] 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 Egypt's exports insofar as they reflect the country's competitiveness in the export markets; they therefore influence the quantity of Egyptian 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 Egypt'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

[30]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 formal treatment of product differentiation in the context of the new theory of international trade, and the resulting import and export demand functions, see Lord, 1991a, chapters 1 and 3.

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

6.6.2 Fiscal Block

The model aims to evaluate the fiscal revenue impact of trade liberalization. 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.

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

6.6.3 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 Egypt.[31] The financial sector is divided into two components: the CBE and the banking system. The structure of the financial sector component reflects the balance sheets of CBE and the banking system.

[31]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).

XXVIII. 6.7 Specification of the Model

Notations:

L	=	Egyptian pound currency
D	=	Dollar currency
R	=	Real value

NB Predetermined variables are underscored.

1. Balance of Payments

Exports of Goods

XMEQR = f_1(LYMKR, XMEPD, EXMKR)	Exports of merchandise, real value
XMEPD = f_2(PCOMP)	Exports of merchandise, dollar price
XMEVD = XMEQR x XMEPD	Exports of merchandise, dollar value

Imports of Goods

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

Non-Factor Services

CXRED = f_5(NYWDR, EXMKR)	Service receipts, dollar value
CSPYD = f_6(NYVNR, EXEGR)	Service payments, dollar value

Factor Services

CYRED = CYRED	Income receipts, dollar value
CYPYD = CYPYD	Income payments, dollar value
CTRED = CTRED	Transfer receipts, dollar value
CTPYD = CTPYD	Transfer payments, dollar value

Balances in Current Account

CTBLD = XMEVD - MMEVD	Trade balance, dollar value
CCBED = CXRED - CSPYD	Net services, dollar value
CBGSD = CXGSD + CMGSD	Balance of goods and nfs, dollar value
CYBLD = CYRED - CYPYD	Net income, dollar value
CTRBD = CTRED + CTPYD	Net transfers, dollar value
CACBD = CBGSD + CYBLD + CTRBD	Current account balance, dollar value

Capital Account

KFDID = f_9(LYEGR, EXEGR) Foreign direct investment, dollar value

KPIAD = KPIAD Portfolio investment assets, dollar value

KPILD = KPILD Portfolio investment liabilities, dollar value

KPIND = KPIAD + KPILD Portfolio investment, net, dollar value

KIATD = KIATD Other investment assets, dollar value

KIATD = KIATD Other investment assets, dollar value

KILTD = KILTD Other investment liabilities, dollar value

KOIND = KIATD + KILTD Other investment, net, dollar value

KCABD = KFDID + KPIND + KOIND Balance on capital account, dollar value

NERRD = NERRD Errors and omissions

Overall Balance

BOPBD = CACBD + KCABD + NERRD Overall balance of balance of payments, dollar value

2. National Income Accounts

Balance on Goods and NFS

CBGSR = CXGSR - CMGSR Balance of goods and nfs, 1991 prices

CXGSR = [(XMEVD + CSRVD) x EXEGL]/ NYEGP Exports of goods and nfs, 1991 prices

CMGSR= (MMEVD + CSPVD) x EXEGL]/ NYEGP Imports of goods and nfs, 1991 prices

Investment

NFDIR = (KFDID * EXEGL) / NYEGP Foreign direct investment, 1991 prices

NIOTR = f_{10}(NYEGR, VIBOR) Other investment, 1991 prices

NFCFR = NFDIR + NIOTR Gross fixed capital formation, 1991 prices

NDSKR = f_{11}NYEGR, VIBOR) Change in stocks, 1991 prices

NITTR = NFCFR + NDSKR Total investment, 1991 prices

Saving Derivation

CACBD = CCBVD - CTOVD Current Acct Bal. - Official Trans, dollar value

CCBOL = CACBD * EXEGL Current Acct Bal. less Official Transfers, LE

NITTL = NFCFR * NYEGP Gross Capital Formation, LE

NSTTL = CCBOL + NITTL		Gross Savings, LE
NSTVR = NSTVL/NYEGP		Gross Savings, 1991 prices

Government Budget

(a) Revenue:

NGTTR =	NGTTR = (ttr * (-MMEVD) * EXEGD)/NYEGP	Taxes on trade, 1991 prices
NGTOR =	f_{12}(NCTTR, NITTR)	Other taxes revenue, 1991 prices
NGTXR =	NGTTR + NGTOR	Total tax revenue, 1991 prices
NGNTR =	NGNTR	Non-tax revenue, 1991 prices
NGTRR =	NGTXR + NGNTR	Total revenue, 1991 prices

(b) Expenditures:

NGIPR =	NGIPD	Wages, 1991 prices
NGOER =	NGOER	Other expenditures,1991 prices
NGCER =	NGIPR + NGOER	Current expenditures, 1991 prices
NGCPR =	NGCPR	Capital expenditures, 1991 prices
NGTER =	NGCER + NGCPR	Total expenditures, 1991 prices
NGBOR =	NGTTR - NGTER	Overall balance, 1991 prices

Private Consumption

NCPRR = f_{13}(NYEGR, VIBOR) Private consumption, 1991 prices

Total Consumption

NCTTR = NCPRR + NCGVR Total consumption, 1991 prices

Gross Domestic Product

NYEGR = CBGSR + NITTR + NCTTR GDP of Egypt, 1991 prices

Exchange Rates

EXEGR = EXEGL x (NYMKP/NYEGP) Exchange rate, real

3. Aggregate Supply

NVA1R =	f_{14}(KFIVD)	Primary sector, value added, 1991 prices
NVA2R =	NYEGR - NVA1R -NVA2R	Secondary sector, value added, 1991 prices
NVA3R =	f_{15}(NCTVR)	Tertiary sector, value added, 1991 prices
NVATR =	NVA1R + NVA2R + NVA3R	Value added, total, 1991 prices
NITVR =	NITVR	Net indirect taxes, 1991 prices
NYEGR =	NVATR + NITVR	GDP of Egypt, 1991 prices

4. Monetary Sector

FNFAL =	FNFAL(-1)*BOPVD*EXEGL	Net foreign assets
FNDAL =	FNDGL(-1)*NGBOL*NYEGP	Net domestic assets

FNTLL	=	FNFAL + FNDAL	Total liquidity
FM2VL	=	FNTLL	M2, LE
VIBOR	=	f_{16}(NYEGR, FM2VL/NYEGP)	Interest rate in Egypt, real

7.0 Policy Impact Assessments

XXIX.7.1 Overview

The macroeconomic model incorporates key assumptions about exogenous and policy-related variables. The principal policy variables for the Egyptian economy are the tariff structure, the exchange rate, 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 Egypt's foreign markets and investors.

Three sets of simulations have been performed with the model. The first provides the benchmark against which policy impact assessments are measured. The second set assesses the impact of alternative trade liberalization policies that include free trade, concertina, two-tier, a uniform rate, and a combination of two-tier and single rate tariffs. The final set evaluates the impact of a real effective exchange rate devaluation to neutralize the initial effects of trade policy reforms on the balance of payments, the national income accounts on the expenditure-side, and the money supply, prices and real exchange rate. Such a realignment in the exchange rate often accompanies trade liberalization to bring the exchange rate more in line with a level that is consistent with a sustainable medium-term external position under a situation in which there are lower trade barriers.

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 Egyptian economy that yield an internally consistent set of estimates about the likely outcome of events over the next few years. For the baseline forecast, they therefore point to important issues about the near-term prospects of the economy.

XXX. 7.2 Baseline Forecast

The baseline assumptions for Egypt's major export markets and foreign investors are that the global economy will continue its recovery and maintain a trend growth rate of 4 percent in 2000-2010 (see Table 7.1). That trend growth rate is in line with the historical trend during the last decade and is based on the IMF's *World Economic Outlook* report for May 2000 (hereafter WEO 2000). The assumptions underlying our baseline projection represent a fairly benign scenario of moderate and sustainable growth. The risk to this assumption is predominantly on the downside and a significantly worse outcome is clearly possible in the important North American and Western European markets for Egypt.

Table 7.1
Major Baseline Assumptions, 2000-2010
(Average annual growth rates)

Growth rate of foreign markets	3.0
Inflation in foreign markets	3.0
London interbank offer rates (LIBOR)	5.0
World prices of primary commodity	1.0
World prices of manufactures	3.0
World prices of petroleum	2.0

The potential for a broad and deep economic downturn in the US and EU markets would severely impact on Egypt's exports and its overall economic growth. Two major signals of the risk highlighted by WEO 2000 are the growing trade imbalances in these two regions and the misalignment of the US dollar relative to the EU euro. The combination of trade imbalances and the currency misalignment could induce a sudden sift in capital movements and deceleration in economic growth.

In the baseline projection, the exchange rate of Egypt is assumed to generally remain unchanged in real terms. Inflation in the principal foreign markets is forecast at 3 percent, which is also in line with WEO 2000 expectations. Since domestic prices in Egypt are endogenous in the model, it is not possible to maintain the exact rate of inflation that would ensure an unchanged real exchange rate. Nevertheless, by keeping the growth rate of net foreign and domestic assets unchanged, and notwithstanding endogenous changes in the monetarization of the fiscal deficit, we were able to achieve a fairly constant real exchange rate during the forecast period. The other major assumptions relate to world market prices for traded prices. In line with historical trends, world non-fuel commodity prices are assumed to rise more slowly than petroleum prices, and oil prices are assumed to rise more slowly than those of manufactures.

The results for the baseline forecasts are presented in Table 7.2. Egypt’s economic growth is expected to accelerate moderately from 5 to 6 percent over the forecast period. Exports of goods and non-factor services are expected to outpace imports of goods and non-factor services at the beginning of the decade, but lag behind those imports in 2005-2015. As is to be expected, the forecast is for the growth of private consumption to exceed that of government consumption, and as in other countries, that private consumption is projected to grow faster than investment. Growth of the service sector is expected to outpace that of industry, and that of industry is expected to outpace that of agriculture. The unconstrained model projects an inflation rate of 3 percent as a direct result of a similar growth rate for broad money.

Table 7.2
Baseline Projections of Key Macroeconomic Variables
(Annual percentage changes)

	2000-2004	2005-2009	2010-2014
Gross Domestic Product (constant LE)			
Exports of Goods and NFS	4.3%	3.8%	3.9%
Imports of Goods and NFS	3.3%	4.0%	4.7%
Gross Fixed Capital Formation	3.8%	5.1%	5.4%
Foreign direct investment	0.7%	0.6%	0.6%
Other investment	4.2%	5.5%	5.7%
Total Consumption	4.9%	5.9%	6.1%
Government Consumption	4.2%	4.7%	5.1%
Private Consumption	5.0%	6.1%	6.2%
Gross Domestic Product	4.9%	5.8%	5.9%
Savings and Investment (constant LE)			
Gross Domestic Investment	3.8%	5.1%	5.4%
Gross Domestic Savings	3.5%	3.9%	3.9%
Fiscal Indicators (constant LE)			
Total Revenue, of which	5.2%	5.4%	5.7%
Trade taxes	4.0%	4.6%	5.4%
Other taxes	5.5%	5.5%	5.8%
Total Expenditures, or which	4.8%	5.1%	5.4%
Current expenditures	4.5%	4.9%	5.3%
Capital expenditures	6.0%	6.0%	6.0%
Money and Prices (nominal LE)			
Broad Money (M2)	3.0%	3.0%	3.0%
Inflation	3.0%	3.0%	3.0%
Nominal Exchange Rate	0.0%	0.0%	0.0%
Real Exchange Rate	0.0%	0.0%	0.0%
Balance of Payments (US dollars)			
Merchandise Exports	6.8%	4.7%	4.8%
Merchandise Imports	7.1%	7.7%	8.6%
Service Receipts	7.6%	7.8%	7.8%
Service Payments	4.9%	5.8%	5.9%
Direct Investment in Egypt	3.7%	3.6%	3.6%

In the balance of payments, the merchandise trade balance is projected to deteriorate as a result of the larger volume of imports. Service receipts, however, are expected to expand strongly and help to alleviate the trade imbalance, particularly in the first half of the decade. In the capital account, portfolio investment inflows into Egypt are expected to remain sluggish, but foreign direct investment should expand moderately to take advantage of the protected domestic markets. These developments will significantly affect the ability of the capital account to sustain Egypt's current account deficit and place greater pressure on Egypt's external financing requirements.

The continued strong growth in imports is expected to help the Government keep the fiscal deficit under 3 percent of GDP during the forecast period. Trade tax revenues are projected to grow by 4 to 5 percent, while the forecast is for other tax revenues to expand by 5.5 to 6 percent during the same period. As a result, the share of trade taxes in total tax revenue is projected to contract from its current level of 20 percent to 18 percent over the next 10 to 15 years.

XXXI.7.3 Fiscal Implications of Trade Liberalization

The magnitude of the influence of trade policy reform on fiscal revenue, real economic activity (GDP, consumption, investment, imports and exports) and price-related variables (interest 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 Egypt 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 (tariffs) 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 case of Egypt, the interim multiplier is measured at year 5, the year in which full implementation of the new tariff structure occurs. The cumulative multiplier is measured at year 20, a period of time that is sufficient for all dynamic adjustments to the new tariff structure to occur and a new steady-state solution to be achieved.

In the calculation of the multipliers, two solutions are obtained from the dynamic simulations of the macroeconomic model.[32] The difference between the two simulations in their predetermined variables occurs in the value assumed by the tariff 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 or ten percent, depending on the magnitude of the policy variable. 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).[33]

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[32] 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.

[33] 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).

Table 7.3 illustrates the effect of alternative tariff strategies on imports, fiscal revenue, investment, and the overall economy activity of Egypt. The strategies cover those of concertina, two-tier, uniform and a combination of two-tier and uniform methods. A free trade strategy is also included. In general, the results are consistent with expectations about the operation and effect on the Egyptian economy from trade liberalization. In all cases, the tariff cuts have an immediate impact on the overall import value, fiscal revenue and investment activity. The interim response after 5 years is about two-thirds that of the total long-run response, suggesting a fairly quick response to the tariff changes. In all but the free-trade strategy, the reduction in tariffs leads to an increase in the value of imports. In the case of free trade, the high degree of restrictiveness of the trade regime for important products having little, if any, price responsiveness associated with tariff cuts. Since there are a number of important imported products having high tariffs and a price-inelastic demand schedule, their effect tends to dominate the overall results.

The concertina tariff structure generally impacts the Egyptian economy somewhat more than the other three strategies (not including the free trade strategy). The reason is less related to the tariff structure than to the fact that the concertina method lowers the average tariff rate by substantially more than the two-tier or uniform tariffs structures. Were the overall tariff rate in the two-tier and uniform tariff structures to be lowered to the same rate as the concertina method, the results would undoubtedly be similar. A lower overall tariff rate stimulates gross capital formation through domestic investment, which in turn stimulates overall growth of the economy. The increased national income further stimulates private consumption, while current expenditures of the Government contract in response to the lower trade tax revenue. The GOE nevertheless receives some compensation for the reduced trade tax revenue from increased tax revenue from other sources as a result of the private sector's expanded economic activity. While the results apply particularly to the concertina method, they are equally valid for the two-tier, uniform, and combination of two-tier and uniform when their average tariff rates are lowered to the same average rate as that for the concertina method.

Table 7.3
Multiplier Analysis of Alternative Tariff Structures on Key Macroeconomic Variables (Annual percent change and average annual US dollars)

		Multiplier (%)		
	Unit of Account	Impact (1 year)	Interim (5 yrs)	Total (20 years)
Imports of goods				
Free Trade	Nominal US$	-0.4%	-0.4%	1.7%
Concertina	Nominal US$	0.3%	0.5%	1.0%
Two-Tier	Nominal US$	0.5%	1.1%	1.5%
Uniform	Nominal US$	0.6%	1.2%	1.5%
Combination	Nominal US$	0.2%	1.2%	1.5%
Imports of goods and nfs				
Free Trade	Constant LE	0.0%	0.5%	2.1%
Concertina	Constant LE	0.3%	0.6%	0.9%
Two-Tier	Constant LE	0.4%	0.8%	0.9%
Uniform	Constant LE	0.4%	0.8%	1.0%
Combination	Constant LE	0.3%	0.9%	1.0%
Trade tax revenue				
Free Trade	Constant LE	-32.2%	-66.7%	-93.7%
Concertina	Constant LE	-19.3%	-28.3%	-35.3%
Two-Tier	Constant LE	-15.7%	-18.6%	-20.7%
Uniform	Constant LE	-16.2%	-19.1%	-21.5%
Combination	Constant LE	-17.0%	-20.5%	-21.8%
Other tax revenue				
Free Trade	Constant LE	0.1%	1.0%	3.1%
Concertina	Constant LE	0.1%	0.4%	0.7%
Two-Tier	Constant LE	0.0%	0.0%	-0.4%
Uniform	Constant LE	0.0%	0.0%	-0.4%
Combination	Constant LE	0.1%	0.2%	-0.4%
Gross capital formation				
Free Trade	Constant LE	1.9%	5.8%	10.0%
Concertina	Constant LE	1.3%	2.4%	3.3%
Two-Tier	Constant LE	0.8%	1.4%	1.4%
Uniform	Constant LE	0.8%	1.4%	1.5%
Combination	Constant LE	1.2%	1.8%	1.6%
Real GDP				
Free Trade	Constant LE	1.1%	2.7%	3.4%
Concertina	Constant LE	0.4%	0.7%	0.7%
Two-Tier	Constant LE	0.1%	0.0%	-0.6%
Uniform	Constant LE	0.1%	0.0%	-0.6%
Combination	Constant LE	0.4%	0.1%	-0.5%

Table 7.4 provides some additional indicators of the alternative tariff strategies. As

Table 7.4
Impact of Alternative Tariff Structures on Key Macroeconomic Variables
(Annual percent change and average annual US dollars)

	2000-2004	2005-2009
Trade Balance (average annual US dollars)		
Current Tariff Structure	(11,937)	(15,694)
Free Trade	(11,864)	(16,196)
Concertina	(12,027)	(15,951)
Two-Tier	(12,141)	(16,063)
Uniform	(12,151)	(16,074)
Combination	(12,154)	(16,091)
Import Duties / Total Tax Revenue (percent)		
Current Tariff Structure	19.7%	17.9%
Free Trade	6.8%	0.0%
Concertina	14.9%	12.0%
Two-Tier	16.7%	14.7%
Uniform	16.6%	14.5%
Combination	16.3%	14.5%
Trade tax collection rate (duties/imports)		
Current Tariff Structure	17.9%	17.9%
Free Trade	7.2%	0.0%
Concertina	15.0%	13.1%
Two-Tier	16.9%	16.3%
Uniform	16.8%	16.1%
Combination	16.5%	16.1%
Import duties / GDP (percent)		
Current Tariff Structure	3.5%	3.2%
Free Trade	1.1%	0.0%
Concertina	2.5%	2.0%
Two-Tier	2.9%	2.5%
Uniform	2.8%	2.5%
Combination	2.8%	2.5%
Fiscal deficit / GDP (percent)		
Current Tariff Structure	-1.5%	-2.5%
Free Trade	-3.0%	-3.9%
Concertina	-2.1%	-3.1%
Two-Tier	-1.9%	-2.9%
Uniform	-1.9%	-2.9%
Combination	-1.9%	-2.9%

expected, the smaller expansion of imports under the concertina method generates a lower trade deficit than under the other strategies. The concertina's lower average tariff rate, however, has a less favorable impact on the Government's overall tax revenue and, as a consequence, it generates a larger fiscal deficit during the forecast period. Given the similarity in the average tariff rates between the two-tier and

uniform tariff strategies, these two strategies and their combined form produce little, if any, differences in their fiscal impact.

XXXII. 7.4 Implications of Exchange Rate Policy Reforms

A devaluation is often needed to counter the trade balance effect of trade liberalization. In the present model, the overall results of the estimated import and export demand functions, as well as foreign direct investment, support generalizations to the effect that the exchange rate significantly impacts on Egypt's balance of payments. For the Government's fiscal position, the devaluation increases the domestic currency value of imports and the associated trade tax revenue. On the expenditure side, the fall in the relative price of tradables and rise in that of wages and non-tradables produces a less than proportional response of the exchange rate devaluation to that of trade liberalization because of the substitution in production or consumption of tradables and non-tradables. Trade liberalization will cause the private sector price of non-tradables to rise. Since the Government is either exempt from tariffs or pays the tariff to itself, the liberalization of trade does not impact on the pubic sector's cost of tradables. But in the case of a devaluation, the relative cost of tradables to the public sector rises, thereby worsening the fiscal deficit and requiring overall expenditure cutbacks. The experience of other countries suggests that these fiscal deficit effects need to be corrected early in the trade and exchange rate reform processes (Hood, 1998).

The magnitude of the effects of exchange rate changes on Egypt's balance of payments and the economy in general can be readily calculated through multiplier analysis. The results indicate how exchange rate changes influence the current and capital accounts, the overall balance of payments, and the national income accounts. Table 7.5 illustrates the effect of a one-time 10 percent devaluation in Egypt's real effective exchange rate. The devaluation is based on an across-the-board devaluation of the Egyptian pound relative to each of the country's major trading partners. As such, it considers the effect of a real cross-rate devaluation of the Egyptian pound in each of its major export products and geographic markets. For imports and foreign direct investment, the devaluation is at the world market level, since a devaluation of the Egyptian pound would not influence the source of Egypt's imports. Although the effect of exchange rate changes on foreign direct investment does not consider cross rates, it is likely that Egypt's exchange rate changes relative to the home country of the foreign investors would significantly impact on the level of foreign direct investment. However, data on investment inflows by country of origin were not available for that type of analysis in this study.

The results show that a 10 percent real effective exchange rate devaluation would significantly impact on Egypt's economy. In the balance of payments, merchandise exports adjust almost entirely within the first period. A 10 percent devaluation leads to a 6.7 percent expansion in the US dollar value of exports in the year of the devaluation and a 7 percent expansion in the medium term. Imports adjust more slowly, but their response to the feedback effect between the effect of the devaluation on the balance of payments and the national income account eventually leads them to expand by more than their level under a constant exchange rate. Initially, the value of imports would decline, but the expansion in real GDP associated with the improved balance of trade on goods and non-factor services eventually leads to an increase in

imports, albeit by a substantially smaller growth rate than that of exports. A similar situation to that of merchandise trade occurs with trade in services. In the capital account, the devaluation leads to a substantial contraction in FDI. The reason is that the real effective exchange rate devaluation increases the cost of imported material inputs and thereby lowers the incentive to expand cross-border production facilities in Egypt. It is likely, however, that with lower costs of imported material inputs under reduced trade barriers and an unprotected market, foreign direct investment will shift from inward-oriented production to outward-oriented production. These structural shifts are not considered in the present model, but could be introduced were more details FDI information available for industries.

Table 7.5
Effect of 10% Devaluation on Egypt's Economy
(Percentages)

	Unit of Account	Multiplier(%)	
		Impact	Total
Balance of Payments			
Goods: Exports f.o.b.	Nominal US$	6.7%	7.0%
Goods: Imports f.o.b.	Nominal US$	-2.8%	4.1%
Services: Credit	Nominal US$	1.2%	2.7%
Services: Debit	Nominal US$	-2.5%	3.1%
Direct Investment in Egypt	Nominal US$	-7.9%	-8.5%
National Income Accounts			
Exports of Goods and NFS	Constant LE	1.6%	3.6%
Imports of Goods and NFS	Constant LE	-2.7%	3.9%
Total Investment	Constant LE	-0.7%	2.8%
Total Consumption	Constant LE	1.9%	3.2%
Government Consumption	Constant LE	0.0%	2.9%
Private Consumption	Constant LE	2.2%	3.3%
Gross Domestic Product	Constant LE	1.7%	3.1%
Government Revenue and Expenditures			
Total Revenue	Constant LE	-0.5%	2.7%
Tax Revenue	Constant LE	-0.7%	3.4%
Tax on trade	Constant LE	-2.8%	4.1%
Others	Constant LE	-0.2%	3.2%
Total Expenditures	Constant LE	0.0%	2.1%
Current Expenditure	Constant LE	0.0%	2.9%
Wages	Constant LE	-0.2%	3.2%
Other expenditures	Constant LE	0.1%	2.7%

With the 10 percent devaluation, the fiscal situation improves in the medium run, notwithstanding an initial contraction in trade tax revenues of 2.8 percent below the equivalent revenue with a constant exchange rate. However, trade tax revenues expand by over 4 percent above the constant exchange rate solution in the medium term because of the economic growth induced expansion in imports. Real GDP grows by nearly 2 percent more than without a change in the real exchange rate, and it expands by over 3 percent in the medium term. In the short run, the expansion is

driven by private consumption, and in the medium term it is private consumption, gross capital investment and exports that generate the economic expansion.

These results point to the effectiveness of exchange rate changes in Egypt as an equilibrating instrument for the current account and one that can be used to replace trade restrictions as an instrument with which to achieve a sustainable medium-term external position. For fiscal revenue the results show that the elimination of the overvaluation of the Egyptian pound expands the share of trade taxes following the initial contraction and, because of the positive tax revenue effect, the devaluation leads to a medium-term improvement in the fiscal balance. Moreover, the elimination of the overvalued currency substantially expands the value of imports measured in domestic prices. As a result, there are positive medium-term effects on the fiscal balance from the larger domestically priced tax base and the larger tax revenue generated from increased investment and consumption by the private sector.

While issues of public finance are beyond the scope of the present analysis, it is clear from the present fiscal impact assessment of trade liberalization in Egypt that tax reform needs to be an integral part of tariff reforms. As Mitra (1992) has suggested, tariff reform should be viewed as part of a broader program of tax reform that supports the transition from a large dependence on trade taxes for fiscal revenue to a broad tax revenue base that ensures revenue growth and stability and increases productivity at the firm level from the more efficient use of existing resources under freer trade.

8.0 Summary and Conclusions

The present model provides a parsimonious representation of the Egyptian macro economy that emphasizes the external sector. It aims to serve a dual purpose. First, it provides a framework for making rational and consistent predictions about Egypt's overall economic activity, the standard components of the balance of payments, the expenditure concepts of the national accounts, and the financial sector balances. Secondly, it offers a means of quantitatively evaluating the impact of trade and exchange rate policy reforms 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 Egypt 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 Egyptian 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 Egyptian 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 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 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.

The model has been used to evaluate the impact of alternative tariff reforms and a devaluation. Three sets of simulations have been performed with the model. The first provides the benchmark against which policy impact assessments are measured. The second set assesses the impact of alternative trade liberalization policies that include

free trade, concertina, two-tier, a uniform rate, and a combination of two-tier and single rate tariffs. The final set evaluates the impact of a real effective exchange rate devaluation to neutralize the initial effects of trade policy reforms on the balance of payments, the national income accounts on the expenditure-side, and the money supply, prices and real exchange rate. Such a realignment in the exchange rate often accompanies trade liberalization to bring the exchange rate more in line with a level that is consistent with a sustainable medium-term external position under a situation in which there are lower trade barriers.

The results show that a lower average tariff rate would stimulate domestic investment, which in turn would expand overall growth of the economy. The increased national income would further stimulate private consumption, while current expenditures of the Government would contract in response to the lower trade tax revenue. The Government would nevertheless receive some compensation for the reduced trade tax revenue from increased tax revenue from other sources as a result of the private sector's expanded economic activity. These findings point to the need to consider tax reform as an integral part of tariff reforms. In other words, tariff reform should be viewed as part of a broader program of tax reform that supports the transition from a large dependence on trade taxes for fiscal revenue to a broad tax revenue base that ensures revenue growth and stability and increases productivity at the firm level from the more efficient use of existing resources under freer trade.

In measuring the effectiveness of a devaluation in countering the trade balance effect of trade liberalization, the findings support generalizations about the effectiveness of the exchange rate as a policy instrument. For government expenditures, the fall in the relative price of tradables and rise in that of wages and non-tradables produces a less than proportional response of the exchange rate devaluation to that of trade liberalization because of the substitution in production or consumption of tradables and non-tradables. For fiscal revenue the results show that the elimination of the overvaluation of the Egyptian pound expands the share of trade taxes following the initial contraction and, because of the positive tax revenue effect, the devaluation leads to a medium-term improvement in the fiscal balance. Moreover, the elimination of the overvalued currency substantially expands the value of imports measured in domestic prices. As a result, there are positive medium-term effects on the fiscal balance from the larger domestically priced tax base and the larger tax revenue generated from increased investment and consumption by the private sector.