

Pilkington Library

Author/Filing Title HADIAN, E.

Accession/Copy No. 040129667

Vol. No.

Class Mark

	LOAN COPY
27 JUN 1997	25 JUN 1999
26 JUN 1998	14 JAN 2000
20 MAR 1998	13 JAN 2000
24 APR 1998	
25 JUN 1999	

0401296679



**Real Exchange Rate Dynamics and Implications
for Macroeconomic Policy in Iran, 1961-92**

by

Ebrahim Hadian

A Doctoral Thesis

**Submitted in partial fulfilment
of the requirements for the award of
Doctor of Philosophy**

**Department of Economics
Loughborough University**

July 1996

 Loughborough University Library	
Date	Jan 97
Class	
Acc No.	040129667

9647191

ABSTRACT

This thesis uses a partial equilibrium framework to examine the short and long-run determinants of the real exchange rate of the Iranian rial and the implications of changes in this real exchange rate for the real side of the Iranian economy over the period 1961-1992.

The long-run determinants of the real exchange rate are found to be the terms of trade, trade policy, real income and investment, whereas in the short-run changes in domestic credit expansion and the effect of the war with Iraq have additional explanatory power.

The change in the real exchange rate is shown to have strong effects on the demands for real imports and (non-oil) exports of Iran and on the level of real output. The policy implications are that consistent macroeconomic policies need to be pursued in conjunction with a dual exchange rate system.

ACKNOWLEDGEMENT

My preparation of this study has been mainly dependent on the assistance and financial support of the Ministry of Culture and Higher Education of the Islamic Republic of Iran, so it is a great pleasure to offer my thanks for the help that I have received.

I am also deeply indebted to my supervisors, Dr Eric J. Pentecost and Dr Mark J. Holmes for their useful advice and encouragement throughout the time spent on this thesis. However, without their help the thesis would not stand as it is, I am solely responsible for errors that remain undetected in this thesis.

I would like to thank my fellow-students in the Department of Economics at Loughborough University for their warm friendship and invaluable assistance.

Finally, a particular debt of gratitude is owed to my family who suffered a long period of neglect throughout my period of study.

CONTENTS

Chapter 1	
Introduction	1.1
1.1 Aims and motivations	1.1
1.2 Methodology	1.2
1.3 An overview of the Iranian economy	1.5
1.4 Plan of the research	1.16
Chapter 2	
Real Exchange Rate Concepts	2.1
2.1 Introduction	2.1
2.2 The theoretical concept of the real exchange rate	2.1
2.2.1 Alternative definitions of the real exchange rate	2.1
2.2.2 Purchasing power parity definition of the real exchange rate	2.2
2.2.3 Price adjusted exchange rate	2.4
2.2.4 Unit labour costs	2.7
2.2.5 Tradable-nontradable relative price	2.9
2.2.6 The equivalence of the measurement of the real exchange rate	2.11
2.2.7 Real exchange rate and international competitiveness	2.12
2.3 Equilibrium real exchange rate and the notion of misalignments	2.13
2.3.1 Equilibrium real exchange rate	2.13
2.3.2 Real exchange rate equilibrium and internal-external balance	2.14
2.3.3 Real exchange rate misalignment	2.15
2.3.4 Causes of misalignment	2.16
2.3.5 The costs of misalignment	2.17
2.4 Realignment of the real exchange rate	2.19
2.4.1 Automatic adjustment	2.19
2.4.2 Nominal devaluation	2.22
2.4.3 Import tariff and export subsidies	2.23
2.5 Measurement problems	2.23
2.5.1 Gross domestic deflator	2.24
2.5.2 Unit labour costs	2.25
2.5.3 Wholesale price index	2.25
2.5.4 Consumer price index	2.25
2.5.5 The choice of nominal exchange rate	2.26
2.5.6 The quality of the data	2.27
2.6 Conclusion	2.27

Chapter 3

Real and Monetary Determinants of the Real Exchange Rate: A Theoretical Discussion

	3.1
3.1 Introduction	3.1
3.2 Fundamental factors and real exchange rate behaviour	3.3
3.2.1 Shifts in the terms of trade and real exchange rate	3.3
3.2.2 Oil shocks and real exchange rate	3.6
3.2.3 Investment and real exchange rate	3.13
3.2.4 Productivity growth and real exchange rate	3.15
3.2.5 Trade policy and real exchange rate	3.16
3.3 Fiscal policy and real exchange rate	3.17
3.4 Monetary policy and real exchange rate	3.20
3.5 Conclusion	3.26

Chapter 4

The Trend behaviour of Iranian Real Exchange Rate

	4.1
4.1 Introduction	4.1
4.2 Real effective exchange rate	4.2
4.2.1 Mathematical formulations	4.3
4.2.2 Relative price and nominal exchange rate indices	4.4
4.2.3 Relevant weighting system	4.4
4.2.4 Empirical results	4.7
4.3 The black market and the behaviour of the real exchange rate	4.14
4.3.1 The theory of the black market for foreign currency	4.15
4.3.2 Inflation and black market	4.17
4.3.3 Black market and extra real appreciation	4.19
4.3.4 Black market and real exchange rate misalignment	4.19
4.3.5 Black market real exchange rate behaviour	4.21
4.4 Stationarity of the real exchange rates and deviation from purchasing power parity	4.26
4.5 Conclusion	4.28

Chapter 5

An Empirical Analysis the Dynamic Process of Iranian Real Exchange Rate Behaviour

	5.1
5.1 Introduction	5.1
5.2 The cointegration technique	5.3
5.3 Definitions and sources of the variables used in estimation	5.5

5.4 Econometric results	5.6
5.4.1 Unit root tests	5.6
5.4.2 Cointegration results	5.7
5.4.3 Error correction specification	5.9
5.4.4 Adjustment path of the real exchange rate	5.11
5.5 Interpretation of the results	5.27
5.5.1 Changes in the terms of trade	5.27
5.5.2 Changes in trade policy	5.29
5.5.3 Changes in the real investment	5.30
5.5.4 Changes in the real income	5.31
5.5.5 Macroeconomic policy	5.32
5.6 Conclusion	5.32
Chapter 6	
Real Exchange Rate and economic performance in the Iranian Economy: A Partial Equilibrium Approach	6.1
6.1 Introduction	6.1
6.2 The real exchange rate and external sector	6.2
6.2.1 Export and import equations	6.3
6.2.2 Econometric results	6.4
6.2.3 Interpretation of the econometric results	6.15
6.3 Real exchange rate and the output gap	6.20
6.3.1 Unemployment equation	6.21
6.3.2 The cointegration equation	6.22
6.3.3 Econometric results	6.24
6.3.4 Interpretation of the results	6.25
6.4 Conclusion	6.26
Chapter 7	
Real Exchange Rate Targeting	7.1
7.1 Introduction	7.1
7.2 Stabilisation policies for reducing real exchange rate variability	7.2
7.2.1 Relative importance of the temporary and permanent shocks to the real effective exchange rate	7.3
7.2.2 Automatic adjustment	7.4
7.2.3 Nominal devaluation	7.5
7.2.4 Commercial policy and real exchange rate stability	7.9
7.2.5 Nominal exchange rate regime and real exchange rate stability	7.10
7.2.6 Macroeconomic policies and real exchange rate stability	7.12

7.3 Evidence from nominal exchange rate reform in the Iranian economy	7.14
7.3.1 Nominal devaluation and domestic price level	7.15
7.3.2 Nominal devaluation and black market exchange rate	7.16
7.3.3 Nominal devaluation and real exchange rate	7.17
7.3.4 Nominal devaluation and macroeconomic policy	7.19
7.3.5 Prominent causes of the ineffective devaluation	7.21
7.4 Conclusion	7.24
Chapter 8	
Conclusions	8.1

LIST OF TABLES

Chapter 1

Table 1.1	Selected macroeconomic variables of the Iranian economy	1.14
-----------	---	------

Chapter 3

Table 3.1	The sign of the effects of alternative shocks on the real exchange rate	3.22
-----------	---	------

Chapter 4

Table 4.1	The 10 largest trading partners of Iran and their shares in the Iranian total trade	4.7
Table 4.2	Real and real effective exchange rates for the Iranian rial	4.8
Table 4.3	Indices of the real exchange rate for the Iranian rial	4.9
Table 4.4	Basic statistical results of real exchange rate indices	4.10
Table 4.5	Black market real exchange rate for the Iranian rial	4.25
Table 4.6	Basic statistical results of black market real exchange rate	4.26
Table 4.7	Augmented Dickey-Fuller tests for unit roots in real exchange rates for the Iranian rial	4.27

Chapter 5

Table 5.1	Unit root tests	5.7
Table 5.2	Test for the number of cointegrating vectors	5.8
Table 5.3	Estimated cointegrated vectors in Johansen estimation	5.8
Table 5.4	Error correction model estimates	5.10
Table 5.5	Distributed lag effect on real effective exchange rate of one-unit, once-and-for-all, increase in the terms of trade	5.15
Table 5.6	Distributed lag effect on real effective exchange rate of one-unit, once-and-for-all, increase in trade policy	5.16
Table 5.7	Distributed lag effect on real effective exchange rate of one-unit, once-and-for-all, increase in real income	5.17
Table 5.8	Distributed lag effect on real effective exchange rate of one-unit, once-and-for-all, increase in investment	5.18
Table 5.9	Distributed lag effect on real effective exchange rate of one-unit, once-and-for-all, increase in (inconsistent) macroeconomic policy	5.19
Table 5.10	Distributed lag effect on real effective exchange rate of a permanent increase in the terms of trade	5.22
Table 5.11	Distributed lag effect on real effective exchange rate of a permanent increase in (restricted) trade policy	5.23

Table 5.12	Distributed lag effect on real effective exchange rate of a permanent increase in the real income	5.24
Table 5.13	Distributed lag effect on real effective exchange rate of a permanent increase in investment	5.25
Table 5.14	Distributed lag effect on real effective exchange rate of a permanent increase in (inconsistent) macroeconomic policy	5.26

Chapter 6

Table 6.1	Unit root tests, export and import equations	6.4
Table 6.2	Tests for the number of cointegrating vectors, import equation	6.6
Table 6.3	Tests for the number of cointegrating vectors, export equation	6.6
Table 6.4	An error correction model for imports	6.8
Table 6.5	An error correction model for exports	6.9
Table 6.6	Distributed lag effect on imports of one-unit, once-and-for-all, increase in the real effective exchange rate	6.11
Table 6.7	Distributed lag effect on imports of a permanent increase in the real effective exchange rate	6.12
Table 6.8	Distributed lag effect on exports of one-unit, once-and-for-all, increase in the real effective exchange rate	6.14
Table 6.9	Distributed lag effect on exports of a permanent increase in the real effective exchange rate	6.15
Table 6.10	Dependence of the "Manufacturing Sector" On imported capital and intermediate goods	6.18
Table 6.11	Real interest rate (1970-1979)	6.23
Table 6.12	Unit root tests, unemployment equation	6.24
Table 6.13	Tests for the number of cointegrating vectors, Unemployment equation	6.24

Chapter 7

Table 7.1	Stationary and random walk components of the Iranian real exchange rate	7.4
Table 7.2	Impact effect of foreign price on the domestic price of tradable goods	7.9
Table 7.3	Inflation rate before and after the nominal exchange rate reform	7.16

Table 7.4	Trends in the gap between the official and the black market exchange rates (rials per US dollar) in the period before and after the nominal exchange rate reform	7.17
Table 7.5	Effectiveness index of nominal devaluation	7.18
Table 7.6	Macroeconomic policies in the period preceding and following the nominal exchange rate reform	7.20

LIST OF FIGURES

Chapter 2

Figure 2.1	Ordinary demand curve for a given tradable goods	2.5
Figure 2.2	Demand curve for foreign currency	2.6
Figure 2.3	Real exchange rate equilibrium and internal-external balance	2.15
Figure 2.4	Automatic adjustment of the real exchange rate misalignment	2.20

Chapter 3

Figure 3.1	Effect of temporary current improvement in the world real price of oil on the real exchange rate behaviour	3.8
Figure 3.2	Effect of permanent improvement in the world real price of oil on the real exchange rate behaviour	3.10
Figure 3.3	Effect of real investment on the real exchange rate when the investment is entirely allocated on the nontradables sector	3.14
Figure 3.4	Effect of real investment on the real exchange rate when the investment is entirely allocated on the tradables sector	3.15

Chapter 4

Figure 4.1	Real and real effective exchange rates for the Iranian rial	4.12
Figure 4.2	Purchasing power parity real and real exchange rates for the Iranian rial	4.12
Figure 4.3	The ordinary supply and demand for foreign currency	4.17
Figure 4.4	Black market exchange rate and a rise in inflation	4.19
Figure 4.5	The black market exchange rate for US dollar and the official real exchange rate in the Iranian economy	4.23
Figure 4.6	The black market and official real exchange rate for the Iranian rial	4.25
Figure 4.7	The trends of log of real effective exchange rate, real exchange rate, and the black market real exchange rate for the Iranian rial	4.28

Chapter 5

Figure 5.1	The impact effect of a temporary expansionary monetary policy on the real exchange rate	5.14
Figure 5.2	Time profile for the real effective exchange rate following a temporary change in the terms of trade	5.15
Figure 5.3	Time profile for the real effective exchange rate following a temporary change in (restricted) trade policy	5.16

Figure 5.4	Time profile for the real effective exchange rate following a temporary change in real income	5.17
Figure 5.5	Time profile for the real effective exchange rate following a temporary change in investment	5.18
Figure 5.6	Time profile for the real effective exchange rate following a temporary change in (unsustainable) macroeconomic policy	5.19
Figure 5.7	Time profile for the real effective exchange rate following a Permanent increase in the terms of trade	5.22
Figure 5.8	Time profile for the real effective exchange rate following a Permanent increase in (restricted) trade policy	5.23
Figure 5.9	Time profile for the real effective exchange rate following a Permanent increase in real income	5.24
Figure 5.10	Time profile for the real effective exchange rate following a Permanent increase in investment	5.25
Figure 5.11	Time profile for the real effective exchange rate following a Permanent increase in (inconsistent) macroeconomic policy	5.26
Chapter 6		
Figure 6.1	Time profile for imports following a temporary change in the real effective exchange rate	6.11
Figure 6.2	Time profile for imports following a permanent change in the real effective exchange rate	6.12
Figure 6.3	Time profile for exports following a temporary change in the real effective exchange rate	6.14
Figure 6.4	Time profile for exports following a permanent change in the real effective exchange rate	6.15

1

Introduction

1.1 Aims and motivations

The principal aim of this thesis is to examine the dynamic behaviour, in both the short and the long-run, of the real exchange rate of the Iranian rial and to evaluate the effects of movements in the real exchange rate on the real sector of the economy.

The level of the real exchange rate and its movements over time are potentially important for the stability and growth of the real economy. Williamson (1983) distinguishes between real exchange rate variability, short run fluctuation in the real exchange rate, and real exchange rate misalignment, persistent deviation of the real exchange rate from its equilibrium level, and stresses the importance of the latter for the macroeconomy. In particular, real exchange rate misalignments can give rise to recession, unemployment, external imbalances and a misallocation of resources which in turn, may lead to calls for greater protectionism.

The evidence of the damage a real exchange rate misalignment can cause is carefully assessed for the misalignment of a broad geographical samples of developing countries by Agarwala (1983), Edwards (1989a) and Cottani et al (1990). These studies show that the persistent departure of actual real exchange rate from its equilibrium value has been a major source of slow growth in most developing countries. Incorrect signals generated by an unsustainable real exchange rate has resulted in inefficiencies in the allocation of resources, and in steady losses in their international competitiveness. They also emphasise that the failure to sustain an adequate exchange rate policy has undermined the economic reforms and free market policies in these countries in recent years.

In the case of Iran, however, it is now widely accepted that unsustainable real exchange rate has had a wide-ranging effect on the country's economic

performance, very few systematic empirical analyses have investigated this subject. For this reason, the current study undertakes an empirical analysis to measure the effects of exogenous and domestically induced shocks on the real exchange rate and the implications for macroeconomic policy in the Iranian economy.

The main hypotheses of this study can be summarised as:

- 1) Temporary and permanent real shocks, in addition to the nominal disturbances, have been an important source of real exchange rate variability. The alternative hypothesis is that the real exchange rate does not revert toward a "trend" following a particular shock. Non-rejection of this hypothesis implies that the Iranian real exchange rate has not been consistent with purchasing power parity theory.
- 2) However, it is likely to find a long-run stable (cointegrating) relationship between real exchange rate and its fundamental determinants and as a result, there may exist an autonomous tendency for the system to correct any deviation of actual real exchange rate from its long-run equilibrium level, the speed of such adjustment is expected to be low and insufficient. If so, the low value of this force which is in operation to move the actual rate back to the equilibrium level will keep the economy out of equilibrium for a long time.
- 3) Although, some of the main forces behind the real exchange rate variability have been external to this economy and thus beyond the control of the government, a major factor contributing to and accentuating the existing variability in the real exchange rate has been the government's inconsistent fiscal and monetary policy.
- 4) Due to the low elasticity of imports with respect to the real exchange rate changes and due to the fact that Iran's main exports (oil) are not substantially affected by real exchange rate movements; (i) the negative effect of the real exchange rate volatility on the country's external sector has been less than its effect on the internal sector, (ii) any attempt to realign the real exchange rate can provide little help to restore the external equilibrium.

1.2 Methodology

The theoretical model underpinning the thesis is that due to Edwards (1989a). In this theoretical model there are several key aspects with respect to real exchange rate behaviour¹.

¹ Of course, Edwards' theoretical model has made many points with respect to the dynamic behaviour of the real exchange rate. Here, we have concentrated only on the several points which are related to our future empirical discussions.

(i) The long-run equilibrium real exchange rate is a function of real variables only, while the actual real exchange rate prevailing at any time responds both to real and nominal variables. The existence of an equilibrium value of the real exchange rate does not mean that the actual real rate has to be permanently equal to this equilibrium value.

(ii) The equilibrium real exchange rate is that rate which results in the simultaneous attainment of internal and external equilibrium. When there are changes in any of the other variables that affect the country's internal and external equilibrium, there will be also changes in the equilibrium real exchange rate. As a result of this fact, there is not one single equilibrium real exchange rate. Rather, there is a path of equilibrium real exchange rates through time.

(iii) The path of the real exchange rate is affected not only by the current values of the fundamental determinants, but also by their expected values. To the extent that there are possibilities for intertemporal substitution of fundamentals to affect the current and expected future values of the real exchange rate.

(iv) After a particular shock, when all other things are sustainable, the real exchange rate is expected to move back to its long-run equilibrium path. The speed of such an adjustment depends on a number of institutional factors that under predetermined exchange rates can reduce the domestic price level.

(v) On the other hand, the excess volatility in real exchange rate has a significant negative effect on the country's economic performance, affecting the balance of payments, the allocation of resources and the structure of production and consumption.

This kind of model therefore strictly requires the use of a simultaneous systems method of estimation to fully capture the endogeneity of exchange rate expectations and the interactions between the external and internal sectors of the model. This econometric methodology, however, cannot be used here, due to the limited range of the data set, which precludes the use of systems methods. The approach adopted here is therefore a partial equilibrium approach, although the use of maximum likelihood cointegration techniques does alleviate the potential simultaneity problems.

The cointegration technique involves estimating a long-run equation based on the theoretical methodology, supplemented by an *error correction* equation which

determines the dynamic structure and the extent to which deviation from the long-run path are being corrected.²

A number of methods have been developed to examine whether a cointegrating relationship exist between variables under consideration and to estimate the relevant cointegrating vector(s). The most widely used is the Engle-Granger two-step method, Engle and Granger (1987). This method, however, has the advantage of being straightforward to apply, as it relies on single equation OLS estimation, but it has a major limitation. The serious problem occurs with Engle-Granger two-step method when there are more than two variables in a system. In this case, there may be more than one cointegrating relationship between the variables and this method does not provide a technique for examining this issue. To avoid this problem and the simultaneity issue noted above, the Johansen (1988) technique is used to determine how many cointegrating vectors are available for the set of variables under consideration.

Prior to seeking the cointegrating relationships, it is necessary to examine each time series variable to test the order of integration since cointegrating vectors can only be found between variables which are first-difference stationary. For this purpose, the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests will be used.

1.3 An overview of the Iranian economy

In this section a brief summary of the main features of the Iranian economy is presented. The aim is to provide general information to familiarise the reader with the country's economy and highlight the underlying economic mechanisms behind the values of the parameters and coefficients which will be estimated in this study. For this reason, the sample period 1961-92 is split into three sub-periods, distinguished not only by different structural conditions, but also by the government responses to those conditions.

² The theory of cointegration is a natural extension to the literature on error correction mechanisms introduced by Sargan (1964) and subsequently popularised by Davidson et al. (1978). Error correction terms were included in models of first difference in order to account for equilibrium error. Granger (1981) developed the concept of cointegration, and the link between cointegration and error correction mechanisms was established by the Granger Representation Theorem in Engle and Granger (1987). For further information about cointegration method, see Holden and Thompson (1992).

1.3.1 The first stage; 1961-72

During this period leading to the first oil shocks, Iran's economic record was for the most part favourable and expansive, albeit somewhat unbalanced and in some ways fragile. According to the official data in Table 1.1, the average annual rate of real GDP was nearly 11.5 percent. Significant rates of growth were also achieved in other main economic variables such as investment, saving, consumption, and employment. Despite the important role of the oil sector at that time, earnings from this sector had a quite desirable effect on the domestic price level and hence on the real exchange rate. The rate of inflation was kept at a low of 3 percent during 1960-72, uncommonly below the average of Iran's trading partners, which was at about 3.6 percent.

During this stage, there was a strong desire to transform the country from a largely agrarian and "immobile" economy into a modern economy by way of fundamental changes in the traditional structure. This development policy, started in the early 1960s, was on the basis of "unbalanced growth" which was the common dictated method for countries seeking economic development. Through this strategy, the economy was led to a path of industrialisation by increasing the amount of investment in the industrial sectors. By 1971, as a result of this imbalance in economic policy the share of agriculture, which dominated the Iranian economy until 1960, was reduced from 29 percent of GDP in 1960 to less than 12 percent in 1971. It was in part a natural response to the highly interventionist state that used its power to expand the industrial sector, thus factors of production were pulled out of the agricultural sector and put into the industrial sector. Furthermore, the decline of agriculture production was also caused by increases in oil revenues during the 1960s which provided further resources with which to expand the industrial sector.

The effect of this policy was the creation of an economy that was heavily reliant on the production and sale of oil, not only to pay for imported consumption goods, but also to keep the manufacturing sector running. As will become apparent, the risks inherent in such policies have subsequently emerged.

1.3.2 The second stage; 1973-78

In this period, the general characteristic of Iran's economy was the size of its public sector. The government has been so overburdened with economic functions that it did on the whole not performed efficiently. The cost of the public sector and its regulation affected the long-run performance of the economy.

In 1973, with growing revenues of oil, the Iranian economy accelerated the industrialisation started in the early 1960s. Basic priorities set by the government emphasised rapid growth, sectoral modernisation and integration into the global economy. For this reason the government undertook a comprehensive programme of massive investment in manufacturing industry, hydrocarbons and the service sector. As a result during the first half of the 1970s the government sector had become progressively more involved in finance, mining and manufacturing. Due to the growing revenues from oil exports, all sectors of the economy experienced significant expansion.

Data published by the central bank of Iran indicate that Iran's average annual growth rate of real GDP was nearly 9.5 percent during 1973-77. Gross domestic investment grew at an average annual rate of more than 26 percent of GDP. Private consumption rose nearly 25 percent a year and public consumption rose 45 percent. Crude oil exports rose from approximately 1 million barrels per day in 1963 to around 5 million barrels per day in 1973, reaching a peak of 5.4 million barrels in 1974.

In the foreign trade sector, the ratio of imports to GDP increased from 20 percent in 1973 to 28 percent in 1976 and declined to 25 percent in 1977. The share of non-oil exports in the country's total exports declined from 15 percent in 1972 to 2 percent in 1977. As a result of the economic expansion, which was brought about by increases in oil exports revenues, both current and development expenditure went up sharply. The result was a tremendous increase in domestic aggregate demand. However, although domestic production increased during this period, it could not satisfy the massive rise in demand. In addition, the government's efforts and its emergency high-cost rescue programmes were not able to break supply shortages. Consequently, a large gap emerged between aggregate supply and aggregate demand which accelerated the rate of growth of domestic prices which had started in the previous stage.

A fall in the world price of oil in 1976 illustrated that oil shocks cannot be treated as permanent events. It undid the earlier euphoria and reduced the anticipated oil revenues. With the increase in expenditure rapidly exceeding increase in incomes, the government budget, that had experienced a fall in the deficits, showed, once again a rise in the deficit. This made the government return to the international market and domestic banking system for borrowing to satisfy expansionary policy needs.

Combined with the fiscal response to the oil boom there was also a strong monetary response. The huge rise in international reserves that occurred in 1974 was not totally sterilised by the monetary authorities. Reserve money almost tripled in 1974, whereas money holdings by the public roughly doubled. In addition, the growing fiscal deficit that emerged in the three years after oil shocks accelerated the rapid monetary growth in these years. By the end of 1978 the money supply had risen nearly five fold from its 1973 level. Large increases in credit to the private sector and domestic liquidity caused a higher rate of inflation. Between 1973 and 1978 the consumer price index rose by an average annual rate of 19 percent. Since the nominal exchange rate was not altered substantially, the real exchange rate appreciated significantly, contributing to the external trade deficit.

The development plan implemented between 1973-78 contained the principles of a model of state capitalism. The government performed the bulk of capital accumulation both in social infrastructure and through state enterprises. This final development plan, prepared during the pre-revolutionary government, designed to guide the country more rapidly to the "Great Civilisation". In this plan, which was revised after the 1973 oil shocks, the planned public investment outlays were nearly seven times the size of the fourth plan (1968-73) that was just completed.

Due to the country's limited absorptive capacity and the raw materials boom in the international markets, accelerated public sector investment in the wide range of economic activities provided little opportunity and added cost-push pressures to the growing rate of domestic inflation.

Another point that should be added is the narrowness of the tax base that resulted from the increasing reliance on oil revenues. More than 50 percent of tax revenues were related to the performance of the external sector. They were taxed on foreign trade and large part of income taxes (such as public and private corporations which are highly import-intensive activities). Therefore, the volume of taxes collected was closely related to what happened in the export sector. The easy access to foreign exchange in 1970s promoted the government to postpone the necessary reforms to broaden the tax system. Such a vulnerable financing situation was another cause of the volatile economic situation. A more desirable policy would have been to provide alternative financial resources which could easily have replaced export earnings in the wake of a decline in the oil market.

1.3.3 The third stage (1979-92)

The Islamic revolution of 1979 is the main landmark in Iran's recent history. As a result, the government has nationalised the large firms, banks and insurance companies and undertaken extensive structural changes. Once again, the size of public sector characterised the Iranian economy.

Data on the macroeconomic performance of the Iranian economy is given in Table 1.1 for the years 1961-92. This indicates that the economy's real performance has passed through several phases of recession and recovery. The first period of recession actually started in 1978 when the Iranian Muslims rose up against the monarchy. Physical damage to property and other revolutionary events together damaged productive economic activity. The downward trend continued in the first year of the revolution, and was accelerated in the following years due to the many changes of administration, a significant fall in oil revenues, massive capital flight, Western governments' sanctions and the most important event, the war with Iraq.

Real GDP experienced a decline of 15 percent (average annual) during 1978-79. The dependence of industry on imported raw materials, spare parts and capital goods in the face of a shortage of foreign exchange resulted in decline in industry output of about 16 percent. The Oil sector also experienced a drastic 66 percent decline in 1980. Real GDP experienced another 14 percent decline in 1980. The declines in real output accompanied by reduction in imports due to trade sanctions and decrease in foreign exchange earnings enlarged the gap between aggregate demand and aggregate supply generating a higher rate of domestic inflation.

This first period of slowdown continued for four years, 1978-82. In 1982, in spite of war and its aftermath, due to the partial restoration of political stability and a gradual decline of external pressures, real output resumed its pre-revolution growth trend. Thanks again to the windfall revenues from oil, the following four year recovery (1982-85) period was substantially supported by the relatively desirable situation in the world oil market. Rising oil revenues, as the main resource of government incomes, enabled the government to finance essential imports of intermediate inputs and other raw materials needed for productivity growth. Between the period 1982-85, the average annual rate of real GDP was a remarkable 6.8 percent.

As can be seen from Table 1.1, the favourable growth cycle, started from 1982, was reversed in 1986 and continued until 1988. This period of recession was caused by a drastic fall in the world price of oil and the loss of oil export volumes

mainly due to attacks on oil facilities and oil tankers by the Iraqi army. The fall in oil income exhausted foreign exchange revenues. This along with growing expenditure on the war, led almost all import-intensive domestic economic activities to a great recession and real GDP, therefore, dropped by 15 percent in 1986.

Since the cease-fire in 1988, steps have been taken to transform the publicly controlled war economy into a normal situation. Substantial resources released from the war effort with an improvement in oil exports have helped the economy to recover and to start moving towards its equilibrium situation.

With the embarking on a new five-year development plan in 1989 and a change in the government's priorities and policies have brought a broad-based expansion in all productive sectors. On the basis of this new policy, a number of state-controlled industries have been privatised, restrictions on imports and credits for investment have been lifted to encourage more private sector participation, foreign investment has been encouraged by lifting some political and economic barriers, and some new policies have been imposed to reduce the volatility in the foreign exchange market and to control domestic inflation. This reconstruction plan helped GDP to rise by 3 percent in real terms since 1989. This improvement picked up speed in 1990 and gave rise to a 12 percent increase in real GDP.

Despite a quite good performance in this area in the last four years of the period of this study, external imbalance, budget deficits, volatile exchange rate, and high inflation have all still remained economic problems.

During 1979-80 the current account moved from the \$12 billion surplus recorded in 1979 to a deficit \$2 billion in 1980. In 1991 the deficit widened to more than \$9.4 billion. Due to the fact that the Iranian authorities seemed unwilling to finance this deficit by borrowing from abroad, the current account deficits were financed entirely from previously accumulated foreign reserves. The lower level of reserves was insufficient to finance the massive current account deficit that emerged in 1980s. The authorities responded to the payments imbalances during this period by imposing increasingly restrictive quantitative controls on external payments. Import quotas were applied to an increasingly broad array of goods and services and become more restrictive. The extent and the duration of imports restriction policy in the post-revolutionary period have been unprecedented in Iran's recent history. The impact of such policies on the volume of imports can be seen from Table 1.1, where the ratio of imports to gross domestic product is given.

The import restriction policy has had a crucial effect on real investment and hence the macroeconomic performance of the economy. Decreases in capital goods purchases and raw materials caused gross domestic capital formation to decline. This downward trend in the real investment has been particularly drastic during the years 1986-89 when the quantitative restriction policies were at a very high level. Over this period real investment fell at an average 18 percent per annum.

After all the rationing of foreign exchange, import quotas and other severe quantitative restrictions were manifestly unable to contain the imbalances generated mostly by external shocks such as deterioration in the terms of trade and turmoil in the international oil market.

Another problem for the Iranian economy has been the government budget deficit and its inflationary financing. In the first two years of the post-revolutionary period, despite the fact that government expenditure was reduced to match the decreases in the government revenues, a sizeable deficit still emerged. This fiscal imbalance accelerated in following years. Since the government was unable to finance these budget deficits through increases in tax rates or borrowing from private sector, more than 70 percent of the fiscal deficit was financed by borrowing from the central bank. In 1981-82, however, government revenues from oil improved, but it still fell short of the planned figure, resulting in a larger deficit. In these years, nearly 80 percent of deficit was financed by borrowing from the banking system. This figure increasingly continued in 1984 and 1985.

The fiscal situation improved through to 1986 and continued in 1988 when oil revenues dropped sharply. In 1988 the budget deficit peaked at a level, that was more than 50 percent of the government total expenditure. Even worse, more than 95 percent of this deficit was financed by the central bank. In 1989, following the government decision to sell foreign exchange earned from oil exports in the black market, and the improvement in the tax and other non-oil revenues, the budget deficit was almost halved. In 1990 a 45 percent increase in oil export revenue with a massive sale of foreign exchange by the government in the black market almost doubled government revenue. Despite the fact that government expenditure rose by more than 48 percent, the fiscal deficit was reduced by 40 percent from the year before. However, the budget deficit was also reduced in 1991-92.

Another important issue which characterises the Iranian economy is the foreign exchange policy. In the years before revolution, the nominal exchange rate was fixed and controlled by the government. However, there was a black market for foreign currency in commercial and non-commercial transactions, the gap between

the two rates was very small. Increasing oil revenues enabled the government to intervene actively in the exchange rate market to prevent any lasting disparity.

During 1980-92, Iran's foreign exchange rate system has passed through several stages of predetermined policy, quantitative controls, transformation in the direction of restrictions and finally a multi-rate system.

After the revolution, along with reducing economic dependence and eliminating the negative effect of external shocks, a radical and interventionist policy was imposed on the exchange rate system. This strategy with accompanied by the Iraq invasion of Iran's territory, the effective impact of Western governments' sanctions on Iran's exports and a drastic decline in oil revenues for most years after the revolution, caused the exchange rate system to become completely centrally managed and tightly controlled in the 1980s.

In response to this policy a huge decline in the black market exchange rate took place. The black market premium, the percentage excess of the black market rate for US dollar over the official rate, has been rising at an average annual rate of 150 percent over the period 1980-92. It amounted to 8 percent in 1978 and jumped to 1960 percent in 1992. This means that the black market rate for the US dollar in 1992 reached a value nearly 20 times the official rate.

The black market operating during the 1980s has had several important implications on the Iranian economy and caused the system to become subject to serious macroeconomic distortions. First, it provided an outlet for excess demand for foreign exchange on the part of importers and flight capital. Political problems along with financial instability, were the most important causes of capital flight. Significant capital flight from Iran in 1979 was motivated by the asset holder's fear that the revolution might expropriate a large part of their assets. Moreover, due to the post-revolutionary government's decision to keep interest rates artificially low, under inflationary conditions the real interest rate fell to negative levels. Asset holders protected their wealth by moving into foreign assets. This kind of capital flight was accelerated when devaluation of the domestic currency in the black market made it almost certain that holdings of foreign assets would carry a large return. Since the foreign exchange available could not satisfy this demand, then the overinvoicing of imports and underinvoicing of exports became a common mean for providing the foreign currency that was sold in the black market to those people who were seeking to move money abroad.

Second, the huge gap between black market and official rate of US dollar also created extensive opportunities for rent-seeking activities and increased corruption and resulted in a misallocation of resources primarily from manufacturing and agriculture sectors to trade and distribution. According to the data published by the central bank of Iran, between 1979 and 1990 the manufacturing sector indicated an average annual growth rate of 0.4 percent as compared to the average annual growth rate of 1.5 percent for the service sector. However, part of this move towards services and away from productive activity can be justified by the war. The high level of the black market premium has made service activities (particularly trade and distribution) less risky and more profitable than productive activities. Clearly, importers with access to foreign exchange at the official exchange rate, which is 20 times below the black market rate, are able to sell part of these imports in the black market, to achieve a considerable gain from trade over a relatively short period of time. This situation has resulted in high import prices and increasing domestic inflation during this period.

A third macroeconomic impact of the black market on the Iranian economy is the potential extra consumption from this pricing mechanism. All suppliers of foreign currency in the black market have been able to obtain more domestic currency, which presumably has been allocated on consumption. On the other hand, capital flight that left the country through the black market weakened local investment. This gap between demand and supply again depressed the domestic economy.

Official data indicates that upward inflationary movement started from the beginning of the 1970s has continued for all years after the revolution. As mentioned above, with a drastic decline in oil production and revenues, due mainly to the outbreak of the war with Iraq in 1980, and significantly reduced national production the domestic price level began to rise. The consumer price index (CPI) rose by 21 percent in 1980. In response to this problem, the government started to control prices and distribution by establishing the Economic Mobilisation Centre. In spite of that attempt, the growth rate of the domestic price level in 1981 was higher than the year before. The consumer price index in 1981 rose by 24 percent which was nearly 3 percent more than 1980. In 1982, CPI rose by 19 percent which was a 5 percent reduction from the previous year. The likely interpretation of this reduction in the rate of inflation can be some responses to the government control and rationing policies and the recovery in oil revenues that led to an improvement in industrial sector and imports of consumer goods and raw materials.

A reduction in the government budget deficit with a slower rate of increase in private sector liquidity resulted in a fall in aggregate demand. On the other hand, an improvement in the output of both agriculture and industry led to the higher level of aggregate supply. As a result, a further reduction in the domestic price level has been experienced. The growth rate of consumer price index in 1985 fell about to 4 percent.

In 1986, a massive reduction in oil revenues and the shortage of foreign exchange once again become the government's major economic problem. This problem accompanied by economic sanctions on both exports and imports, recession in industry and expanded private sector liquidity, accelerated the inflation rate once again. CPI sharply increased to 18 percent. This rise continued in 1987 and 1988 with the CPI rising by 28 and 29 percent respectively. The main cause of the upward trend of inflation, as before, was the government huge budget deficit due mainly to a sharp decline in oil revenues, a massive increase in private sector liquidity, changes in the government control policy, and administrated rises in the price of some public goods and services.

The ceasefire in 1988 reduced military expenditure and redirected resources to other economic activities. This, accompanied by a reduction in the government budget deficit and consequently smaller monetary growth, resulted in a lower inflation rate in 1990, of 8 percent. An increase in the private and public investment expenditure and growing demand for raw materials and basic essential goods put new pressure on prices and caused the CPI to rise by 17 percent in 1991 and 23 percent in 1992.

In sum the main causes of Iran's high inflation can be summarised as, a long war with Iraq, turmoil in the world market of oil for most of the 1980s, the trade embargo and Western governments' sanctions, the large government budget deficit and its inflationary financing, high growth rate of population, and some management problems.

Throughout the 1980, the government tried to fight inflation by rationing, price controls, subsidies to essential goods, and distribution of the basic essential goods by official channels. Moreover, strict legislation against hoarding, price growing, and speculative transactions have been the other part of the government anti-inflationary policy. However, it is difficult to assess properly the impact of such policies on the growing rate of inflation, there is no doubt that in the absence of such policies the economy would have been suffered further from higher inflation.

Table 1.1
Selected macroeconomic variables of the Iranian economy (1961-92)

Year	(GDP)	I/GDP	(CPI)	(TOT)	G/GDP	BD/G	X/GDP	M/GDP	CA	BMP	(DC)	U
		%			%	%	%	%	Bill of US \$			
1961	8	13	5	12	16	14	16	7	-0.042	12	12	3.5
62	7	14	7	16	16	14	18	8	-0.035	16	23	3.8
63	12	13	-2	-11	17	13	20	10	-0.052	2	19	4
64	11	18	4	12	19	17	19	10	-0.142	3	12	4.1
65	12	21	2	0	22	9	16	15	-0.215	6	11	4.5
66	10	20	-1	7	20	-1	16	16	-0.170	3	15	4.9
67	11	23	2	6	23	12	17	18	-0.127	4	20	5.5
68	15	24	1	3	26	17	18	19	-0.414	1	22	5.6
69	13	25	4	-3	24	15	17	17	-0.539	1	23	6.1
1970	11	26	2	0	31	18	20	20	-0.507	1	29	6.1
71	12	24	4	6	31	18	25	21	-0.118	4	15	6.4
72	16	26	6	5	31	25	25	21	-0.388	1	23	6.9
73	9	23	10	0	29	23	36	20	0.154	2	39	7.5
74	9	18	15	211	42	8	48	22	12.27	1	-12	7.5
75	3	29	13	2	46	11	41	32	4.71	11	61	8.5
76	18	35	11	4	41	9	38	28	7.66	5	65	9.2
77	8	31	28	2	41	15	29	25	2.82	5	21	10.5
78	-21	32	12	-8	44	23	23	21	0.104	2	37	10.9
79	-9	19	11	20	35	13	30	15	11.97	8	19	11.4
1980	-14	21	21	64	36	40	13	16	-2.44	95	55	11.7
81	-2	19	24	12	35	37	12	16	-3.45	92	34	12
82	13	18	19	-11	32	25	16	12	5.73	199	25	12.3
83	13	22	20	-7	29	29	14	14	0.358	306	0.2	12.6
84	0.9	20	13	-1	24	22	11	11	-0.414	511	11	13.1
85	0.2	17	4	1	23	21	8	8	-0.467	575	29	13.6
86	-15	14	18	-42	21	44	3	6	-5.155	842	21	14
87	1	14	28	-2	20	39	4	5	-2.09	1282	24	14.8
88	-9	14	29	-14	21	50	7	8	-1.868	1385	18	15.8
89	3	13	22	8	18	22	10	13	-0.191	1583	22	15.8
1990	12	15	8	21	20	9	15	19	0.327	1736	19	15.1
91	10	22	17	-9	19	12	15	20	-9.448	1826	23	11.4
92	5	23	23	-3	20	7	14	17	-6.504	1960	21	12.5

Definition of the variables:

GDP = gross domestic product, I = investment, CPI = consumer price index (1985 = 100), TOT = terms of trade, G = government expenditure, BD = budget deficit, X = export, M = import, CA = current account, BMP = black market premium ($B - E/E$), where B is the black market exchange rate and E is official exchange rate), DC = domestic credit, and U = the rate of unemployment. Sign (^) indicates the percentage changes.

1.4 Plan of the research

This research is organised as follows: The second chapter will provide the background for the real exchange rate (RER) issues that will be discussed in the subsequent chapters. In this chapter, alternative measures of RER and their relationships are examined. A second important subject that permeates much of the discussion in this area is the distinction between the equilibrium and the disequilibrium RER. Misalignment, its causes and effects lead the discussion to the next topic.

Chapter 3 is to analyse theoretically the dynamic effects of external shocks and domestic policy action on the real exchange rate. The focus of this chapter is on the effects on the RER of changes in the terms of trade with a special emphasis on the effect of changes in the world price of oil, trade restriction policy, productivity growth, investment and government's macroeconomic policies.

Chapter 4 provides a preliminary look at the trends and variability of the Iranian real exchange rate between 1961 and 1992. In addition to the official RER, because of the important role played by the black market for foreign exchange in this economy, the behaviour of the RER in this market will be investigated. In the final section of this chapter, the results from a univariate time series analysis of the logarithm of the official and the black market real exchange rates will be presented. The purpose of this investigation is to indicate whether the RER in the economy under study has behaved according to the purchasing power parity.

In Chapter 5, we will investigate empirically the relative importance of real and nominal variables in determining the real exchange rate in the Iranian economy. This investigation not only provides a clear distinction between short-run and long-run responses of the RER to the various shocks, but also presents the economic reasons behind of such responses. Moreover, in order to capture the proper figure specified by such a relation, the distributed lag effect on the RER of changes in its determinants will be estimated.

The purpose of Chapter 6 is to examine empirically the correlation between real exchange rate movements and economic performance in the economy under consideration. For this reason, the effects of RER on the country's exports and imports as proxies for external sector, and the output gap as an indicator on internal sector will be analysed.

Chapter 7 is organised to investigate how real exchange rate volatility can be reduced. In this chapter in addition to assessing the Iranian government's responses to such a crucial issue, some alternative policies will be suggested.

Finally, Chapter 8 concludes with summary of the analysis.

2

Real Exchange Rate Concepts

2.1 Introduction

To analyse the theories that attempt to illustrate real exchange rate (RER) behaviour and the empirical evidence that may support them, it is necessary to have a precise definition and an accurate measurement of the concept of this issue. Without such information, even a well-informed discussion about the causes and consequences of a volatile RER may be unable to go a long way. As will be seen, not only empirical works but also the theoretical aspects of RER behaviour require such a basic argument. Because it provides a basic set of identities that serves as a frame of reference for subsequent discussions. In consequence, for most of this research work we can only proceed with being concerned about the issues raised in this chapter.

This chapter considers several basic concepts of the real exchange rate. In the following section (Section 2) the theoretical concept of the RER will be presented, while in sections 3 and 4 equilibrium RER and the notion of misalignments will be investigated. Section 5 goes into some details about the measurement of RER. Finally, in section 6, the main conclusions will be reported.

2.2 The theoretical concept of the real exchange rate

2.2.1 Alternative definitions of the real exchange rate: So far, the term real exchange rate has been used without a specific definition or measure of this variable. Whereas there are several alternative ways in which the RER is defined, it is quite important to have a clear idea of what we exactly mean by the real exchange rate. In the absence of a single definition the specific meaning of RER will vary with the meaning implied by the various definitions. Therefore, the first task undertaken in this section is to present some alternative definitions of RERs. Four major and apparently different measures; the purchasing power parity,

adjusted nominal exchange rate, the unit labour costs, and the relative price of tradables to nontradables will be introduced. Then the resulting characterisation of those definitions will be compared in order to reveal why the focus of this study will lie on one of them.

2.2.2 Purchasing power parity definition of the real exchange rate

Purchasing power parity approach (PPP) is the oldest, but still popular, theory of the equilibrium real exchange rate that postulates a relationship between the nominal exchange rate and price level. The theory, in its strong form views the nominal exchange rate between two countries currencies is equal to the ratio of the countries' price levels. The basic idea behind PPP is the law of one price, that is that in competitive markets free of transport costs and official barriers to trade, identical goods sold in different countries must sell for the same price when their prices are presented in terms of same currency, [Krugman and Obstfeld (1991)]. The PPP theory attempts to extend the law of one price from individual commodities to the baskets of commodities that determine the average price level in an economy, [Sachs and Larrain (1993)]. This statement which relies on the law of one price is referred to the strong or absolute version of PPP which, in turn, implies a proposition known as weak or relative version of PPP. According to the law of one price,

$$P_i = EP_i^* \quad (2.1)$$

where P_i is the domestic price of commodity i , E is nominal exchange rate, and P_i^* is the foreign price of commodity i . If it is supposed that the general price index for both home and foreign countries are the same weighted average of the individual commodity prices, then by definition we have:

$$P = EP^* \text{ or } E = P/P^* \quad (2.2)$$

This definition refers to the absolute PPP. The relative version of PPP states that, in a given period, the percentage change in the nominal exchange rate between two countries is equal to the inflation differential between two economies. Thus, as Krugman and Obstfeld (1991) argue, the relative version of PPP translates the absolute PPP, a statement about price and exchange rate levels, into one about price and exchange rate changes. This can be presented as;

$$\hat{E} = \hat{P} - \hat{P}^* \quad (2.3)$$

where $\hat{}$ denotes the percentage change.

In spite of many limitations of the purchasing power parity theory (some of them will be mentioned in the following discussion), it is still widely used to provide the basis for a definition of the real exchange rate in a number of structural macroeconomic models. The PPP definition of the real exchange rate, RER_p , between two currencies is expressed as the average nominal foreign exchange rate between a country and its trading partner with an adjustment for the difference in inflation rate between two countries. Under this definition the term real exchange rate is presented as:

$$RER_p = EP^* / P \quad (2.4)$$

This definition of the RER assumes that a change in the nominal exchange rate will be offset by a change in the relative price of domestic to foreign goods (and vice versa) in order to restore the long-run equilibrium. The major prediction of the above definition is that real exchange rate is unity and never changes, at least in the long-run.¹

Purchasing power parity theory is still a standard reference point for making comparison and adjustment the level of exchange rates. Without purchasing power parity, overvaluation or undervaluation of exchange rates makes no sense. Therefore, the PPP measure of RER is still prominent in theoretical work on exchange rate equilibrium determination and foreign exchange market intervention policies. In spite of this fact, empirical evidence indicates that the PPP theory cannot explain actual data on the exchange rates and relative price levels. In practice there are a number of problems with the rationale of PPP theory.

1) Inflation rates in different countries are usually based on different commodity baskets. Even if we accept that there are not any natural and artificial barriers to trade and all commodities are tradable, there is no reason for exchange rate changes to be offset by the inflation rate differential in order to hold the real exchange rate constant.

2) Goods and services produced in a country can be divided into tradable and nontradable goods. The price of nontradables is entirely determined by domestic demand for and supply of them. In such cases, the price of a given nontradable good is not the same in two countries when quoted in the same currency.

¹ Based on the absolute PPP, $EP^* = P$ and on the relative PPP, $\hat{E} = \hat{P} - \hat{P}^*$. When we consider these versions of PPP with the real exchange rate definition, $RER_p = EP^* / P$, we will have:

$RER_p = 1$ and $\hat{RER}_p = 0$.

3) When PPP is regarded as a working definition and we want to make a prediction to show how exchange rates should change in response to relative price changes, the choice of a base period at which the real exchange rates were last in equilibrium is very difficult, if it is not impossible to establish.

4) The elasticity of demand for a given bundle goods is different from one country to another. Any price changes therefore have different effects on the expenditure patterns in two countries. In this circumstance it is difficult to estimate and compare the effects of a given price increase on the relative price level and exchange rate in two different countries.

5) In order to restore the country's external equilibrium, we need to reallocate resources across the different sector of the economy. In this case, it is necessary to know how relative prices affect the evolution of the external sector and the different accounts of the balance of payments. The PPP definition of the real exchange rate does not provide precise information regarding this issue.

Moreover, an increase in traded goods productivity, for example, by using new technology, trade policy changes, tastes, labour force growth, any changes in the domestic demand or production pattern, a shift in world demand towards home produce, and changes in the structure of government spending may bring about a purchasing power disparity between economies.

2.2.3 Price adjusted exchange rate

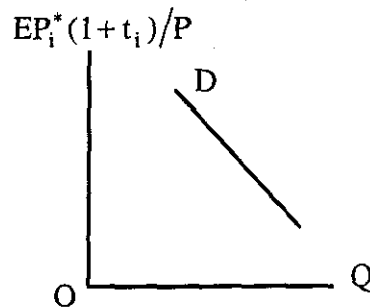
Another definition of the real exchange rate introduced by Harberger (1986) is constructed in terms of the nominal exchange rate and domestic price level. This definition is not widely used in the open-economy macroeconomic literature. As we shall see, the concept of the price adjusted exchange rate, which is emphasised by Harberger as an exceedingly robust definition of the real exchange rate, might with some justification be labelled the PPP real exchange rate.

As is well known, the demand curve for foreign currency is built up from the demand function for individual import items. With this assumption that tradable goods are composite goods and thus the prices of their component items move up and down together, the relative price of each member of the tradable goods basket can be defined as: $\frac{P_i^* E (1 + t_i)}{P}$, [where P_i^* is the world price of commodity i , E is nominal exchange rate, and t is the distortion (such as import tariffs, export taxes, and so on) causing the domestic price to be more than the world price

changed at the exchange rate market, and P is the price index faced by domestic demanders].

Now consider the case of a commodity whose ordinary demand is measured on the horizontal axis and the relative price of one unit of this commodity on the vertical axis in Figure 2.1

Figure 2.1
Ordinary demand curve for a given tradable good



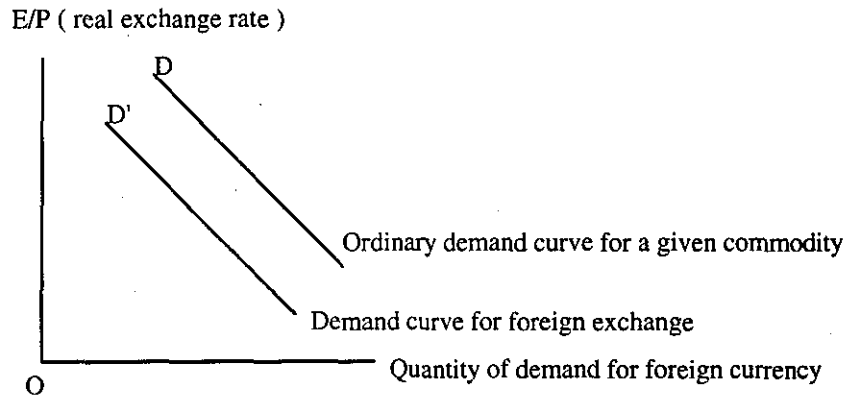
To express this demand curve in units of foreign currency, the quantity axis has to be multiplied by P_i^* .² Now the horizontal axis measures the value of foreign currency faced by domestic consumers, and vertical axis shows the price of one unit of foreign currency, $E(1+t_i)/P$, that is $1/P^*$ times the relative price of one unit of this commodity.

The unit price of foreign currency can now be measured with the sum of tariffs or taxes which have to be paid by domestic demanders. But this is not the final target. The final object is to determine the actual price of foreign currency (real exchange rate). To achieve this target, we need to produce a demand curve for foreign currency in which the price represents the actual value of foreign currency. In this case, the sum of tariffs or taxes ought to be reduced from $E(1+t)/P$ by dividing its amount of $(1+t)$. As the result of this process, a demand curve for foreign currency which has the quantity of demand in terms of foreign currency (or in fact the quantity of demand for foreign currency) on the horizontal axis and the real price of foreign currency on the vertical axis will be produced.

² In this case, it is the price of one unit of that commodity in terms of foreign currency.

Figure 2.2

Demand curve for foreign currency



Harberger believes that this particular definition of the real exchange rate can handle all types of disturbances which originate in the domestic and international economy. It is, however, difficult to accept that this approach can handle all the issues familiar from the real exchange rate literature.

The definition of the relative price of each member of tradable goods, $EP_i^*(1+t_i)/P$, defeats the whole idea of having one comprehensive measure of competitiveness for the economy as a whole. If the individual price of tradable goods' separate component items do not move up and down together, this concept will be less accurate.³

Furthermore, Harberger (1986) in its own word states that, "The only flaw I find in using E/P as the general and definitive concept of the real exchange rate is the fact that its equilibrium value falls (signifying an appreciation of the local currency) when there is a general world inflation". To resolve this problem he suggests that "... where world inflation is the problem (or an integral part of the problem), the concept of real exchange rate can be made nearly symmetrical by introducing a world price deflator P^* along with the domestic price deflator P . The real exchange rate concept then becomes EP^*/P ", [Harberger (1986), p. 402].

As can be seen, this definition is exactly the same as that introduced by purchasing power parity theory, and hence some the difficulties mentioned in previous section can be attributed to this concept as well. Moreover, as Maciejewski (1983) argues, the nominal exchange rate is the relative price of two currencies that is an

³ This definition may be justified in a specific situation where there is only a predominate export or import good.

inherently nominal measure. Therefore, an adjusted nominal exchange rate index no longer embodies a real concept.

2.2.4 Unit labour costs

In the past few years, the measurement of the real exchange rate in terms of unit labour costs has been used by some researchers, including, *inter alia* Artus and Night (1984).

The idea behind this approach is that such indices are more stable than relative goods prices and can directly measure the relative competitiveness across countries by providing some indications that estimate the relation between countries' unit labour costs which affect the profit margins of enterprises that produce the tradables and import substitutes.

Empirically, the real exchange rate (RER) has been measured as the relative price between the foreign consumer price (CPI)* and the domestic consumer price (CPI) levels, which measured in terms of a common currency, is given by:⁴

$$\text{RER} = \frac{E(\text{CPI})^*}{(\text{CPI})} \quad (2.5)$$

Suppose, each country produces tradable and nontradable goods and the domestic and foreign consumer price are defined as a geometric average of the price of tradables and nontradables.

$$\text{CPI} = P_T^\alpha P_N^{1-\alpha} \quad 0 < \alpha < 1 \quad (2.6)$$

where P_T is price of tradables in terms of domestic currency, P_N is nontradables price, and α and $(1-\alpha)$ are the share of tradables and nontradables in total domestic expenditure. For the foreign country we have;

$$\text{CPI}^* = P_T^{*\beta} P_N^{*(1-\beta)} \quad 0 < \beta < 1 \quad (2.7)$$

Under the assumption that purchasing power parity holds for tradable goods (i.e. $P_T = EP_T^*$) the equation of the real exchange rate can be represented as;

$$\text{RER} = E^{(1-\beta)} P_N^{*(1-\beta)} P_T^\beta / P_N^{(1-\alpha)} P_T^\alpha \quad (2.8)$$

With further assumption that the share of tradables and nontradables in total expenditure for both economics are the same, i.e., $\alpha = \beta$, then we will have:

⁴ This issue will addressed in further details latter on.

$$RER = (EP_N^*/P_N)^{(1-\alpha)} \quad (2.9)$$

This is the relative price of foreign nontradable goods with respect to the domestic nontradable goods. If the price index of nontradables for both economies are a function of their unit labour costs (for example, $P_N = AW$ and $P_N^* = A^*W^*$, where the coefficients A and A^* are constant and W and W^* are the domestic labour costs in home and foreign countries), it will give:

$$RER = K(W^*/W)^{(1-\alpha)} \quad \text{where } K = (A^*E/A)^{(1-\alpha)} \quad (2.10)$$

Research on countries' real exchange rate behaviour indicates a different empirical regularity. The factor-endowment difference between countries creates different wage-levels across the countries. As Bhagwati (1984) investigates, industrial countries have high capital-labour ratios, while less developed countries have lower capital-labour ratio. As a result of these differences in endowments of capital and labour, the marginal productivity of labour in industrial countries is higher than in less developed countries. Since the wage-level is positively related to the level of marginal productivity of labour, less developed countries thus have lower wage levels.

On the basis of a unit labour costs definition of the real exchange rate, lower wage results in a higher real exchange rate and hence a higher degree of international competitiveness. But, as mentioned above, the empirical evidence indicates something different. In spite of low wage level in developing countries, they frequently experience overvalued and volatile real exchange rates. [see Edwards (1989a)].

In addition to this, wage rates in every country are highly sensitive to cyclical movements in labour productivity, so any changes in cyclical productivity has a significant effect on the behaviour of this real exchange rate index. However, some attempts have been made to normalise relative unit labour cost measures in order to correct the competitiveness measure for these labour productivity changes. But, because of limited availability of the data, the normalised unit labour cost measures have been computed just for the OECD countries.⁵

Normalised unit labour cost measures have been computed on the basis of assumption regarding trend labour productivity. If trend productivity growth changes, such measures introduce a further distortion. Besides, this measure

⁵ Even for these countries the required data are available only for manufactures, that are unlikely to be a good proxy of the countries relative prices.

ignores the contribution of profit margins to relative prices. It implicitly assumes similar capital costs and similar marginal rate of substitution between capital and labour including no significant changes in the capital-labour ratio [Wright (1993)]. Consequently, this concept is unlikely to be a perfect measure of the real exchange rate.

2.2.5 Tradable-nontradable relative price

The definition of the real exchange rate based on the relative price of tradables with respect to nontradables is also a quite modern approach. Due to some shortcomings in the previous definitions that make them unable to handle some types of disturbances generated by the international or domestic economy, modern macroeconomic analyses prefer to measure the RER as relative price of tradables to nontradables price. For instance, Dornbusch (1974), Krueger (1978), Frenkel and Mussa (1984) and Edwards (1985) have employed this measure, either explicitly or implicitly. This concept is represented as;

$$\text{RER} = P_T/P_N \quad (2.11)$$

As before, P_T is the domestic price of tradables and P_N is the domestic price of nontradable goods. Tradable goods are those with prices determined on international markets. They include exportable and importable goods. Nontradable goods are those which are not part of international trade. They can only be consumed in the home economy in which they are produced and thus their prices are entirely determined in domestic market.

Based on the above discussion, when the country in question is small and the law of one price holds for tradable goods, we can use EP_T^* instead of P_T . As the result of this, a more practical definition of the real exchange rate will be achieved. That is:

$$\text{RER} = EP_T^*/P_N \quad (2.12)$$

There are two flaws in using this concept of the RER. First, it implicitly assumes that all traded goods are subject to the same domestically imposed disturbances,⁶ while in the real world, an economy with many goods, different tradable goods may be subject to different disturbances rates, [Edwards (1989a)]. Second, this

⁶ In this case the RER can be measured as: $\text{RER} = EP_T^*(1+t)/P_N$, where t is the domestic distortion.

definition focuses attention on tradables as a single bundle, while in many cases we need to separate of importables from exportables [Harberger (1986)].

Regarding the first limitation, two (not really effective) solutions have been introduced. The first one is that, when domestically imposed distortions, such as different rate of tariffs or taxes are at work, the P_T/P_N concept of the real exchange rate can be amended by considering the effects of taxes or subsidies. In this case, we need to define the RER for a specific good or specific sector. Then the amended definition becomes $EP_{Ti}^* (1 + t_i)/P_N$, where t_i is the distortion on good or sector i , causing the domestic price of tradables to be above its foreign price. This new definition is not able to provide a need for having a comprehensive measure of competitiveness for the economy as a whole. The second solution is by defining the economy-wide real exchange rate index exclusive of the distortions, [Edwards (1989a)]. In this case, the concept of real exchange rate takes its previous form, that is; $RER = EP_T^*/P_N$.⁷

The second limitation reveals the further failure of the P_T/P_N concept of the RER in some empirical uses of this definition. In a world with exportable and importable goods, the tradable-nontradable definition loses some of its meaning. Any changes in exportables price as a component of tradables may have completely different effect from importables price changes. For handling this problem an augmented version of this concept has been devised. That is two separate definitions of the RER, a definition based on the relative price of importables to nontradables, $RER_M = EP_M^*/P_N$, and the other based on the relative price of exportables to nontradables, $RER_X = EP_X^*/P_N$, [see Ostory (1988) and Edwards (1988, 1989a)]. Empirically, after understanding the behaviour of these two concepts, it is possible to make a unique index for relative price of tradables to nontradables.

Despite these problems, there are several advantages to this concept particularly from a policy point of view. They are as follows;

I) Since the price index of nontradables in the home country has a high correlation with the domestic price level, when we use the P_N as part of the definition of the real exchange rate, it helps us to analyse the effect of the domestic economy separate from international effects.

II) Small countries usually have limited opportunities to change their terms of trade so as to improve the degree of countries' international competitiveness

⁷ In fact, the second solution explicitly accepts that there is no a basic way of handling the existence of such domestically imposed distortions.

through their internal policies. The tradable-nontradable concept helps these countries to restore their external balances by changing the commercial and macroeconomic policies.

III) This definition is also useful when considering resource allocation between the tradable and nontradable sector and helpful to analyse the impact of the exchange rate policy on the different sectors in an economy. For example, a rise in the real exchange rate by increasing the price of tradables, makes the tradable goods (here exportable and import substitute goods) relatively more profitable. So the income of factors which are used in tradable sector will rise, consequently, the production resources move out from nontradables towards tradables sector. It causes an increase in the production of tradable goods and helps to improve the trade balance.

2.2.6 The equivalence of the measurements of the real exchange rate

Two of four distinct concepts of the real exchange rate were presented in the preceding section are commonly used in empirical studies. They are purchasing power parity and the relative price of tradable to nontradable goods. Under some plausible situations, these two apparently different concepts are closely related and functionally equivalent. When the price of nontradables is treated as a residual component of a general price index, rather than as a directly observable price, such a relationship can be justified. Despite this fact, some authors, [see for example Edwards (1988)], do not agree with a close relationship and functional equivalence between these two different measures of the RER. Therefore, it will, be useful to find that what kind of relationship exists between PPP and tradable-nontradable definitions of RER.

As before the PPP real exchange rate is defined as; $RER_p = EP^*/P$, and the domestic and foreign price levels are geometrically weighted averages of tradable and nontradable prices in terms of home currency;

$$P = P_N^\alpha P_T^{(1-\alpha)} \quad \text{and} \quad P^* = P_N^{*\beta} P_T^{*(1-\beta)} \quad (2.13)$$

Substituting the definitions of P and P^* into RER definition gives:

$$RER_p = (RER_{TN})^\alpha P_N^{*\beta} P_T^{*(-\beta)} \quad (2.14)$$

where RER_{TN} is tradable-nontradable concept of the real exchange rate. And then, it can be represented as:

$$\hat{RER}_P = \alpha \hat{RER}_{TN} + \beta (\hat{P}_N^* - \hat{P}_T^*) \quad (2.15)$$

Although, the final equation generally indicates that changes in the PPP and tradable-nontradable definitions of the RER are not functionally equivalent, several features of this equation can be important for macroeconomic analysis. First, if the share of nontradables in the foreign price level faced by domestic traders is zero (i.e. $\beta = 0$), the tradable-nontradable measure of the RER will be a function of the PPP-based concept of the RER.

Secondly, with the further assumption that the domestic price level is highly correlated with nontradables prices (i.e. α is close to unity), for a given change in $P_N^* - P_T^*$, real exchange rate variability in the PPP concept will be almost equivalent to the variability of the tradable-nontradable RER. Finally, if changes in P_N^* are assumed to be equal to changes in P_T^* , then $\hat{P}_N^* - \hat{P}_T^* = 0$. As a result of this assumption the changes in the PPP real exchange rate will be functionally equivalent to the changes in the tradable-nontradable real exchange rate.

In the following empirical chapter, however, where we apply the approach to data from Iran, we have to choose price indices as proxies for the price of tradables and nontradables. Depending on the selected price indices, the PPP and tradable-nontradable definitions may present an identical measure of the real exchange rate.

Despite this fact, the theoretical aspects of the two concepts are different and in some sense (as discussed above) the tradable-nontradable concept has some analytical clarity. For this reason, I prefer to use the real exchange rate as the relative price of tradables with respect to nontradables in my subsequent discussions.

2.2.7 Real exchange rate and international competitiveness

International competitiveness, in this study, refers to a country's production share in world trade. Such a measurement of international competitiveness can be proxied by movements in the real exchange rates. A rise in the country's RER, or real depreciation, reflects a decrease in the production cost of tradable goods in that country. With the assumption that the relative prices in the rest of the world remain unchanged, this real depreciation means the country now produces tradable goods in a way that is more efficient than before, in comparison with the other countries. As a result, the country's net export may rise. This increase clearly represents improved international competitiveness. Similarly, a fall in the RER indicates a deterioration in the international competitiveness.

2.3 Equilibrium real exchange rate and the notion of misalignments

2.3.1 Equilibrium real exchange rate; Edwards (1989b) argues that, "... the equilibrium real exchange rate is defined as the relative price of tradables to nontradables that results in the simultaneous attainment of equilibrium in the external sector and in the domestic (that is, nontradables) sector of the economy", (p.4). In this case, the external equilibrium means that the current account balances are compatible with long-run sustainable capital flows. The internal equilibrium is achieved when the quantity of demand for nontradables is equal to the quantity of supplied in the domestic market.

There are a set of variables that may affect the equilibrium real exchange rate. These variables are classified as the fundamental determinants of the equilibrium RER and can be divided into three categories:⁸

- I) The external real exchange rate fundamentals*, such as terms of trade, world real interest rate, and international transfers.
- II) The domestic real exchange rate fundamentals*, which are directly affected by internal policy. The most important among them are: trade restriction policy (e.g. import tariffs, export taxes, and so on), capital controls, productivity growth, and changes in the structure of the government spending.
- III) The non-policy induced factors*, such as technological progress and the exploitation of a new natural resource.

Two important implications come from such a relationship between equilibrium real exchange rate and its fundamental determinants. First, in contrast to the purchasing power parity approach, the equilibrium RER is not constant, because any changes in these fundamentals cause changes in the equilibrium RER. Second, instead of one equilibrium point, there is a path of equilibrium real exchange rates through time [Edwards (1985)].

One point that should be added to this discussion is that any changes in the real exchange rate equilibrium caused by changes in fundamentals may not necessarily reflect a new equilibrium. Temporary and permanent changes in the determinants of the RER may result in different values of this index. When there are temporary changes in the fundamentals, they cause a particular value of the real exchange rate which may be out of line with respect to its long-run equilibrium level. Therefore, the distinction between these two different effects will arise as one of the crucial issues for policy-makers.

⁸ This relationship will be investigated in detail in the next chapter.

2.3.2 Real exchange rate equilibrium and internal-external balance

The simple definition of real exchange rate equilibrium given above captures the fact that changes in the fundamental variables not only affect the RER but also play an important role in determining the country's internal and external equilibrium. The analysis of internal-external balance, therefore, offers a clear illustration of how the real exchange rate equilibrium can be attained. Figure 2.3 modifies this relationship by using a diagram due to Salter (1957) and Swan (1962) to illustrate possible additional aspects of the RER equilibrium and internal-external balance when they are relevant.

Assume that the country in question produces and consumes tradable and nontradable goods and uses both labour and capital in the production process of the two goods. With the assumption that the level of capital is fixed, both tradable and nontradable sectors will be the subject of the usual condition of the decreasing marginal productivity of labour. The production possibility curve can, thus, be depicted graphically as PP, where the horizontal axis measures the quantity of tradables, and the vertical axis measures the quantity of nontradables.

The cost of a given increase in, for example, tradables in terms of nontradables can be measured by the slope of the production possibility curve at any relevant point. On the other hand, in a competitive economy, this cost should be equal to the relative price of tradables in terms of nontradables. Thus, the slope of PP is equal to the relative price of these two goods, or the real exchange rate.

In this situation, total absorption will be the expenditure spent on tradables and nontradables as measured by OC, the expenditure-consumption line, in Figure 2.3. Therefore, the OC curve plays an important role in the determination of the market equilibrium. LL and L'L' are the budget constraint lines.

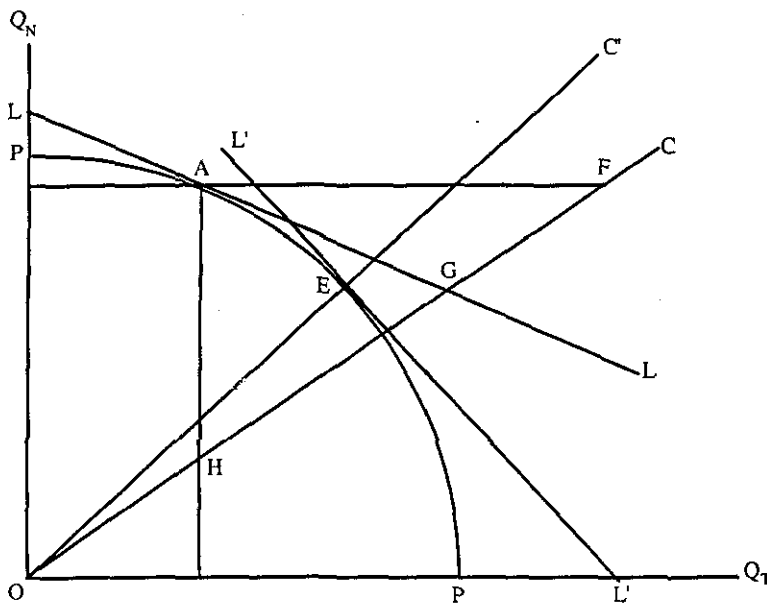
Suppose, initially production is at point A, which indicates the initial price ratio P_T^A/P_N^A . By considering the characteristics of nontradables which are not part of international trade, the initial absorption point should be F. At this point, demand and supply for nontradables are equal, i.e. internal equilibrium, but the demand for tradables exceeds their supply by AF. This is the initial current account deficit. On the basis of the RER equilibrium definition, the relative price ratio P_T^A/P_N^A is not at the equilibrium level. Some policy reactions are required to restore external balance. With the assumption that the price ratio is kept unchanged, a reduction of real expenditure causes the point F to move down towards origin. If excess expenditure is eliminated so that it becomes equal to full employment income,

point G, there will be an external deficit and excess supply of nontradable goods. The shift from external deficit to balance requires a further reduction in absorption relative to income. If absorption is reduced to point H, there will be external equilibrium, but more excess supply of nontradables. A decline in demand for nontradables will lead to reduced supply of these goods, and hence unemployment.

Point E at the intersection of the PP and the OC' curves, is the point at which absorption and full employment income are equal. At this point there is internal and external balance. The slope of PP at point E indicates the price ratio appropriate to internal and external balance, or real exchange rate equilibrium.⁹

Figure 2.3

Real exchange rate equilibrium and internal-external balance



2.3.3 Real exchange rate misalignment

Another important issue in regard to the real exchange rate is whether the existence of an equilibrium value of the RER concludes that any observed real exchange rate has to be permanently equal to this equilibrium value. Rodriguez (1978) Khan and Lizondo (1987) and also Edwards (1988, 1989a) argue that

⁹ To achieve point E, in addition to the appropriate absorption policy, a switching policy is also required to shift OC to OC'.

temporary changes in real variables and inconsistent macroeconomic policy can cause the observed RER to depart from its equilibrium value. They also argue that while short-run and small departures caused by temporary changes in fundamentals or by inconsistent macroeconomic policy can be quite common and do not provide a problem for the authorities, large and persistent deviation between actual RER and its equilibrium value will lead to a misalignment of the real exchange rate which may have serious implications for the domestic economy. A misalignment can be measured as;

$$\text{RER misalignment} = \left[\frac{\text{Actual RER}}{\text{Equilibrium RER}} - 1 \right]$$

A value of this index different from zero denotes a misalignment of the real exchange rate¹⁰. The closer is this index to zero (in its absolute value), the smaller will be the deviation of actual rate from its equilibrium value.

2.3.4 Causes of misalignment

Misalignment, defined as a large and persistent difference between actual RER from its equilibrium level, can arise by any of the following reasons or by some combination of them.

a) Unadjusted changes in the fundamental variables: As mentioned above, any changes in a fundamental variable causes changes in the equilibrium RER. If the actual RER is not adjusted (whether automatically or by the government) to response to these changes, it will lead to a RER misalignment.

b) Inconsistent macroeconomic policy: There is a general point on which there is almost complete agreement in the relevant literature. That is that in order to have a sustainable real exchange rate, it is necessary for macroeconomic policy to be consistent with the selected exchange rate system. Empirical evidence shows that in most cases of misalignment, the inconsistency between macroeconomic policy and the selected exchange rate system is one of the main causes [Khan and Lizondo (1987) and Rodriguez (1978)].

c) Inefficient foreign exchange market: The precise determination of nominal exchange rates necessarily needs all information that is relevant not only to the current fundamental and macroeconomic variables but also to the future behaviour of them. In the absence of such information, there would be no strong reason for monetary authorities and also speculators to intervene efficiently in this market.

¹⁰ Based on our previous discussions, if this index is smaller than zero, it means that the country's RER is overvalued, whereas if it is positive, the RER is undervalued.

That is because of a lack of relevant information market participants may have the wrong model of the fundamental determinants and their expectations.

On the basis of this wrong model, in the sense that it fails to assign appropriate information on factors in determining the exchange rate, the prevailing exchange rate may be determined too far from its equilibrium level.

2.3.5 *The costs of misalignment*

Real exchange rate misalignment in the form of an overvaluation affects economic performance adversely, by way of a misallocation of productive resources and hence results in welfare and efficiency costs.¹¹ The greater and larger is the misalignment, the greater will be the economic costs. The following discussion will focus on influence of a misalignment on various indicators of economic performance.

a) Misalignment and economic growth: The economic significance of the influence of misalignment on economic growth has been investigated by Agarwala (1983), Edwards (1988), Cottani et al. (1990), and Dollar (1992) for a group of developing countries. They found that, economic growth was adversely affected by overvalued real exchange rates. Countries, that faced larger and more persistent misalignments, exhibited poorer economic performance than those in which the real exchange rate remained closer to its equilibrium value.

b) Misalignment and external balance: The adverse effect of misalignment (in the form of an overvalued real exchange rate) on the country's external sector is confirmed by all empirical studies of misalignment, [see for example, Cottani et al. (1990), Ghura and Grennes (1993), and Edwards (1986, 1989a)]. The RER misalignment, in the form of overvalued RER, in some aspects, acts as an implicit tax on the country's exports. This kind of misalignment, that is the result of domestic rates of inflation that increasingly exceed the world rate of inflation, leads to a fall in the relative profitability of producing exportable goods, and hence less will be produced for export. Khan and Knight (1988) have shown empirically that both exports and imports in developing countries are adversely affected by the overvalued real exchange rate. It is clear that why a country's exports may be negatively affected by a misalignment, but it is questionable as to how imports are negatively affected by the same misalignment. To answer this question, Khan and

¹¹ In theory, any departure from equilibrium level, either overvaluation or undervaluation, may be costly. But here, it is simply assumed that the real exchange rate overvaluation is more common and more costly to the economic performance than undervaluation.

Knight (1988) explain that, an overvalued real exchange rate may lead to a decline in exports and foreign exchange earnings which, in turn, reduces the country's ability to pay for imports. Thus, imports may fall with real exchange rate misalignment.

c) Misalignment and investment: Domestic as well as foreign investment may be negatively affected by misalignment. An overvalued real exchange rate accompanied by unsustainable macroeconomic policies creates an uncertain environment in which domestic and foreign investors are less willing to cooperate to finance any domestic projects. Williamson (1983) argues that, misalignments may cause a firm to reduce its investment and scrap its capacity that could be productively employed at equilibrium prices. He also argues that, in an uncertain situation, multinationals may shift new investment abroad and come to rely on foreign sources of supply.

d) Misalignment and employment: As a result of an overvalued real exchange rate, the production of nontradables becomes more profitable than tradables, resulting in resources being shifted from the tradables towards nontradables sector. Although this adjustment will occur in the long-run, a number of implications may arise with such structural transitions. Unemployment is one of the most important of them. Under a normal situation the adjustment process requires construction of new capital equipment and retraining of labour. If workers are laid off job in the tradable sector more rapidly than they can find new jobs in the nontradable sector, unemployment will be unavoidable. Moreover, under circumstances where wages and prices are rigid downwards in the nontradable sector, the unemployment cost of the real exchange rate misalignment will be aggravated.

e) Misalignment and social welfare: As mentioned above, misalignment of the real exchange rate is usually associated with an unsustainable current account deficit. An adequate policy for creating a current account surplus to compensate the existing deficit which has occurred by the preceding overvaluation may reduce the domestic demand. In other words, domestic consumption has to be cut, at least in the short-run, to reduce current account deficit. Furthermore, in the absence of external financing of imports, which arise from the negative effects of a misalignment on the foreign exchange earnings, the governments usually impose some quantitative restrictions on imports so as to save their international reserves and to limit their current account deficit. Thus, misalignments may result in a severe welfare losses.

2.4 Realignment of the real exchange rate

In the previous section, causes of the real exchange rate misalignment have been discussed and it was mentioned that the failure of policy-makers to return the actual real exchange rate to its long-run equilibrium level may lead to the major costs. Now, the crucial question is how policy-makers can relieve the costs imposed by misalignment and manage the relevant variables to return rapidly to the equilibrium situation. This section aims to point out the alternative ways in which the real exchange rate may adjust back to equilibrium.

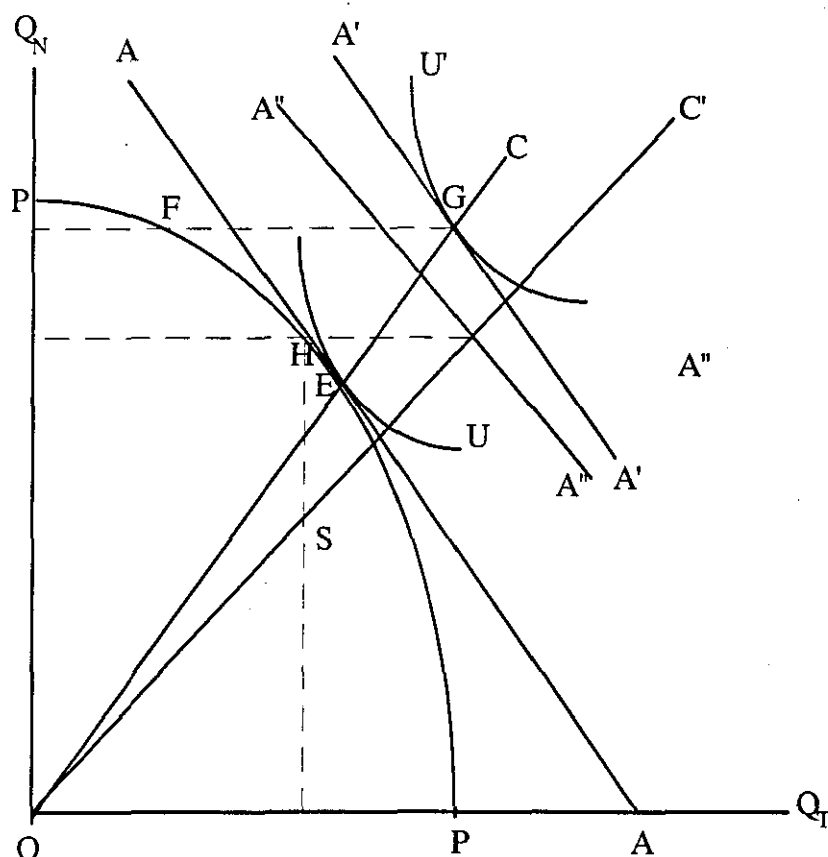
2.4.1 Automatic adjustment

When misalignments are caused by unadjusted fundamental variable changes, an inefficient foreign exchange market, or inconsistent macroeconomic policy, the first necessary step is to eliminate the source of such a disequilibrium. This policy can be supplemented by the other schemes or can automatically be adjusted by the market forces.

One of the common features of developing countries is that their governments usually cope with a high budget deficit. Due to the lack of foreign and domestic resources to overcome this problem, their budget deficits are mostly financed by borrowing from central bank through the creation of money. A high rate of inflation and correspondingly a real appreciation are the frequent result of such policies. The real appreciation of the domestic currency terminates an excess demand for tradable goods, generating a trade imbalance. Under fixed nominal exchange rates, a decline in the domestic price of nontradable goods is required in order to return to the equilibrium level. Since an expeditious diminution in this price is quite difficult under most circumstances, obviously any automatic adjustment could take a long time accompanied by large misalignment costs.

The case of automatic adjustment can be illustrated in Figure 2.4. As before, PP is the production possibility frontier between the production of nontradable goods (N) and tradable goods (T), respectively, any point on this curve shows the full employment of the given stock of resources, and the slope of the PP in any point is equal to the relative price of tradables to nontradables (real exchange rate). The vertical axis measures the quantity of nontradables and the horizontal axis the quantity of tradables. The ray OC is the expenditure-consumption line which shows the spending choices of consumers and plays a key role in the determination of market equilibrium. AA is the budget constraint line, and UU is the social indifference curve.

Figure 2.4
Automatic adjustment of the real exchange rate misalignment



The initial situation depicted at point E is assumed to be full equilibrium where income equals expenditure and where the country's external and internal sectors are in equilibrium. Suppose now the government decide to finance its budget deficit by borrowing from the banking system. Such money creation (or any of the other expansionary monetary and fiscal policy) increases the aggregate expenditure and as a result the budget line shifts upward, from AA to $A'A'$. This excessive expenditure leads to the excess demand for all goods, including nontradables. In terms of the figure, it means that the consumption equilibrium moves to point G . On the other hand, as a consequence of the expansion of the domestic money supply, the relative price of nontradables will arise. This, in turn, causes the production equilibrium to move from point E towards point F . Because, the increase in the relative price of nontradables has an effect in raising the income of

factors which are used in this sector, so, the production resources move out from tradable industry to nontradable industry. This substitution raises the output of nontradable goods.

On the demand side, increases in the price of nontradables shifts part of the demand for these goods towards tradables. In addition, the higher relative price of nontradables also shifts the expenditure-consumption line from OC to OC' and budget line from A'A' to A"A". Eventually, the internal sector equilibrium will be restored, and it will be a point somewhere between E and F (for example point H), but the external sector will face an excess demand (trade deficit) for traded goods. In the case of automatic adjustment, this situation will remain until the effect of the last expansionary policy is terminated.

The reduction of domestic credit, when all other things are constant, shifts the budget line downward along the expenditure-consumption line. This reduces the excess demand for tradable goods to achieve the trade balance equilibrium. If OC' (new relative price level) is unchanged, the production of nontradables is still profitable relative to tradables. Consequently, the production point will remain at its previous level, point H. In this circumstance, the reduction of the aggregate expenditure results in an excess supply of nontradable goods. So as to clear up this excess supply and to accomplish the internal equilibrium, the only way is to cut the relative price of nontradable goods. This action shifts OC' towards OC and makes the tradable sector relatively profitable by raising the relative price of tradables which has a short-run effect in raising the income of factors in this sector. In the long-run substitution in productive factors increases the supply of tradable goods and shifts the production point from H to E. Eventually, substitution on the production side and reduction on the demand side move the external sector towards the initial equilibrium level.

Now assume that domestic prices and wages are inflexible in the nontradable sector. Under this assumption, the required decrease in the nontradables price is prevented by this price rigidity, and the production situation remains unchanged. To accomplish simultaneously by the equilibrium of the external and internal sectors, we will have to reduce the quantity of production in the internal sector. It means that the position of the new equilibrium settles inside of the PPF (point S) with increased unemployment.

Under this situation where the price of nontradable goods is inflexible, a nominal devaluation of the domestic currency can generate the necessary increase in the relative price of tradables to nontradables, which is indeed what we need to restore

the country's external and internal equilibrium. In this case, production point will remain on the production possibility frontier and equilibrium can be achieved without producing unemployment.

2.4.2 Nominal devaluation

A nominal exchange rate devaluation by the authorities raises the relative price of tradables in terms of nontradables at home and may lower the relative price of tradable to nontradable goods abroad. In response to such changes in relative prices, productive resources move into the tradable sector while consumption shifts from tradable to nontradable goods. By contrast, in the foreign economy the opposite move may take place. This process can result in a trade balance surplus (or lower deficit) for the home country. The magnitude of the effect of relative price changes depends on the substitutability between the two goods and the sustainability of the accompanying policies. A nominal devaluation that is expected to correct external imbalances through an increase in relative prices (real depreciation) should be necessarily supported by a contractionary macroeconomic policy. Because any expansionary fiscal or monetary policy raises the domestic price level, as a result, the real exchange rate will remain unchanged without any affect on the country's external balances.

Generally, from a theoretical point of view, nominal devaluation can affect an economy in three main ways [Corden (1985)].

a) Expenditure-reducing effect: Devaluation of the home currency raises the price of tradable goods in terms of domestic price. That, in turn, raises the average level of the domestic prices. Such an increase may have negative income and wealth effects on the home economy, reducing the domestic absorption. The real aggregate demand for all goods and services including tradables will decline. In consequence, the external deficit may be reduced.

b) Expenditure-switching effect: When nominal devaluation raises the price of tradable goods, the demand shifts from tradables towards nontradables. However, because of the opposite effects of expenditure-reducing and expenditure-switching on the demand for nontradable goods, the final effect is ambiguous, the substitution of expenditure can improve the country's external situation.

c) Supply-increasing effect: Since the exchange depreciation raises the domestic price of tradables, in addition to the shift in demand towards home goods, the productive resources move into the tradable sector. Eventually, this process may lead to decline the country's trade deficit.

Of course, such an optimistic interpretation of changes in the nominal exchange rate is not accepted by all economists. Structuralist economists stress several contractionary demand-side effects of devaluation and argue that the absence of some inconsistent accompanying policies, it may lead to an unsustainable economic recession. They also discuss the production structure of the internal sector may be sticky in the short-run. So any changes in the relative price may not be able to expand the tradable outputs in the short term.¹²

Apart from this problem, it is high-priority to remember that the success of the nominal devaluation in helping to restore the country's external equilibrium largely depends on the accompanying macroeconomic policies. Otherwise, the existence of the inconsistent macropolicy may eliminate the effects of the exchange rate adjustment.

2.4.3 Import tariff and export subsidies

As Edwards (1988) investigated, to avoid some of the disadvantages of nominal devaluation, the contemporaneous imposition of import tariffs and export subsidies can be used to regain external equilibrium. A tariff on imported goods increases its relative domestic price and also export subsidies similarly increase the relative domestic price of exportable goods. If these increases are in the same proportion, the relative price of tradables (as a group of importables and exportables) will be increased. If the price of nontradables remains unchanged, due to a consistent macroeconomic policy (or at least, $\hat{P}_N(\hat{P}_T)$), the domestic relative price of tradables with respect to nontradables, P_T/P_N , will increase. That is expected in the case of a successful devaluation.¹³

In addition there are some alternative policies which can bring down the relative price of domestic goods, but due to their opposition with trade liberalisation and their negative effects on employment and output, such policies are not attractive for policy-makers.

2.5 Measurement problems

Empirical studies of the real exchange rate have faced some crucial questions on the choice of appropriate proxies for tradable and nontradable goods price indices.

¹² In the last chapter, the advantages and difficulties of the nominal devaluation as an essential piece of stabilisation policy will be discussed in further details.

¹³ However, these policies are widely used in developing countries, it is not advised by all economists as an adjustment policy, because such restriction policies usually lead to extra efficiency costs.

Basically, there are two alternative proxies for the two indices which are required for calculating the real exchange rate; i) a specific index of each of them, or ii) a general price index that covers all commodities including tradables and nontradables. At the purely theoretical level, the first index seems to be more appropriate than the second one. But due to limitations in the data, particularly in developing countries, there are not well-established specific indices of the two goods. For the second candidate, a number of relative price indices have been either developed or computed by the international organisations as possible proxies for the estimation of the real exchange rate. Prominent among them are; (1) GDP deflator, (2) unit labour costs, (3) wholesale price index, and (4) consumer price index.

Even though no one index is inherently superior to all others and the appropriateness of each must necessarily be judged in relation to the specific purpose for which it is needed. It is essential that each such index be conceptually well defined so as to protect them against inappropriate use.

2.5.1 Gross domestic product deflator

The gross domestic product (GDP) deflator, that is, the ratio of the current to the constant of GDP, can be viewed as a proxy for aggregate prices. Specifically, GDP deflator includes a composite indicator of the value added of all primary factors that enter into the production of domestically produced goods and services. Such indices therefore include all aspects of the economy and they are too comprehensive to be a "pure tradables" or "nontradables" price index. In this situation, some difficulties with data and estimation are unavoidable. Particularly, the estimation of value added at constant prices for certain types of goods and services may not be sufficiently reliable for most developing countries, (Maciejewski 1983).

Another major problem with the GDP deflator is the delay in publishing the statistics, due to the complexities involved in measurement. It is well known that the frequency of observation is an important factor in estimating real exchange rate variability. This is particularly true of a situation in which relative prices change rapidly and drastically. Moreover, the GDP deflator is sometimes estimated in terms of market prices, which are affected by indirect taxes and subsidies. Thus it may result in serious problems of comparability. Due to these and other limitations, the GDP deflator is unlikely to be a good proxy for relative price to compute the real exchange rate in developing countries.

2.5.2 Unit labour costs index

As mentioned in the beginning of this chapter, some authors prefer to construct the real exchange rate as a ratio of unit labour costs (Artus and Knight 1984). The idea behind this approach, advantages and problems with this issue have been addressed in the Section 2.2.2 where the alternative definitions of the real exchange rate have been investigated. According to that discussion, the unit labour costs index presents a number of limitations as measures of the relative price of domestic output and hence of overall competitiveness.

2.5.3 Wholesale price index (WPI)

The wholesale or producer price index is another proxy which not only measures the wholesale prices of nontradable goods but also measures the wholesale prices of import substitutes, imports and exports in a country. This index has recently been strongly recommended by Harberger (1986) and Edwards (1988, 1989a) as a proxy for the tradables price index. The reasons behind this argument, that foreign countries' WPI can be considered as reasonable proxies for the world price of tradables, are that such indices are not affected by changes in subsidies or indirect taxes, unless they impact on the manufacturer and not just on the consumer. In addition, the WPI is readily and periodically available for nearly all countries.

In spite of the fact that this indicator has the advantage of including a large number of tradable goods, it is not necessarily the most accurate (Maciejewski 1983). If it is used in empirical work to estimate any country's international competitiveness, it may result in under estimation of changes in competitiveness. Edwards (1988) has this to say; " Since these indices contain highly homogeneous tradable goods whose prices tend to be equated across countries when expressed in a common currency, the real exchange rate computed using WPIs will not vary enough to measure actual change in competitiveness. Furthermore international comparisons based on wholesale price indices (as well as other indices) may be distorted by the use of different weights across countries (p.53) ."

2.5.4 Consumer price index (CPI)

In recent empirical work, the consumer price index has been used as a proxy for nontradable goods prices. This is because, this index includes a broad group of goods and services that provide a comprehensive measure of changes in the domestic producers' competence in their both internal and external competitiveness. Moreover, this index is produced monthly and with little delay

and it is also subject to very little revision. The consumer price index is constructed by regular observation of price changes of a weighted basket of goods. So, it should be noted that the selection of the CPI as a deflator for tradables or nontradables, significantly depends on the share of the two goods in spending patterns. In the preceding section it was argued that the consumer price index can be presented as;

$$\text{CPI} = P_T^\alpha P_N^{(1-\alpha)} \quad 0 < \alpha < 1$$

The parameter α is the share of tradables in the consumption expenditure. The CPI is influenced by the proportion accounted for by tradable and nontradable goods. The bigger is α (i.e., closer to one) the less will be the share of nontradables in the consumption expenditure¹⁴. This means that the CPI will not be a good price indicator for these nontraded goods. In addition to this issue there are, of course other disadvantages to this approach. The major problem is that different groups of consumers usually have very different consumption patterns which lead to different value of the CPI.

2.5.5 The choice of nominal exchange rate

Another important issue regarding the measurement of the real exchange rate is related to the choosing of the appropriate nominal exchange rate. Normally, every country trades with a group of other countries. In consequence, there are many bilateral nominal exchange rates for the currency of each country. Under this circumstance, a number of crucial questions will arise: should we use a bilateral rate with respect to the main trading partner, or should we use a multilateral rate in order to consider the variability of the exchange rate of all trading partners? In these cases where there are multiple official rates for each country, which one has to be selected? Moreover, since almost all developing countries, which have adopted a fixed nominal exchange rate, are confronted with a quite significant black market in their exchange market, there is an important question as to how we should proceed.

A convenient way is to use effective rate by considering the most common official rate. However, such indices involve some of the distortions caused by the existence of multiple exchange rates. To interpret the role of black markets in real exchange

¹⁴In practice, the problems associated with the estimation of such indicators is that the share of tradable and nontradable goods in the CPI may be difficult to measure, this is because information about α requires knowledge of the level of consumption of these two goods in the public consumption pattern that is usually confronted some limitations.

rate behaviour, we ought to construct another index that considers the non-official black market data rather than official rate.

2.5.6 The quality of the data

Another factor that could be expected to influence the real exchange rate measurement is the quality of the data. Therefore, a number of questions may arise in the choice and treatment of the available data in a way consistent with the RER concept used here. For countries on fixed exchange rates, inadequate international reserves and price control schemes, the possibility of having a sizeable nonofficial transaction through the black market will arise. It is not surprising that when the possibility of nonofficial transaction is taken into account, it complicates the analysis of the RER behaviour.

In the presence of some types of illegal transactions, imposing any stabilisation policy in order to restore the RER equilibrium may result in an undesirable situation. Obviously, in this circumstance, the estimated value of the official RER cannot demonstrate the right degree of the country's international competitiveness. In consequence, the best way is to consider the weights attached to the official and nonofficial transactions in the country's total transactions. Of course, this approach requires adequate data on nonofficial activities that is, unfortunately, unavailable for most countries.

2.6 Conclusion

This chapter started from the most elementary concept of the real exchange rate. First, we had a look at the alternative definition of this issue and their relationship in order to introduce one of those that can correctly handle the relevant disturbances generated by the domestic and world economy. However, there is no particular definition to replicate all relevant disturbances. The concept of the relative price of tradables to nontradables, P_T/P_N , which has become quite popular in recent years has been adopted. Secondly, the equilibrium real exchange rate as the relative price of tradables to nontradables is that associated with the simultaneous achievement of the country's internal and external balances has been discussed. Thirdly, the persistent deviation of the actual RER from its equilibrium value (real exchange rate misalignment), its causes, effects and adjustment mechanism have been investigated. Finally, we have confronted one of the most crucial issues of this analysis, that is the measurement of the real exchange rate. The problem of choosing the appropriate price indices and nominal exchange rate have been tackled. This has been done by introducing the wholesale price index

(WPI) for tradables, consumer price index (CPI) for nontradables, and the common nominal exchange rate (in the context of multiple exchange rates) for converting foreign prices.

3

Real and Monetary Determinants of the Real Exchange Rate: A Theoretical Discussion

3.1 Introduction

In recent years, the concept of the real exchange rate has been considerably developed by a variety of theoretical models that have attempted to analyse how the RER prevailing at any time is determined by both fundamental (real) and monetary variables. Examples of such models may found in the work of Dornbusch (1974, 1980), Khan (1986), Mussa (1986), Edwards (1986, 1989a), Khan and Montiel (1987), and Ostry (1988). The general characteristics of these models are that: (1) They have been developed on the basis of a small open economy in which $P_T = EP_T^*$ (where P_T is domestic price of tradables, E is nominal exchange rate, and P_T^* is foreign price of tradables). (2) They consider a two-goods economy with tradables (exportables and importables) and nontradables. (3) The RER equilibrium is measured as the relative price of tradables to nontradables at which the country's both internal and external sectors are in equilibrium. (4) These models emphasise that the equilibrium real exchange rate can response to fundamental variables only, while the prevailing real exchange rate can be affected by both fundamentals and macroeconomic variables. As a result of this fact, there is not one equilibrium value of the real exchange rate, but rather a path of equilibrium value through time.

A major theoretical problem with some of these models [such as Dornbusch (1974, 1980), Khan (1986), and Khan and Montiel (1987)] is that, they have been developed based on non-optimising procedures. Their arguments explicitly emphasise essentially intratemporal substitution effects without making any distinction between the different effects of current versus future shocks, or of temporary versus permanent shocks on the RER behaviour. A number of different models have been developed in response to the deficiencies in the non-optimising

static models. More recent presentations have considered the real exchange rate in an explicit intertemporal form in which the demand and supply decisions are derived from the maximisation of an intertemporal utility function. Examples include Edwards (1986, 1989a) and Ostry (1987). Such a model embodies the basic idea that individuals' behaviour in response to changes in economic variables is a forward-looking decision. It means that, individuals do not response exclusively to the current situation, instead, they also look ahead to the future conditions. Based on the current and expected future situations they decide how much to demand or to supply.

Therefore, in order to analyse how do changes in economic variables affect the real exchange rate behaviour, we need to consider an intertemporal optimising model in which the distinction between permanent and temporary effects, or between current and future expected effects can be made clear.¹

The purpose of this chapter is to analyse the economics of the real exchange rates. Specifically, it aims to analyse theoretically the interaction between real exchange rate and a number of its real and monetary determinants which seem to be more relevant to the less developed economies. The framework of this analyses is based on the intertemporal model developed by Edwards (1989a)².

The motivation for adopting the Edwards model is by now clear: (i) It is an intertemporal, optimising, general model of a small open economy and, therefore, useful for our purpose in this study. (ii) It can be extended easily to analyse how various shocks affect the movements of the real exchange rate. (iii) It has been examined by a comprehensive empirical investigation of the real exchange rate behaviour.

This chapter is organised as follows: Section 2 analyses the impact of a number of fundamental (real) variables on the real exchange rate. In section 3, the relationship between real exchange rate and fiscal policy is investigated. Section 4 considers the effects of monetary policy on the real exchange rate and ends with a comprehensive table in which the signs of the effects of various real and nominal shocks on the real exchange rate are demonstrated. Finally, section 5 summarises the main conclusions.

¹ In spite of the theoretical advantages of the intertemporal optimising models, there is no a powerful econometric technique to decompose the time series of the fundamentals into a permanent and a temporary component.

² See Edwards (1989a), chapters 2 and 3.

3.2 Fundamental factors and real exchange rate behaviour

In this section the focus of analysis is on the effects on the real exchange rate of shifts in the terms of trade (particularly changes in the price of imported goods and the world price of oil), changes in the composition of the government spending, imposition of the trade restriction policies, changes in the domestic productivity growth and the improvement in aggregate investment. Focus on these particular factors can be justified by their practical relevance for the Iranian economy and because required data on these factors (except for the composition of government spending) is available for estimating their relationships with the real exchange rate in this economy.

3.2.1 *Shifts in terms of trade and real exchange rate*

Recent experience [Cottani et al. (1990), Edwards (1989a)] shows that almost all developing countries have been subject to large disturbances in their terms of trade. Traditional approaches to the analysis of the likely effects of such disturbances on various macroeconomic variables, including real exchange rate, were based on non optimising models that emphasise the role of the income effect generated by the changes in the terms of trade. Their argument was usually that a deterioration in the terms of trade results in a lower real income. This, in turn, reduces domestic savings out of any given level of nominal income. Under the assumption that the other relevant variables are constant, lower saving leads to a worsening in the country's account position. On the basis of these analyses, the likely effect of, for example, a deterioration in the terms of trade will lead to a real depreciation. An improvement in the terms of trade will result in a real appreciation. A rise in the price of imports lowers the nation's disposable income, generating a higher excess supply of nontradable goods, downward pressure on the price of nontradables and hence a real depreciation.

A problem with these analyses is that if importable goods are competitive and have many domestic substitutes or if importables represent a low proportion of the production of tradables, the substitution effect may dominate the income effect for an import price increase, resulting in a real appreciation. In addition, the current account, aggregate spending, and saving are forward-looking variables, therefore, the behaviour of such variables depends on the maximisation of an intertemporal utility function subject to lifetime budget constraints. Consequently, the distinction between the current as opposed to future shocks, or of temporary as opposed to permanent shocks should be made clear [Ostry (1987)].

3.2.1.1 Temporary current deterioration in the terms of trade

We now analyse how a temporary current change in the country's external terms of trade affect the real exchange rate equilibrium. Consider the case where a temporary rise in the relative price of importables takes place in period 1 (current period), that is $\hat{P}_{M1} > 0$ and $\hat{P}_{M2} = 0$. This will affect both tradables and nontradables prices, generating a new equilibrium RER. Let us first consider the case of the tradables price. Clearly any rise in the foreign price of importable goods will result in an increase in the price of tradable goods. The magnitude of this effect depends on the relative weight of importables and exportables in the price index of tradables. In this case, the equilibrium real exchange rate will depreciate as a consequence of this kind of deterioration in the terms of trade.

On the other hand, a rise in the relative price of importables affects domestic markets through several separate channels. With the assumption that there are only two periods, the utility function is separable through time and consumption expenditure is substitutable between present and future periods, a temporary current increase in the foreign price of importables (when all other things are constant) raises the domestic price of importable goods in period 1. If importable and nontradable goods are net substitutes, this process leads to substitution among goods within the current period. It means that the excess demand for nontradables will emerge resulting in internal disequilibrium. In order to restore the internal equilibrium, the price of nontradables has to go up and that means a real exchange rate appreciation. But if the two goods are complements, a real depreciation may take place. This kind of effect is called intratemporal substitution effect.

Since the increase in the relative price of importables is confined to period one, current consumption expenditure will be relatively more expensive than in the future. According to the Edwards' intertemporal model, the public switch their consumption away from period one into period two. This will result in an excess supply (or less excess demand) of nontradable goods and in a lower relative price of nontradables, or in a higher real exchange rate (real depreciation) in the current period. Such expenditure-switching effects which raise the future consumption level and reduces the current consumption (or conversely) is named the intertemporal substitution effect.

In addition to the intratemporal and intertemporal effects, a temporary current deterioration in the terms of trade reduces real income by increasing the domestic price level. If nontradables are normal goods, there will be a decrease in the demand for these goods and a tendency for their price to go down in the current

period, generating an equilibrium real exchange rate depreciation, [Khan and Montiel (1987), and Edwards (1989a, 1989b)]. The magnitude of this effect depends on the income elasticity of demand of importables and nontradables.

As it can be understood, the final effect of such deterioration on the real exchange rate behaviour is ambiguous and depends on whether the negative intratemporal substitution effect dominates the positive income and intertemporal substitution effects. If this happens, and $\hat{P}_N > \hat{P}_T$, a temporary current rise in the foreign price of importables will appreciate the equilibrium real exchange rate.

3.2.1.2 An anticipated future deterioration in the terms of trade

We now investigate the impact on the path of the equilibrium real exchange rate of an expected deterioration in the terms of trade. Consider the case where economic units anticipate that the price of importable goods will increase in the next period, that is $\hat{P}_{M2} > 0$ and $\hat{P}_{M1} = 0$. Naturally, an expected rise in the foreign price of importables leads to an increase in the expected domestic price of these goods, making future consumption relatively more expensive than the current period's. In this case, the consumer will switch consumption away from period two into period one, creating an excess demand for all commodities, including nontradables, in the current period. In order to clear the domestic market, the price of nontradables has to go up. This eventually, results in an equilibrium real appreciation in period 1.

On the other hand, based on the permanent income theory, decreases in future real income brought about by a deterioration in the terms of trade, will reduce the current demand for nontradable goods. This, in turn, has a positive effect on the real exchange rate. In consequence, the final effect is ambiguous depending on whether the negative intertemporal substitution effect dominates the positive income effect. If the intertemporal effect dominates, and $\hat{P}_N > \hat{P}_T$, a real exchange rate appreciation will take place.

3.2.1.3 Permanent changes in the terms of trade

We now consider the way in which the permanent terms of trade disturbance affects the equilibrium path of real exchange rates. Such an effect caused, for instance, by a permanent rise in the relative price of importable goods, i.e. $\hat{P}_M > 0$, can be analysed in the same way that is used in the context of static one-period models. A deterioration in the terms of trade reduces real income and real wealth, resulting in a decline in the demand for all goods on one hand, and changes the intratemporal composition of consumption expenditure, generating an excess

demand for nontradable goods on the other hand. As mentioned before, if the substitution effect dominates the income effect, and $\hat{P}_N > \hat{P}_T$, a real appreciation will be experienced.

3.2.2 Oil shocks and real exchange rate

Changes in the world real price of oil, P^O , generally have a significant effect on the real exchange rate behaviour of the oil exporting countries. There are two main channels through which a change in P^O alters the real exchange rate. First a rise in P^O results in higher real income and hence in an increase in demand for nontradable goods. Under the given value of other relevant variables, such a higher demand causes the relative price of nontradables to rise generating a real appreciation.³ This rise in the relative price of nontradables and fall in the real exchange rate, brought about by the increase in the world real price of oil refers to the spending effect of a commodity export boom, [Corden (1982)].

Second, in addition to spending effect, an increase in P^O results in a higher demand for and supply of money [Harberger (1983) and Neary (1984)]. The more plausible case is that a higher price of such commodity exports leads to an excess supply of money, [Edwards (1986)].⁴ If it happens, this excess supply of money will increase the relative price of nontradables, and as a result, further real appreciation will take place.

It has already been pointed out that in analysing the relationships between the real exchange rate and its fundamental determinants it is important to make a distinction between temporary and permanent changes in the fundamentals. The reason is simply that with a temporary increase in the world real price of oil and its effect on the price of nontradables in the current period, some consumption expenditure may be pushed into the future, thereby requiring a fall in the price of nontradables in the current period (current real depreciation) and a rise in the price of nontradables in the future (future real appreciation). In addition, even if P^O is only expected to increase in the future, a real appreciation may take place now through the intertemporal and permanent income effects.

³ Notice that further simplifying assumption of this argument are; i) the real exchange rate is measured as the relative price of importables to nontradables, ii) the effect of oil price changes on nontradables dominates its effect on the importables.

⁴ That may be due to the dominant effect of foreign exchange earnings on the country's monetary base.

3.2.2.1 Temporary current changes in the world real price of oil

Consider a temporary current improvement in the real price of oil, that is $\hat{P}_1^O > 0$ and $\hat{P}_2^O = 0$. Generally, a higher price of oil will lead to an increase in real income. Assume that this new-found income meets with immediate changes in the current consumption expenditure.⁵ Clearly, when the expenditure goes on nontradables, it creates an incipient excess demand for nontradables in period one relative to period two. Depending on the relative magnitude of the intratemporal and intertemporal elasticity of substitution, the oil price improvement in current period will be associated with a real appreciation in both periods. Such a relationship may be illustrated with the aid of the following figure.

In Figure 3.1, N_1N_1 and N_2N_2 indicate the combination of P_1^N and P_2^N (nontradable prices in period 1 and 2) consistent with equilibrium in the nontradable goods market in period 1 and period 2.⁶

Suppose that the initial point is E in which we have intertemporal internal and external equilibrium. Consider a rise in the world real price of oil. Nontradable goods market equilibrium will be disturbed, as the higher spending implies that N_1N_1 schedule shifts out to $N_1'N_1'$, generating an excess demand for these goods. This excess demand will push P_1^N up.

Consider now the N_2N_2 schedule. The consumption of nontradables in period 2 may be affected through two separate channels. First, the rise in P_1^N will put some pressure on the market for nontradables in the future through the intertemporal substitution effect. Second, a rise in P^O causes individuals to save part of this new-found income in order to spend on future consumption (income effect). As a result, an incipient excess demand for nontradables in period 2 will appear and the N_2N_2

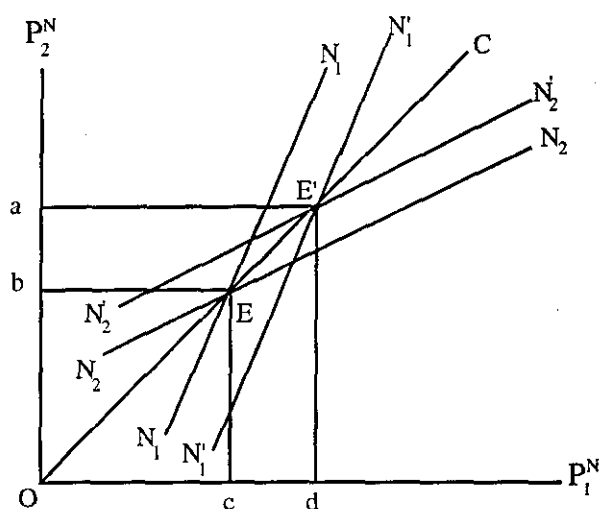
⁵ This assumption will be relaxed in the following section.

⁶ The intuition behind the positive slope of N_1N_1 and N_2N_2 , and why N_1N_1 is steeper than N_2N_2 are straightforward. A rise in the price of nontradables in the current period makes consumption in this period relatively more expensive. This leads to substitution of part of aggregate spending from current period to the future. This will increase the consumption for nontradables and create an excess demand for this goods in that period. Then, an increase in P_2^N will be required to restore internal equilibrium in period 2. The same will be happening to P_1^N , if we have an expected increase in P_2^N . On the other hand, since a change in the relative price of nontradables in period t is expected to have larger effect on excess demand in period t than in the other period, the slope of N_1N_1 schedule (in this figure) should be steeper than the slope of N_2N_2 . For further information about this figure and how the intersection of N_1N_1 and N_2N_2 can characterise the relative price of nontradables compatible with simultaneous attainment of intertemporal external and internal equilibrium, see Dornbusch (1980) chapter 6, Edwards (1989a) chapter 2, and Ostry (1988).

schedule will shift upward to $N_2'N_2'$. The equilibrium, therefore, moves from point E to point E'.

Figure 3.1

Effect of temporary current improvement in the world real price of oil on the real exchange rate behaviour



The movements in the N_2N_2 schedule are a reflection of two factors (see above), which could be greater or smaller than illustrated in Figure 3.1. This, of course, depends on the intertemporal substitution elasticities and the individual's marginal propensity to save. If this happens, it will result in the case in which the new equilibrium is above or below the OC (consumption-expenditure) line.

3.2.2.2 Anticipated future improvement in the world real price of oil

Consider now the impact of the future improvement in P^O on the real exchange rate behaviour, $\hat{P}_1^O = 0$ and $\hat{P}_2^O > 0$. Such an improvement will affect both P_1^N and P_2^N , creating a new equilibrium situation. The intuition behind the positive effect of increases in P_2^O on P_2^N is analogous to that of the impact of P_1^O on P_1^N . Therefore, the N_2N_2 schedule will shift upward. In this case, based on the permanent income theory of consumption, an expected increase in income will marginally affect current consumption. Such a positive intertemporal effect will

give rise to an excess demand for nontradable goods in the current period and shift the N_1N_1 to the right (the same as what happened in Figure 3.1).

Eventually at point E' , the intersection of $N'_1N'_1$ and $N'_2N'_2$, is a new equilibrium point in which the new relative prices of nontradables are compatible with the simultaneous attainment of internal and external equilibrium.⁷

3.2.2.3 Permanent changes in the world real price of oil

We now analyse how the permanent improvements in the price of oil will affect real exchange rate behaviour. As may be understood from the above discussion, the final effects of the current temporary and anticipated changes in P^O on period 1 and 2 expenditure on nontradables, and hence on the RER, are dependent on the strength of the substitution and income effects. With the permanent changes in P^O on the RER will be very similar to the effect derived in the context of one-period models.

Figure 3.2 is the apparatus for the interpretation of the oil permanent shocks on the RER. In this figure the vertical axis measures the real value of output in terms of nontradables, and the horizontal axis in terms of tradable goods. PP, as before, is the production possibility frontier drawn concave to the origin. With resources given, producers can move along the curve by transferring resources from the production of one output to the other to maximise the revenue. The slope of the tangent to PP also represents the relative price of tradables to nontradables (the real exchange rate). Both the supply and demand decision have been taken on the assumption that the relative price was initially given. Then, demand conditions are depicted by the indifference curve U. I is the budget line. For a given income, the community can choose its composition of expenditure anywhere on this line. The preferred composition of consumption at the equilibrium relative price can be indicated by the expenditure-consumption line OC, through the point of tangency of PP and the highest possible indifference curve.

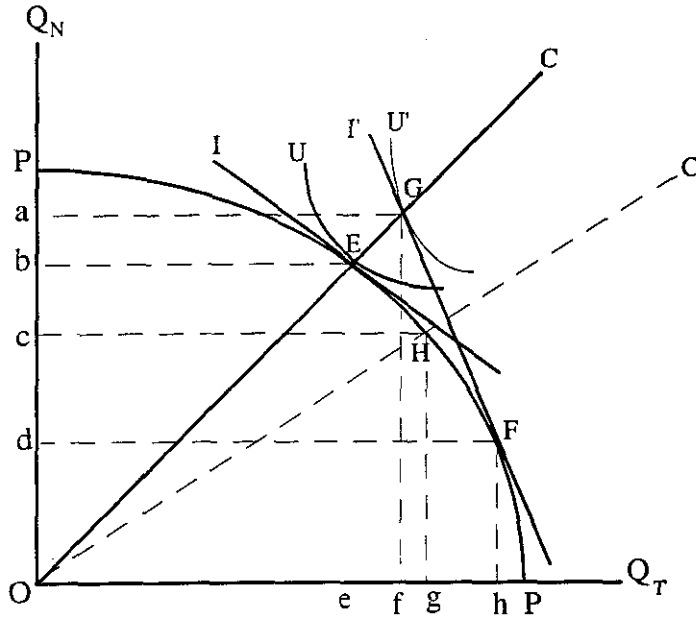
The initial equilibrium situation, E is assumed to be planned by the authorities who had full information about preferences and resources. Consequently, firms have been instructed to produce where the highest indifference curve touches production possibility frontier. At this point, the economy is in full equilibrium. Income equals expenditure and the demand and supply of tradable and nontradable

⁷ However, the analyses of interaction between current temporary and expected changes in the world price of oil and nontradable prices in period one and period two went the same way, but there is no reason that the new equilibrium point, E' , that is dependent on a variety of elasticities, to be the same in both cases.

goods are respectively equal and hence both the home goods market clears and the current account is in equilibrium.

Figure 3.2

Effect of permanent improvements in the world real price of oil on the real exchange rate behaviour



Now suppose that the world real price of oil is increased. The economy produces more oil and less nontradable goods, shifting production point from E to F. If there is no spending lag, the income generated by the point F will result in consumption at point G. At this point we will have an excess supply of tradables equal to fh and an excess demand for nontradables equals to da. The higher demand for nontradables can only be satisfied by greater domestic production of these goods. But, in fact, the increases in the production of nontradables will happen by drawing resources away from the tradables sector to the nontradables sector. Such a resource movement requires increases in the relative price of nontradables and contracts the non-oil tradable production (or deindustrialisation). As a result, the expenditure-consumption line OC, will move clockwise around PP. There is some point, such as H, where both the internal and external sectors are in equilibrium, income is equal to absorption, and both capital and labour (production resources) are fully employed. The aggregate supply moves from point F and aggregate

demand from point G to H. Equilibrium at point H presents that the relative price of tradables to nontradables has decreased under its pre-oil level (real appreciation) and non-oil tradable output falls by amount gh (deindustrialisation).

In sum, the general consequence of oil shocks are usually accompanied deindustrialisation, known as Dutch disease, real exchange rate appreciation and a loss of international competitiveness.⁸ Such an interaction between oil shocks and real exchange rate is based on the assumption that all factors are perfectly mobile between sectors, households have immediate access to their share of the new-found income, and the government spends its share from the outset. But in some cases where the production of oil is wholly under the government ownership and all the oil revenues accrue to the government, the long-run real effects as well as short-run monetary effects of oil price changes will depend on the government budgetary plan. The government which is responsible for linking its spending to current receipts, may fail to spend them from the outset. In consequence, there will be a possibility that spending of new-found incomes reaches its final level significantly later than the date of improvements. Even in countries where the government is not the direct recipient of these revenues, its policy can have a profound impact on the final level of new incomes. Furthermore, if such revenues are allocated to change the structure of domestic investment (and hence the production pattern), it will be expected to lead to a long-run sustainable economic situation rather than a permanent real appreciation with a low degree of international competitiveness.

3.2.2.4 Monetary effect of oil shocks on the real exchange rate

So far, we have ignored the crucial role of monetary effects of oil shocks in our discussion. Generally, in an open economy with a fixed nominal exchange rate regime, changes in commodity export price are an important factor affecting monetary policy. A rise in the foreign exchange earnings directly leads to rapid growth in foreign exchange reserves. This situation may be accentuated by government policy requiring exporters to convert foreign exchange earning into domestic currency. The foreign exchange inflows cause an increase in the domestic monetary base. Assuming the economy's output cannot increase by the same proportion as the money supply, and that financial markets are not well developed, expansion of the money supply above the level desired may increase the demand for goods and thus create an inflationary situation.

⁸ For a complete and detailed analysis of the Dutch disease problem, see Corden (1984).

Upward pressure on domestic price implies pressure for real exchange rate appreciation. However, it is a common view, that as long as the nominal exchange rate is held fixed and capital flows are controlled, the growth rate of high powered money is affected by foreign exchange flows and consequently real appreciation is an unavoidable side effect of the rise in commodity export prices.

On the other hand, since the government may exercise direct and indirect control not only on the nominal variables, but also on the exchange rate and some real factors, the link between commodity export price changes, monetary policy and the domestic price level is complex. In many developing countries, the government insists on financing their budget deficit by borrowing from the banking system. As is well known, government borrowing from the banking system is a major factor that influences the rate of growth of the money supply. In most of these countries, however, even where the government is not the direct recipient of the new-found wealth, substantial increases in foreign exchange earnings lead to net borrowing from the banking system to be reduced. Such a reduction can neutralise part of the monetary stimulus arising from the external sector. Large reductions in net borrowing may hold the money supply at its previous level. In addition to this fiscal dimension of monetary policy, there are a set of monetary instruments that can be used by the government to sterilise the exceptional increases in foreign exchange inflows in order to reduce the effect of rising net foreign asset on the money supply.

In an economy with highly developed financial markets, the central bank can carry out a neutralising operation through open market operations. Even in the absence of a well-developed financial market, the monetary authorities can exercise monetary policy by changing the reserve ratio or discount rate. An increase in reserve ratios of commercial banks, for example, will reduce the money multiplier and moderate the growth rate of money supply. Discount market operations also lead to changes in the supply of high-powered money. A rise in the discount rate causes the commercial banks to avoid borrowing from the central bank. When they borrow less, this reduces the monetary base and the availability of credit in the economy. Such policies could be more efficient in some countries, such as Iran, where the all commercial banks are directly controlled by the government. As a result, the overall impact of a rise in net foreign asset on the growth rate of high-powered money depends on the degree of dependency of the economy on the foreign sector and the capability of the government to use monetary instruments to sterilise foreign exchange inflows.

3.2.3 Investment and real exchange rate

An increase in real investment is expected, at least in the long-run and some plausible conditions, to raise the country's output potential which may help the economy move to a lower domestic price level and therefore to a real depreciation.⁹

To analyse the impact of changes in real investment spending on real exchange rate requires a distinction to be made between changes in spending on tradables or nontradables. Increasing investment on the nontradables sector will raise the supply of that commodity. At the original relative price, an excess supply of nontradables will emerge. Elimination of this excess supply, in order to obtain internal balance, requires a reduction in the price of nontradable goods, that means a real depreciation. Real depreciation, in turn, causes resources move into the tradables sector. Eventually, the expansion in output of tradables leads to a trade surplus. To clear the external sector, current spending should be increased. This will increase the domestic demand for both the tradables and nontradables resulting in equilibrium in both sectors with a sustainable level of real depreciation.

On the other hand, if the investment is allocated to the tradable sector, it will have the opposite effect on the real exchange rate. Increasing investment on tradables will create a trade balance surplus. Under constant level of relative prices, an increase in current expenditure is required in order to achieve trade balance equilibrium. This action will lead to a higher domestic demand for all goods, including nontradables. Higher aggregate demand implies a higher price of nontradable goods or a real appreciation.

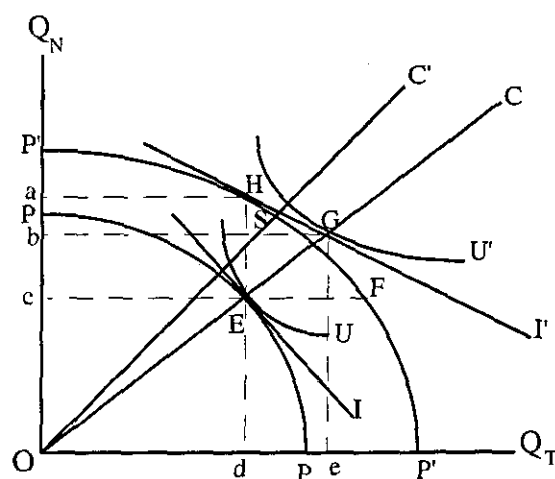
The main characteristics of such adjustment processes can be illustrated by Figure 3.3. In this figure, point E is the initial equilibrium point. Increases in investment will shift the production possibility curve from PP to P'P'. The new point of production could be somewhere between point F and point H, depending on the sector of the investment. If investment is entirely allocated in the nontradable sector, the new production point will be at point H. The income generated by point H will result in consumption at point G. At this point, there will be an excess supply of nontradable goods equals to ab . In order for the domestic market to clear, relative price of nontradables would have to decrease. Decreases in the price of nontradables cause the expenditure-consumption line shifts up to OC', the

⁹ Since almost all developing countries' investment are highly import-intensive activities, during an attempt to increase domestic output, a short-run external deficit (or a reduction in external surplus) will be most likely experienced.

resources shift towards tradables and demand towards nontradables generating a new production point, for example point S, where under a real depreciation, income is equal expenditure and the quantities supplied and demanded are equal for both tradable and nontradable goods.

Figure 3.3

Effect of real investment changes on the real exchange rate when the investment is entirely allocated on the nontradables sector



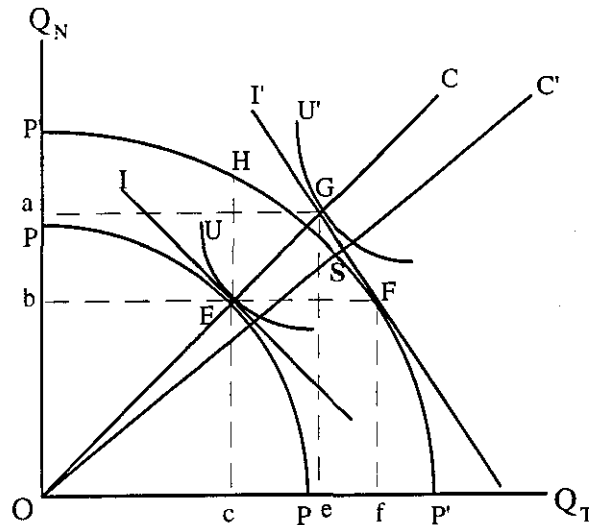
In contrast, if investment is entirely allocated on the tradables sector, the result will be quite different. Production and income will be at point F, in Figure 3.4. The relevant consumption is at point G. At that level of consumption, there will be an excess supply of tradables or a trade balance surplus equal to ef, and an excess demand for nontradables equals to ab. To eliminate the internal disequilibrium, a combination of high price and production of domestic output is required. The final result of such an adjustment process is the opposite of what has been explained above. That is a decline in the country's real exchange rate, slope of OC', or real appreciation.

Consequently, the effect of investment on the real exchange rate is ambiguous. Depending on how the investment is allocated between the various sectors, we will have different influence on the RER. In the real world, when we have an increase in investment, it is usually allocated on both sectors. In this case, the final result will be dependent on the share of each sector from the total increase in investment.

Assuming that the share of is larger in the tradables sector than in the nontradables sector, a real appreciation is likely to take place.

Figure 3.4

Effect of real investment changes on the real exchange rate when the investment is entirely allocated on the tradables sector



3.2.4 Productivity growth and real exchange rate

This section investigates the case in which productivity growth affects the real exchange rate. Any type of productivity shock will have two opposite effects, a supply effect and an income (demand) effect. But, when increases in production are biased towards a particular sector, it is possible that the supply effect dominates the demand effect in that sector. Therefore, if productivity growth is faster in nontradables sector, its supply effect may dominate resulting in a lower price of nontradables and hence a real depreciation.

Not all economists share this opinion. Instead, some argue that generally there is a negative relationship between productivity growth and real exchange rate movements. They argue that those industrial countries, whose productivity growth in their tradables sector is relatively high, tend to have lower relative price of tradables to nontradables, Samuelson (1964). Balassa (1964) in his reinterpretation of the purchasing power parity approach examined the data derived for 1950s (for the seven major industrial countries). His results indicate that in these countries' productivity increases in the service (nontradable) sector were in all cases lower

than the rise of productivity for national economy as a whole as well as for agriculture and industry taken separately. The likely interpretation of this result may stem back to the major role played by the industrial countries in determining the world price of tradables. Under the assumption of a small open economy where the country is a price-taker on the world markets, any increases in the supply of tradables by these countries will not lead to a change in the price of tradable goods.

3.2.5 Trade policy and real exchange rate

In considering the effect of trade policy it is also useful to distinguish between permanent and temporary changes of this variable. Such an interaction, therefore, needs to be analysed in the context of an intertemporal optimising model. Formally, there are a variety of ways in which trade policy (restriction or liberalisation) can be imposed. However, each of those ways may have different effect on the real exchange rate behaviour, but for simplicity, we analyse this matter under two general components, trade restriction and trade liberalisation policies.

3.2.5.1 Trade restriction and real exchange rate

Empirical evidence shows that price of nontradable goods necessarily rises when a trade restriction policy (such as import tariffs, quotas, licences, prohibitions, and so on) is imposed [Edwards (1986, 1989a) and Cottanie et al. (1990)]. That is because in response to higher import prices or a lower quantity of imports, demand for nontradables will increase. If there are no (negative) income effects, the relative price of nontradables will depend positively on the intratemporal substitution elasticity and negatively on the intertemporal substitution elasticity.

In this circumstance, the relative price of exportables to nontradables may be the appropriate measure of the country's international competitiveness, [see Khan and Ostry (1992)]. As a result, the aftermath of the rise in the price of nontradable goods will be a real appreciation.

3.2.5.2 Trade liberalisation and real exchange rate

A reduction of quantitative restrictions, whether by trade liberalisation or by reducing capital controls, may result in a lower demand for domestic goods through the various substitution and income effects noted above. Decreases in the demand for domestic goods will tend to reduce the price of these goods and hence depreciate the real exchange rate. Of course, some of the trade liberalisation policies, such as tariff reduction, may have a positive income effect that causes

demand for domestic goods to rise, which may wholly or in part offset the substitution effects.

As long as a permanent policy is considered and all commodities are assumed to be normal, the substitution effect is expected to outweigh the income effect [Khan and Ostry (1992)]. But, with a temporary policy (current or anticipated), the income effect, accompanied by the intertemporal effect, may dominate the intratemporal effect creating a real appreciation. For example, consider the case where economic agents face a reduction in import tariffs in period 1. Naturally, a decrease in the foreign price of importables in the current period leads to a decrease in the domestic price of these goods, generating current consumption relatively cheaper than future's. In this situation, consumers will switch their consumption away from the future period to the current period, leaving an excess demand for all goods in period 1, (intertemporal effect). Moreover, a reduction in import tariffs increases real income and results in an increase in the demand for all goods, (income effect). On the other hand, changes in the relative price of importables leads to substitution between nontradables and importables within the current period, (intra-temporal effect). Therefore, the final effect of a temporary trade liberalisation policy on the RER depends negatively on the income and intertemporal effects on one hand, and positively on the intratemporal effects on the other hand. In the case of a permanent policy positive intratemporal effect is offset by negative income effect only, which in some plausible conditions is expected to provide different results.

3.3 Fiscal policy and real exchange rate

As far as the empirical evidence is concerned, the widely divergent fiscal policies pursued by a number of governments in developing countries during recent years have resulted in a sharp movement in their real exchange rate, [see Reinhart (1991) and Edwards (1989a)]. The direction and magnitude of such a relationship between fiscal policy and the RER depends on these main factors: (i) consumption pattern of the government, (ii) sources of the government revenues, (iii) elasticities of income, intratemporal, and intertemporal substitution. Therefore, to analyse the impact on the real exchange rate of a change in government spending, it is necessary to make a clear distinction between the different effects of factors mentioned above.

With this issue in mind, this subsection is organised to sketch out the real exchange rate response to different forms of government fiscal policies.

Consider a temporary current increase in government purchases of nontradable goods that is financed by a taxation policy. The initial effect of this unexpected temporary spending is a higher relative price of nontradable goods. But, this is not the final result. If individuals know that this change in the structure of the government spending is temporary, they anticipate that the price of nontradables will decrease in future when the temporary policy ends. This anticipation, normally, affects the community's consumption behaviour, and they will shift part of their consumption into the future (intertemporal effect). Furthermore, increases in tax in current period may also serve to reduce the individuals disposable income and hence to reduce their demand for all goods in that period.

Taking all of these effects into account it is clear that the current response of the economy to such a government spending policy is ambiguous, depending on whether the negative spending effect dominates the positive taxation and intertemporal effects. If so, then the economy will experience a real appreciation in the current period. The future (period 2) response of the economy is unambiguously an excess demand of nontradables and a higher relative price of these goods, generating a real appreciation in that period.

Consider now a temporary current increase in government spending on the nontradables financed by a public debt.¹⁰ With the assumption that the government faces an intertemporal budget constraint, in this case, the individuals will expect that taxation in the future will have to go up to finance the public debt. Increases in taxation in future will cause the individuals to save more in the current period in order to spend in the future. Therefore, the final result (in the current period) will be the same as mentioned in the previous case.

Another possible form of fiscal policy is that, the government may increase its current spending on nontradables at the expense of government spending on the tradable goods. In such a case, two opposite forces will be in work in both periods, and thus the current and future responses of the economy to this policy are ambiguous. In the current period, such a shift in the government spending will create an excess demand for nontradables in period 1. Second, since the individuals know that the spending shift is temporary, and that it will be ended in period 2, they will change their saving and consumption behaviour in period 1. In the future, a negative intertemporal substitution effect with accompanied by positive effect of government spending shift back makes the final response (in period 2) of the

¹⁰ This is not the form of borrowing from the central bank.

economy to temporary current shifts of the government spending ambiguous as well.

Let us now consider the case where the individuals expect that the government will increase its spending on nontradables in period 2. Although this expected policy will be imposed in future and there is no a direct pressure on the demand for nontradables in the current period, it may have an immediate direct effect on the relative price of nontradables and hence the real exchange rate in period 1. Such a relationship can be analysed in the same way just presented in this section. In this way, the real exchange rate response to these disturbances in both periods will be the sum of the substitution effect and the government spending effect.

Finally as a fundamental variable, consider a permanent increase in the level of nontradable government spending. The required budget can be financed by a permanent increase in taxation or at the expense of permanent spending on tradable goods. In the former case, the negative effect of tax rises on the nation's disposable income may offset the positive effect of government spending, therefore, the final effect on the real exchange rate is ambiguous. In the latter case, it enters positively into the value of excess demand for nontradables, resulting in a higher price of these goods. If this effect dominates the intratemporal substitution effect, thus a long-run real appreciation will take place.

Although, fiscal policies discussed in this subsection play an important role in determining the level of the long-run real exchange rate, there is another form of fiscal policy that is usually addressed under inconsistent macroeconomic policies. Such a policy leads to a volatile RER inconsistent with underlying fundamental factors will be associated with the country's macroeconomic disequilibrium.

A clear example of this kind of inconsistent fiscal policy is inflationary financing of the government budget deficit by money creation.¹¹ The impact on real exchange rates of inconsistent fiscal policies can be well illustrated with the aid of the following example. Suppose the government faces a budget deficit (BD) equal to a fraction, ω , of real GNP; that is;

$$BD = \omega \cdot GNP.$$

¹¹ It is also argued that, an inflationary financing of budget deficit by money creation (as an inconsistent fiscal policy) with an inconsistent set of other macroeconomic policies will be short term. The inability of such policies to prevent the real exchange rate from moving back towards its equilibrium level in the long-run has been analysed widely in the relevant literature [see for example, Connolly and Taylor (1984), Khan and Lizondo (1987), and Cottanie et al. (1990)].

If the government decides to finance this deficit by money creation, the required increase in the high powered money will be:

$$\Delta M = \omega \cdot P \cdot GNP.$$

With this assumption, in the long-run, the ratio of $\Delta M/M$ is equal to the rate of inflation and with some manipulation we will have:

$$\Delta M/M = \omega \cdot P \cdot GNP / M$$

where $\Delta M/M = \pi$ is the rate of inflation and $M/P \cdot GNP = v$ is the ratio of high-powered money to GNP, as a result:

$$\pi = \omega \cdot \frac{1}{v}$$

Assume that the government has a budget deficit of 5 percent of GNP in period t , and the ratio of high-powered money to GNP in this economy is 20 percent in that period, the required rate of inflation will be: $\pi = 5 \cdot \frac{1}{20} = 25\%$. Under a fixed

exchange rate system if this required rate of inflation is higher than the rate of world inflation, it will be translated into an appreciation of the real exchange rate. If there is no change in the fundamentals to offset that real appreciation, it may prevent the real rate from moving back towards its equilibrium value and hence give rise to a growing real exchange rate misalignment.

3.4 Monetary policy and real exchange rate

A common feature of all real exchange rate misalignments in developing countries is a colossal increase in their money supply.¹² In the context of a fixed nominal exchange rate where goods prices cannot adjust instantaneously to maintain equilibrium in the goods market, monetary expansion that exceeds the growth in the demand for domestic money will put upward pressure on the value of the excess demand for all goods, including nontradables, resulting in a temporary real appreciation. If this real appreciation brought about by the expansive domestic monetary policy is not offset by a sustainable change in the fundamental real determinants of the RER, it will lead to a persistent departure of the actual RER from its equilibrium value, or RER misalignment.

¹² For an empirical investigation of this issue, see for example, Cottanie et al. (1990), and Edwards (1989a).

To understand the adverse influence of inconsistent monetary policy on the RER movements, assume that under fixed nominal exchange rates and the fundamental determinants of RER are constant, the government imposes an expansive monetary policy. As Cottanie et al. (1990) have discussed, in order for the real exchange rate to remain of its equilibrium level, the rate of growth of domestic prices must be equal to the rate of growth of foreign price plus nominal devaluation, $\hat{P} = \hat{E} + \hat{P}^*$, (where $\hat{P}$ is the growth rate of domestic price level, $\hat{E}$ is nominal devaluation, and $\hat{P}^*$ is the rate of growth of foreign price). To attain this consistency, the growth rate of domestic money supply must not exceed a certain limit, beyond which the real exchange rate would become unsustainable. With the further assumption that the income elasticity of money is unit and the velocity of money is unchanged, the following condition can hold for a sustainable level of money supply:¹³

$$\hat{M}_t = \hat{E}_t + \hat{P}_t^* + \hat{y}_t$$

where $\hat{M}$ is the rate of growth of domestic money supply and $\hat{y}$ is the rate of growth of real GDP. On the other hand, an expansionary monetary policy can be created by a higher domestic credit or an international reserves accumulation. That is;

$$\hat{M}_t = \hat{R}_t + \hat{D}_t$$

where $\hat{R}$ is the rate of change of international reserves and $\hat{D}$ is the rate of change of domestic credit. If the country's international reserves remain constant, the consistency condition can be represented as;

$$\hat{M}_t = \hat{D}_t = \hat{E}_t + \hat{P}_t^* + \hat{y}_t.$$

If the monetary authorities, under a fixed exchange rate and $\hat{E} = 0$, expand domestic credit, whether to finance the government budget deficit or to increase credit to the private sector, so that $\hat{D} > \hat{P}^* + \hat{y}$, it will translate to a higher domestic price level and a real appreciation. The intuition behind this fact is that, an unanticipated increase in the domestic credit will lead to a rise in the real stock of money. This, in turn, generates a higher real absorption and thus an incipient excess demand for nontradable goods, or an appreciation of the real exchange rate.

There are many such variables that are also important in analytical and policy discussions of real exchange rate behaviour, but, due to the fact that some of them are not directly related to the economy under consideration, we content ourselves with the summary of the expected partial effect of each of those variables on the

¹³ See Cottanie et al. (1990) p. 68.

real exchange rate under plausible theoretical conditions and assumptions in Table 3.1.

Table 3.1

The sign of the effects of alternative shocks on the real exchange rate

Type of shocks	Plausible theoretical condition and assumption	Expected effects on the RER
a) Terms of trade		
A temporary current increase in the price of importables; $\hat{P}_{M1} > 0$ and $\hat{P}_{M2} = 0$	1) Consumption expenditure in period 1 $\uparrow \Rightarrow D_{N1}$ shifts towards $D_{N2} \Rightarrow D_{N1} \downarrow$ (intertemporal effect) 2) $y_1 \downarrow \Rightarrow D_{N1} \downarrow$ (income effect) 3) D_{M1} shifts towards $D_{N1} \Rightarrow D_{N1} \uparrow$ (intra-temporal effect) If $(1+2) > 3 \Rightarrow P_{N1} \downarrow$ If $(1+2) < 3 \Rightarrow P_{N1} \uparrow$ and if $\hat{P}_{N1} > \alpha \hat{P}_{M1}$	Positive Negative
A temporary future increase in the price of importables; $\hat{P}_{M1} = 0$ and $\hat{P}_{M2} > 0$	1) Consumption expenditure in period 2 $\uparrow \Rightarrow D_{N2}$ shifts towards $D_{N1} \Rightarrow D_{N1} \uparrow$ 2) $y_2 \downarrow \Rightarrow$ on the basis of the permanent income theory, $D_{N1} \downarrow$ If $(1) > (2) \Rightarrow P_{N1} \uparrow$ If $(1) < (2) \Rightarrow P_{N1} \downarrow$	Negative Positive
A permanent increase in the price of importables; $\hat{P}_M > 0$	1) $y \downarrow \Rightarrow D_N \downarrow$ (income effect) 2) $D_N \uparrow$ (intra-temporal effect) If $(1) > (2) \Rightarrow P_N \downarrow$ If $(1) < (2) \Rightarrow P_N \uparrow$ and if $\hat{P}_N > \alpha \hat{P}_M$	Positive Negative
A temporary current increase in the price of exportables; $\hat{P}_{X1} > 0$ and $\hat{P}_{X2} = 0$	1) $D_{N1} \downarrow$ (intertemporal effect) 2) $D_{N1} \uparrow$ (income effect) 3) $D_{N1} \uparrow$ (intra-temporal effect) If $(1) > (2+3) \Rightarrow P_{N1} \downarrow$ If $(1) < (2+3) \Rightarrow P_{N1} \uparrow$ and if $\hat{P}_{N1} > \beta \hat{P}_{X1}$	Positive Negative
A temporary future increase in the price of exportables; $\hat{P}_{X1} = 0$ and $\hat{P}_{X2} > 0$	1) $D_{N1} \uparrow$ (intertemporal effect) 2) $D_{N1} \uparrow$ (income effect) $(1) + (2) \Rightarrow P_{N1} \uparrow$	Negative
A permanent increase in the price of exportables; $\hat{P}_X > 0$	1) $D_N \uparrow$ (income effect) 2) $D_N \uparrow$ (intra-temporal effect) $(1) + (2) \Rightarrow P_N \uparrow$ and if $\hat{P}_N > \beta \hat{P}_X$	Negative
b) Productivity growth		
Productivity growth in the tradables sector	1) $y \uparrow \Rightarrow D_N \uparrow$ (income effect) $(1) \Rightarrow P_N \uparrow$	Negative

Table 3.1

Productivity growth in the nontradables sector	1) $y \uparrow \Rightarrow D_N \uparrow$ (income effect) 2) $S_N \uparrow$ (supply effect) Usually $(2) > (1) \Rightarrow P_N \downarrow$	Positive
Productivity growth in both tradables and nontradables sector	1) $y \uparrow \Rightarrow D_N \uparrow$ (income effect) 2) If productivity growth in nontradables sector > in tradables sector $\Rightarrow S_N \uparrow$ It is expected that $(2) > (1) \Rightarrow P_N \downarrow$	Positive
c) <i>Increases in investment and technological progress</i>	The long-run impacts of increases in investment and technological progress on the real exchange rate are the same as the impact of productivity growth on the RER explained above. The short-run impact of increases in investment $\Rightarrow D_N \uparrow \Rightarrow P_N \uparrow$	Positive Negative Negative
<i>d) Trade policy</i>		
A temporary current increase in import tariffs	1) $\Rightarrow P_{M1} \uparrow \Rightarrow D_{M1}$ shifts towards $D_{N1} \Rightarrow D_{N1} \uparrow$ (intratemporal effect) 2) $\Rightarrow y_1 \downarrow \Rightarrow D_{N1} \downarrow$ (income effect) 3) $\Rightarrow D_{N1}$ shifts towards $D_{N2} \Rightarrow D_{N1} \downarrow$ (inter-temporal effect) If $(1) > (2+3) \Rightarrow P_{N1} \uparrow$, and if $\hat{P}_{N1} > \alpha \hat{P}_{M1}$ If $(1) < (2+3) \Rightarrow P_{N1} \downarrow$	Negative Positive
An anticipated increase in import tariffs in period 2	1) $\Rightarrow P_{M2} \uparrow \Rightarrow D_{N2}$ shifts towards $D_{N1} \Rightarrow D_{N1} \uparrow$ (intertemporal effect) 2) $\Rightarrow y_2 \downarrow \Rightarrow D_{N1} \downarrow$ (permanent income effect) If $(1) > (2) \Rightarrow P_{N1} \uparrow$ If $(1) < (2) \Rightarrow P_{N1} \downarrow$	Negative Positive
A permanent increase in import tariffs	1) $\Rightarrow P_M \uparrow \Rightarrow D_M$ shifts towards $D_N \Rightarrow D_N \uparrow$ (intratemporal effect) 2) $\Rightarrow y \downarrow \Rightarrow D_N \downarrow$ (income effect) If $(1) > (2) \Rightarrow P_N \uparrow$, and if $\hat{P}_N > \alpha \hat{P}_M$ If $(1) < (2) \Rightarrow P_N \downarrow$	Negative Positive
The other trade policies, such as quantitative restrictions on imports, export taxes and so on, have quite similar effects on the real exchange rate.		
Liberalisation of the capital account	If net capital flows $> 0 \Rightarrow D_N \uparrow \Rightarrow P_N \uparrow$ If net capital flows $< 0 \Rightarrow D_N \downarrow \Rightarrow P_N \downarrow$	Negative Positive
d) <i>Foreign borrowing</i> ¹⁴	1) If it is spent on the tradables $\Rightarrow \hat{P}_N = 0$ 2) If it is spent on the nontradables $\Rightarrow P_N \uparrow$	---- Negative

¹⁴ In this case, for simplicity, we did not consider the impact of repayment ways. In fact, to understand the final effect of foreign borrowing, we need to include these parameters.

Table 3.1

Foreign aids and transfers have the same effects on the real exchange rate behaviour.		
<i>e) Interest rate</i>		
World interest rate changes	If $\hat{r}^* \uparrow \Rightarrow$ capital flight $\Rightarrow D_N \downarrow \Rightarrow P_N \downarrow$	Positive
A decline in the domestic interest rate	1) $\Rightarrow M \uparrow \Rightarrow D_N \uparrow$ 2) $\Rightarrow I \uparrow \Rightarrow$ (in the long-run) ¹⁵ $S_N \uparrow$ 3) If there is no capital control $\Rightarrow$ capital outflows $\Rightarrow P_N \downarrow$ If (1) & (2+3) $\Rightarrow P_N \downarrow$ If (1) & (2+3) $\Rightarrow P_N \uparrow$	Positive Negative
<i>f) Fiscal policy</i>		
A temporary current increase in the government spending on the tradables financed by;	1) individuals disposable income $\downarrow \Rightarrow D_{N1} \downarrow$ 2) Increase in tax will be ended in period 2 $\Rightarrow D_{N1} \uparrow$ (income effect) If (1) & (2) $\Rightarrow P_{N1} \downarrow$ If (1) & (2) $\Rightarrow P_{N1} \uparrow$	Positive Negative
i) Increases in tax in the period 1		
ii) increases in public debt	1) $\Rightarrow$ A hike in future taxes in order for the government intertemporal budget constraint to be satisfied $\Rightarrow D_{N1} \downarrow$ 2) $\Rightarrow M \uparrow \Rightarrow D_{N1} \uparrow$ If (1) & (2) $\Rightarrow P_{N1} \uparrow$ If (1) & (2) $\Rightarrow P_{N1} \downarrow$	Negative Positive
iii) decreases in demand for nontradables	1) $\Rightarrow D_{N1} \downarrow$ 2) It is expected that such a shift will be ended in period 2 $\Rightarrow D_{N2} \uparrow \Rightarrow P_{N2} \uparrow \Rightarrow$ consumption in future will be relatively more expensive $\Rightarrow D_{N2}$ shifts towards $D_{N1} \Rightarrow D_{N1} \uparrow$ If (1) & (2) $\Rightarrow P_{N1} \downarrow$ If (1) & (2) $\Rightarrow P_{N1} \uparrow$	Positive Negative
A temporary future increase in the government spending on the tradables financed by;	1) $\Rightarrow$ Individuals save more in the current period in order to spend in the future $\Rightarrow D_{N1} \downarrow \Rightarrow P_{N1} \downarrow$	Positive
i) increases in the future tax		
ii) decreases in demand for nontradables	1) $\Rightarrow D_{N2} \downarrow \Rightarrow P_{N2} \downarrow \Rightarrow$ consumption in period 2 will be relatively cheaper $\Rightarrow D_{N1}$ shifts towards $D_{N2} \Rightarrow D_{N1} \downarrow \Rightarrow P_{N1} \downarrow$	Positive
A permanent increase in the government spending on the tradables financed by;		
i) increases in tax	$\Rightarrow$ disposable income $\downarrow \Rightarrow D_N \downarrow \Rightarrow P_N \downarrow$	Positive

¹⁵ The short-run positive effect of investment on the demand for nontradables has been ignored.

Table 3.1

ii) decreases in the demand for nontradables	$\Rightarrow D_N \downarrow \Rightarrow P_N \downarrow$	Positive
A temporary current increase in the government spending on the nontradables financed by: i) increases in tax	1) $\Rightarrow D_{N1} \uparrow$ 2) Tax $\uparrow \Rightarrow$ disposable income $\downarrow \Rightarrow D_{N1} \downarrow$ 3) It is expected that this policy will be ended in period 2; 3-1) Decreases in tax in period 2 $\Rightarrow D_{N2} \uparrow$ 3-2) Ending the government temporary consumption policy $\Rightarrow D_{N2} \downarrow$ If (3-1) $\langle$ (3-2) $\Rightarrow D_{N2} \downarrow \Rightarrow P_{N2} \downarrow \Rightarrow D_{N1}$ shifts towards $D_{N2} \Rightarrow D_{N1} \downarrow$ If (1) $\rangle$ (2+3) $\Rightarrow P_{N1} \uparrow$ If (1) $\langle$ (2+3) $\Rightarrow P_{N1} \downarrow$	Negative Positive
ii) increases in public debt	1) $\Rightarrow D_{N1} \uparrow$ 2) Tax in period 2 is expected to be increased in order to satisfy the government intertemporal budget constraint $\Rightarrow y_2 \downarrow \Rightarrow D_{N1} \downarrow$ (permanent income effect) 3) It is expected that this policy will be ended in period 2 $\Rightarrow D_{N2} \downarrow \Rightarrow P_{N2} \downarrow \Rightarrow D_{N1}$ shifts towards $D_{N2} \Rightarrow D_{N1} \downarrow$ If (1) $\rangle$ (2+3) $\Rightarrow P_{N1} \uparrow$ If (1) $\langle$ (2+3) $\Rightarrow P_{N1} \downarrow$	Negative Positive
iii) Shifts from tradables	1) $\Rightarrow D_{N1} \uparrow$ 2) This shift will be ended in period 2 $\Rightarrow D_{N2} \downarrow \Rightarrow P_{N2} \downarrow \Rightarrow D_{N1}$ shifts towards $D_{N2} \Rightarrow D_{N1} \downarrow$ If (1) $\rangle$ (2) $\Rightarrow P_{N1} \uparrow$ If (1) $\langle$ (2) $\Rightarrow P_{N1} \downarrow$	Negative Positive
A temporary future increase in the government spending on the nontradables financed by: i) Increases in the future tax	1) $\Rightarrow$ Individuals save more in period 1 in order to spend in period 2 $\Rightarrow D_{N1} \downarrow$ 2) $\Rightarrow D_{N2} \uparrow \Rightarrow P_{N2} \uparrow \Rightarrow$ future consumption will be relatively more expensive $\Rightarrow D_{N2}$ shifts towards $D_{N1} \Rightarrow D_{N21} \uparrow$ If (1) $\rangle$ (2) $\Rightarrow P_{N1} \downarrow$ If (1) $\langle$ (2) $\Rightarrow P_{N1} \uparrow$	Positive Negative
ii) decreases in the demand for tradables	$\Rightarrow D_N \uparrow \Rightarrow P_N \uparrow$	Negative
f) Monetary policy	If $\hat{M} \rangle \hat{E} + \hat{P}^* + \hat{y} \Rightarrow$ required monetary growth will exceed the certain limit $\Rightarrow D_N \uparrow \Rightarrow P_N \uparrow$	Negative

Table 3.1

<i>h) Nominal devaluation</i>	$1) \Rightarrow EP_T^* \uparrow$ $2) \Rightarrow P_M \text{ and } P_X \uparrow \Rightarrow \text{demand for tradable goods shifts towards nontradable goods} \Rightarrow D_N \uparrow$ $3) \Rightarrow P_M \uparrow \Rightarrow P_N \uparrow$ If $(1) \rangle (2+3) \Rightarrow \hat{P}_T \rangle \hat{P}_N$ If $(1) \langle (2+3) \Rightarrow \hat{P}_T \langle \hat{P}_N$	Positive negative
-------------------------------	---	----------------------

Definition of the variables:

1 and 2 refer to the period 1 and period 2. P_M is domestic price of importables, D_N is demand for nontradables, D_M is demand for importables, P_N is nontradables price, α is the share of importables price in the price of tradable goods, y is real income, P_X is domestic price of exportables, β is the share of exportables price in the price of tradable goods, S is supply, M is money supply, E is nominal exchange rate, and P^ is foreign price level.*

3.5 Conclusion

In this chapter we have investigated a number of relationships between the real exchange rate and its real and nominal determinants by using an intertemporal optimising model for small open economies elaborated by Edwards (1989a). The impact on the real exchange rate of the changes in the terms of trade, productivity growth, investment, trade policy, and government fiscal and monetary policies have been discussed. The main purpose of involving such discussion and considering some particular variables has been to provide a general theoretical framework of the empirical analysis in the following chapters.

This analysis represented a separate and distinct channel through which changes in the real exchange rate determinants affect a country's real exchange rate. As we have briefly shown in Table 3.1, in most cases, it is difficult to find a clear relationship between real exchange rate and its determinants. In general speaking, the effects of temporary shocks on the real exchange rate were found to depend on three factors; intertemporal substitution elasticity, intratemporal substitution elasticity, and income effects. the relative significance of each factors determines the sign and magnitude of the final effect of a particular temporary shocks. the analysis of permanent shocks revealed that two factors, income and intratemporal substitution effects, determine the final response of the real exchange rate.

4

The Trend Behaviour of Iranian Real Exchange Rates

4.1 Introduction

As noted in the introductory chapter, in recent years the issues surrounding the behaviour of the real exchange rate have attracted the attention of economists and policymakers in the Iranian economy. Some experts have argued that inappropriate exchange rate policy pursued by the government, particularly in the 1980s, has been one of the main causes of the acute real overvaluation of the domestic currency resulting in a deterioration in the country's external and internal sector [Pessaran (1992)]. It is also emphasised that in many cases it is difficult to achieve even small RER movements in the direction of a sustainable equilibrium.

In spite of the prominent role played by the real exchange rate, relatively few empirical studies have been devoted to deal the size, trends and variability of the RER in this economy. The objective of this and following chapters are, therefore, to provide a broad look at the behaviour of the RER in the Iranian economy between 1961 and 1992. Precisely, the present chapter addresses the trends and variability of the RER by using annual data over this period.

In section 2, alternative measures of multilateral and bilateral indices of the official RER and their trends and variability are investigated. Section 3 analyses the role of the black market in the determination of the RER behaviour. The relationship between purchasing power parity theory of the RER and the behaviour of the official and black market real exchange rates in the economy under consideration will be examined in section 4. Finally, section 5 contains the main conclusions.

4.2 Real effective exchange rate

Most available real exchange rate models have been expressed in terms of a two-country framework, employing bilateral data including a bilateral nominal exchange rate. Consequently, the role of other currencies which have a significant impact on the reporting country's external balance has been omitted. Of course, in an ideal world of perfect information which is freely, costlessly, and constantly available for all major currencies, an effective (multilateral) real index would be a weighting of bilateral real index corresponding to all trading partners. In the real world where the principle currencies are floating and every country usually trades with a group of countries, a bilateral rate with respect to just one partner can not provide a good measures of the degree of international competitiveness. In this circumstance, the multilateral rate that considers the variability of nominal exchange rates and relative price movements of a large number of partners should be used.

In spite of the key role that the multilateral real exchange rate plays in macroeconomic equilibrium, there is no clear consensus on how such indices should be measured. The existence of many indices of relative prices and many weighting schemes, inevitably, leads to different measures of the real effective exchange rate. Certainly, all measures of this index that have been produced by international organisations (or private sectors) do not provide similar information to make any assessment of how loss in international competitiveness could be make up. Consequently, any attempt to give an efficient framework to measure the real effective exchange rate (REER) index, analysing the discrimination between the various measures of such indices is a necessary step to shed some light on the way in which those problems can be resolved.

With this in mind, the current chapter focuses on the measurement of the real effective exchange rate for the Iranian rial in order to provide a precise index for the subsequent empirical analyses.

The construction and the interpretation of multilateral indices of real effective exchange rates are likely to depend strongly on the combination of four primary issues; 1) the mathematical formulation of the index, 2) the appropriate selection of the price measures fed into relative price, 3) the appropriate selection of the weighting system used in the index, 4) the proper choice of sample of foreign currencies and prices for constructing of the index [see Maciejewski (1983)]. Each of these issues will be addressed in the following section.

4.2.1 Mathematical formulations;

The following mathematical formulation can be used to construct the real effective exchange rate index.

$$REER_t = \frac{\sum_{i=1}^k W_i E_{it} P_{it}^{*T}}{P_t^N} \quad (4.1)$$

REER = multilateral index of real effective exchange rates in period t for home country,¹

$i = 1, 2, 3, \dots, k$ refers to k major trading partners of the home country,

W_i = weight corresponding to country i,

P_i^{*T} = the price of tradable of ith country,

P_t^N = the domestic price of nontradables in period t,

E_i = nominal exchange rate between home currency and ith country's currency.

Historically, bilateral exchange rates between the home currency and all of its trading partners' currencies are not available. For this reason, we will have to use a numeraire currency (such as the US dollar or SDR) in order to compute these rates. In the case of Iran, the bilateral exchange rate between the Iranian rial and the US dollar is announced by the central bank of Iran. Of course, since May 1980, when the official exchange rate in Iran had been fixed at 92.3 rials per unit of SDR, the rate of the US dollar is determined on the basis of rial's parity with SDR. Consequently, the following arbitrage relation between the US dollar and other currencies will be used.

$$E_i = E^n / E_i^n \quad (4.2)$$

E^n = value of one unit of numeraire currency in terms of domestic currency,

E_i^n = value of one unit of numeraire currency in terms of the ith country's currency,

Such a real effective exchange rate index generally refers to an average change in the home country's exchange rate against all other trading partners deflated by relative price movements. A decline in the value of this index reflects the real appreciation of the home currency, which suffer a loss of international

¹ Most of the explanations the effective exchange rate index hold price and quantity of trade and also the share of the trading partners in total trade of the country under consideration constant at the base period level. This equation, however, considers the price and quantity of trade and the share of trading partners tend to move during the period of study.

competitiveness. This, in turn, implies a deterioration on the external balance by reducing exports and increasing imports of the country under consideration.

4.2.2 Relative price and nominal exchange rate indices

In chapter 2 it was argued that as there are no obvious data available for prices of tradable and nontradable goods, they must be proxied by other appropriate indices. The approach employed there introduced the domestic consumer price index (CPI) as a proxy for domestic price of nontradables (P_N) and the foreign wholesale price index (WPI)* as a proxy for foreign price of tradable goods (P^*).

In the case of multiple nominal exchange rates, characterised by the country in question, choosing the nominal exchange rate in order to express the foreign price of tradables in terms of local currency is another crucial issue. In the case of Iran, due to the fact that foreign transaction have been taking place within a multiple exchange rate system, we have to select the appropriate rates which play more significant role in determining the country's foreign payments than the other indices. For this reason, the official nominal exchange rate that has been held fixed by the government and the black market exchange rate which is freely determined by the demand and supply mechanism in that market have been used to compute the real effective exchange rate. As mentioned in Chapter 2, a good index of real exchange rate in the case of multiple nominal exchange rates could be a weighted average of the available nominal exchange rates. But, due to the lack of data on the exact size and share of each nominal exchange rate in the country's total activities, it is not possible to provide such an index.

4.2.3 Relevant weighting system

Apart from issues of what is the appropriate price and nominal exchange rate, a more serious problem arises from the choice of weight to be assigned to each of the bilateral real exchange rates in arriving an aggregate real effective exchange rate.

The proper choice of weights for an index of the effective rate depends on its purpose. Variations in the weights used in the construction of indices may often yield significantly different quantitative results. An index of the effective rates, that is intended to be used in connection with estimation or analysis of exchange rate and relative price movements effect on the country's external and internal (nontradable sector) balances has to use the relative influence of changes in the

exchange rates of various foreign currencies and changes in their general price level on external and internal balances. In principle, three basic weighting systems can be identified;

1) *Export weights*: This weights are based on the foreign countries' shares in total exports of the home country. This measure provides an indicator of movements in the export competitiveness of the domestic country, only if domestic producers are the main competitors in world exporting markets. But in the case of developing countries whose shares in the global export are not remarkable, this system is unlikely to be useful.

2) *Import weights*: The import weighting procedure is advised when the major trading partners of the home country are the main competitors in the world exporting market. This approach uses the export shares of the major trading partners in the home country's total imports. Using the import-weighted index is not advisable in any situation in which the role of home country in world exporting market is not tangible. Because it can not correct the flaws of multilateral index as a device for registering various exchange rates and relative price movements on the home country's exports.

3) *Trade weights*: This procedure, which is a combination of two previous system, is based on this consideration that competition on the world exporting markets originate from both home country and its major trading partners. Multilateral indices which are constructed by using the trade weighting system, are an arithmetic averages of bilateral indices. These kind of indices are empirically preferred to those system noted above and will be used in the constructing of the Iranian real exchange rate indices.

In order to show precisely the trends and variability of the real effective exchange rates in the economy under study, a number of different bilateral and multilateral indices for the Iranian currency (Rial) over the 1961-1992 period have been computed. The existence of many potential deflators and weighting systems could give rise to various indices, but on the basis of our present purpose, to show the trend in the real exchange rates rather than its cyclical variations, the particular choice of the proxies for tradable and nontradable prices may not significantly affect the general conclusion regarding the trend in the real exchange rate (Pessaran 1992).

In this chapter, two multilateral rates have been computed. The first one is based on the relative price of tradables and nontradables approach that uses the partner

country's wholesale price indices as proxies for foreign price of tradables and the home country's consumer price index as a proxy for domestic price of nontradables. The second index is related to traditional and popular purchasing power parity measure of the real exchange rate which used the foreign and domestic consumer price indices for nontradables and tradables². In order to make a comparison between multilateral and bilateral indices and to show the difference between significant role of multilateral index (in comparison with the bilateral index) in analysing the country's external balance and domestic stability, two indices of bilateral real exchange rates for the Iranian rial with respect to the US dollar have also been calculated

To construct these indices the following procedure has been used; a) the weights w_i are calculated in accordance with the proportion of total trade that carried out with country i , b) ten major trading partners of Iran are considered, c) the official nominal exchange rates are used, d) the data from the Central Bank of Iran and the International Monetary Fund (Direction of Trade and International Financial Statistics) are used.³

Table 4.1 shows the ten largest trading partners of Iran between 1961-1992 and the weights, w_i , that is the share of the relevant country in the Iran's total trade. As may be seen from this table, in most years, especially before the Islamic revolution (1979), around 70% of Iran's trade was related to the seven major developed countries, namely; Japan, Germany, the United Kingdom, France, Netherlands, Italy and the United States. While during this period the share with the other countries were not individually important. After the revolution, partly due to political reasons and some reduced barriers to trade with developing countries, the geographical composition of Iran's trade has shifted away from those developed countries to some developing and other industrialised countries. Nevertheless, the developed countries, named above, have again become the major trading partners of Iran in recent years, but the United States and the United Kingdom could not regain their lost opportunities and have experienced the major brunt of these changes in the direction of trade. In spite of this situation, as may be seen from Table 4.1, the share of trade with the United States has been shown to be more than the other countries'. This is because of the role of the US dollar in the global

² This also helps us to assess our discussion (in chapter 2) about the relationship between PPP and P_T/P_N measures of the real exchange rate.

³ Due to the importance of the black market exchange rate in the Iranian economic performance, it will also be considered later in this chapter.

trading system including Iran's. In this respect, following Pessaran (1992), the United States has been considered as a representative of the rest of the world which is trading with Iran. In fact that is not the real share of the United States.

Table 4.1

The 10 largest trading partners of Iran and their shares in the Iranian total trade
(Selected years between 1961-1992)

1961		1971		1981		1991	
Country	Share	Country	Share	Country	Share	Country	Share
USA	39.2	USA	31.4	USA	40.3	USA	38.3
Germany	19.3	Japan	26.3	Japan	13.4	Germany	14.1
UK.	13.9	Germany	12.3	Germany	9.5	Japan	14
Japan	5.7	UK.	8	Spain	6.4	Italy	9.1
India	4.7	Italy	6.1	Italy	5.8	France	5.8
Belgium	3.9	Netherlands	5.3	India	5.5	Netherlands	4.3
Australia	3.5	France	4.2	Romania	4.9	S. Korea	4.1
Italy	3.4	India	3.1	Bahamas	4.8	Belgium	3.8
France	3.3	Belgium	1.8	UK.	4.7	UK.	3.3
S. Africa	3.1	Canada	1.5	France	4.7	Emirates	3.2

4.2.4 Empirical results

Tables 4.2-4.4 and Figures 4.1 and 4.2 present the evolution of the Iranian official real and real effective exchange rates during the 1961-1992 period. Several important features can be achieved from these results. First, they show that the REERs and RERs of Iran have been quite volatile during this period. Second, a comparison of the standard deviations and coefficients of variation for three sub-periods indicates that the volatility has increased sharply between 1980 and 1992. Third, in spite of the different variability, all indices exhibit that the Iranian real exchange rate has experienced a massive appreciation during this period. In response to these definite downward trends (high levels of real appreciation) the demand for cheap imports increased sharply and the profitability of non-oil exports fell.⁴

⁴ However, real appreciation reduces the oil income in terms of the domestic currency, but because the export price of oil is determined in the international markets which do not reflect the production cost and also domestic price of oil, any changes in the Iranian exchange rate (appreciation or depreciation) do not have any effect on the volume of oil exports and the resulting foreign-exchange revenue.

Table 4.2

Real and real effective exchange rates for the Iranian rial (1961-1992)*

year	$REER = \frac{\sum_{i=1}^n w_i E_i (WPI)_i^*}{(CPI)}$	$RER = \frac{E(WPI)_{US}}{(CPI)}$	$REER_p = \frac{\sum_{i=1}^n w_i E_i (CPI)_i^*}{(CPI)}$	$RER_p = \frac{E_i (CPI)_{US}}{(CPI)}$
1961	134	193	120.5	173.4
62	119	183	109.1	167.3
63	137	181	126.9	168.3
64	126	175	117.1	164.1
65	117	175	108.7	163.3
66	123	181	115.2	169.6
67	114	178	108.7	170.2
68	112	181	108.5	175.8
69	99	184	97.4	182.2
1970	93	187	92.7	188.9
71	98	186	98.6	189
72	92	183	92.3	184.6
73	92.4	167	89.7	157.7
74	107	173	83.4	152.5
75	102	171	83.3	151.3
76	102	165	94	147.1
77	87.7	137	80.6	122.5
78	78.3	132	72.9	118
79	98.8	146	90.3	128.9
1980	72.1	131	66.4	114.9
81	71.4	126	65.7	112.2
82	65.6	114	61.2	105.2
83	50.8	102	48.6	95.9
84	40	98	38.1	94.8
85	37	84	37	84.2
86	36.6	62	38.2	65.1
87	26.3	43	27.7	45.5
88	21.9	36	23	38.5
89	16.7	31.9	17.6	33.8
1990	16.6	28.5	17.8	30.7
91	14.1	24	15.6	27.1
92	11.7	20	13.2	23.5

* The real exchange rate is measured with respect to the US dollar.

Table 4.3

Indices of the real exchange rate for the Iranian rial between 1961-92
(1970 = 100)

Year	REER	RER	REER _p	RER _p
1961	144.1	103.6	130	91.7
62	127.9	97.9	117.7	88.5
63	147.3	96.8	136.9	89
64	135.5	93.6	126.3	86.8
65	125.8	93.6	117.3	86.4
66	132.2	96.8	124.3	89.7
67	122.6	95.2	117.3	90.1
68	120.4	96.3	117.1	93
69	106.4	98.4	105.1	96.4
1970	100	100	100	100
71	105.7	99.5	106.4	100
72	98.9	97.9	99.6	97.7
73	99.3	89.3	96.8	83.4
74	115.1	92.6	40	80.7
75	109.7	91.4	89.9	80.1
76	109.7	88.3	101.4	77.8
77	94.3	78.3	86.9	64.8
78	84.2	70.6	78.6	62.4
79	106.2	78.1	97.4	68.2
1980	77.5	70.1	71.6	60.8
81	76.8	67.4	70.9	59.4
82	70.5	60.9	66	55.7
83	54.6	54.6	52.4	50.7
84	43	52.4	41.1	50.2
85	39.8	44.9	39.9	44.5
86	39.5	33.2	41.2	34.4
87	28.3	23	29.9	24.1
88	23.5	19.3	24.6	20.1
89	18	17.1	19	17.9
1990	17.8	15.3	19.2	16.2
91	15.2	12.8	16.3	14.3
92	12.6	10.7	14.2	12.4

Table 4.4
Basic statistical results of real exchange rate indices

1961-92	Mean	Standard deviation	Coefficient of variation	Range
REER	78.53	39.44	50.22	125.3
RER	130.58	59.01	45.19	173
REER _p	73.75	35.64	48.36	113.7
RER _p	123.32	54.53	44.22	165.5
1961-70				
REER	117.4	13.91	11.85	44
RER	181.8	5.54	2.99	18
REER _p	110.48	10.20	9.23	34.2
RER _p	172.3	8.06	4.68	25.6
1971-80				
REER	93.03	11.05	11.88	34.9
RER	159.1	20.85	13.11	55
REER _p	85.15	9.92	11.65	32.2
RER _p	146.65	26.12	17.81	74.1
1981-92				
REER	34.06	42.56	124.96	59.7
RER	64.12	38.61	60.22	106
REER _p	33.64	17.74	52.74	52.5
RER _p	63.04	33.56	53.24	88.7

Figure 4.1

Real exchange rate (RER), with respect to the US dollar, and real effective exchange rate (REER) for the Iranian rial (1961-1992)

$$RER = E(WPI)_{US} / (CPI), \text{ and } REER = \sum_{i=1}^n w_i E_i (WPI)_i^* / (CPI)$$

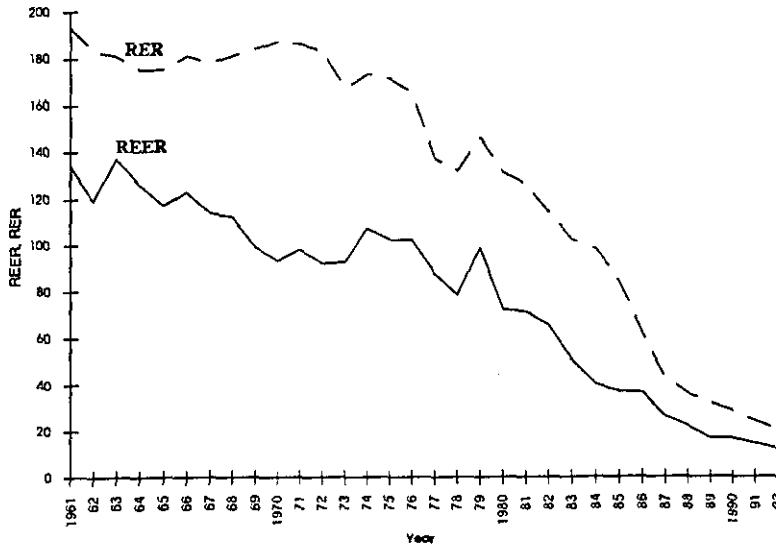
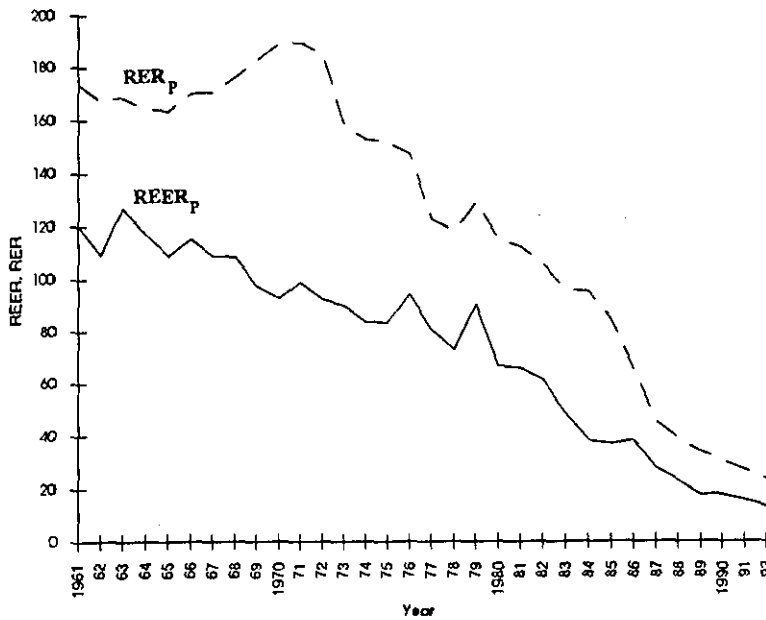


Figure 4.2

Purchasing power parity RER, with respect to the US dollar, and REER for the Iranian rial (1961-1992)

$$RER_p = E(CPI)_{US} / (CPI), \text{ and } REER_p = \sum_{i=1}^n w_i E_i (CPI)_i^* / (CPI)$$



As a result a growing foreign exchange crisis developed. As noted previously, in 1983 the government started responding to the foreign exchange problem by increasing the nominal exchange rate through a multiple-rate system, the import compression policy and foreign exchange controls. But the correction was not effective in resolving such problems.

From a detailed analysis of the real exchange rate diagrams, it is necessary to classify the period of this study into three sub-periods. The rules as regards the classification are only approximate and take into account the impact of various factors on the real exchange rate behaviour throughout the period.

The first sub-period is from 1961-1970. During these years, because of the relative stability in the domestic economy and also predominantly the Bretton Woods system which, in turn, reduced the volatility of the major currencies, the trends of various real exchange rate indices do not show a massive real appreciation of domestic currency. In these years, that were consistent with the third and fourth development plans, the gap between aggregate demand and aggregate supply was small and the growth rate of money liquidity was insignificant. Consequently, inflation was kept at an uncommonly low rate of (about) 3 percent a year. However, rising world prices resulted in some difficulties for developing countries whose economies depended upon imports, but this was not a serious problem with respect to the Iranian real exchange rates.

Another point regarding this sub-period is that the real exchange rates do not show a strong long-term trend. For bilateral indices two distinct eras can be distinguished. The two eras are separated by a real appreciation (1961-1966) and a real depreciation (1967-1970). While multilateral indices exhibit a quite stable trend.

The second sub-period is from 1971-1980. In this era, the Iranian official real exchange rate exhibit a long-term trend towards a significant real appreciation. During these years, with a sharp rise in the world price of oil and a high level of the volume of oil exports, a golden financial opportunity for the Iranian economy was provided. For this reason, the development plan of this period was subject to a drastic revision. More attention to the private sector, a rise in money liquidity and growing aggregate demand due to the increase in oil revenue on the one hand, and the sharp increase in the government current and capital expenditure which were not put to productive use and an increase in investment of private and public

sectors on the other hand, generated a huge excess aggregate demand that aggravated the rising rate of inflation which had started in the previous sub-period.

Using the anti-inflation policy, which due to the high level of demand with respect to supply and to inconsistency between other macroeconomic policies was not able to resolve these problems.

In sum, changes in fundamental variables such as the world price of oil, external terms of trade, and the composition of the government expenditure and also inconsistency between the government fiscal and monetary policy resulted in a real appreciation in the Iranian official real exchange rates during these years.⁵

The third sub-period is from 1981-1992. In this sub-period we also can observe strong downward trends which started in 1971. However, the main causes of real appreciation between 1972 and 1979 were due to changes in fundamental factors, but the same can not be said about the massive real appreciation which has been observed since 1980. During 1981-1992 changes in the fundamental variables were mostly in the opposite direction to what happened to the real exchange rates. A reduction in oil production and oil exports cut by a half compared with before the revolution (1979). The collapse of the oil price, particularly in 1986, the flight of private capital and a deterioration in the external terms of trade should, on the basis of the theoretical view of chapter 3, lead to a real depreciation. But due to a fall in agricultural and industrial production, loss of productive potential because of the specific revolutionary situation, accumulation of private capital in the service sector, boycott of the Iranian economy by some industrial countries, starting the war between Iran and Iraq, a sharp increase in the government's current expenditure in order to meet the public's essential demands and war needs, huge budget deficit and more important than the others the financing of this budget deficit entirely by borrowing from the central bank, a large gap has been created between aggregate demand and aggregate supply which, in turn, resulted in a more inflationary situation. Nevertheless, the post-revolutionary government started responding to these problems by various rationing schemes and price controls, but, overall, the Iranian economy has experienced a high rate of inflation and accordingly, under a predetermined nominal exchange rate, a massive real appreciation.

⁵ The impact of such inconsistency will be discussed empirically in the next chapter.

In total, the main factor in the government's unsuccessful policy of controlling high rate of inflation and stabilising the value of the domestic currency, was an inconsistency between its macroeconomic policies. In particular financing its large fiscal deficit by money creation, and adopting the predetermined exchange rate system, accompanied by other restriction (mentioned above) which led to an increase in aggregate demand and a decrease in aggregate supply generating a higher rate of inflation or in other words a strong real appreciation.

4.3 The black market for foreign currency and the behaviour of the real exchange rate

So far, only the behaviour of the official real exchange rate has been investigated. As mentioned in Chapter 1, in many developing countries, including Iran, the black market for foreign currency is quite significant and potentially influential when considering exchange rate policy. Under these circumstances, when some international transactions in goods, services and assets are subject to the black market exchange rate, the possibility of having more than one real exchange rate will arise.

Experience shows in many cases that the two indices (official and unofficial) are different and tend to move in opposite directions. That is because, when access to the official foreign exchange market is limited and there are various foreign exchange restrictions on international transactions, an excess demand for foreign currency at the official rate will emerge. When it happens, some of the supply of foreign currency will be sold legally or illegally at a market whose price is higher than the official rate. Exporters, who have to surrender all foreign exchange to the government, have an incentive to understate the true value of their exports in order to reduce the amount of foreign exchange that should be surrendered to the central bank. Similarly, importers, when applying for foreign currency to the authorities, will overstate the value of the imports. It means that the black market for foreign exchange is always associated with mis-invoicing of trade values to divert part of the foreign currency obtained at the official rate towards the black market. The common implication of such an issue is that the government loses its expected foreign exchange income. The foreign exchange deficit usually leads to the imposing of an extra protectionist measures to selectively cut the level of imports or a massive depreciation to increase export revenues and decrease import costs, (see Dornbusch 1993). These policies, in addition to reducing the standard of

living, may create an inflationary environment. If such a situation is accompanied by a huge domestic credit creation, as happened in the Iranian economy, it will contemporaneously generate an appreciation of the official real exchange rate and a depreciation of the black market exchange rate.

The black market for foreign exchange has operated continually in the Iranian economy since 1977. Of course, before the revolution (1979) there was no sizeable black market in foreign exchange because the demand for foreign currency was totally controlled by the government at the official rate. Immediately after the revolution, the demand rose sharply. However, the post-revolutionary government has imposed some policies to end the unsatisfied demand, but it could not make available foreign exchange to meet the demand for foreign currency at the existing official rate. As usual, the government had to organise the rationing of available foreign exchange. As a result of such controls and widespread trade restrictions, a significant black market in goods and foreign currency have been generated. This has increased inflationary pressures and produced serious macroeconomic distortions in the Iranian economy.

Empirical evidence suggests that the variation and existence of the black market exchange rate depends on a variety of factors. Therefore, instituting an appropriate policy to relieve the impact of the black market on the economic activity and to draw the resources away from operating in this market is quite difficult, requiring a view of the significance and the nature of the black market.

The purpose of this section is to investigate the relationship between the black market for foreign currency and the real exchange rate behaviour in Iran over the period 1980-1992.⁶

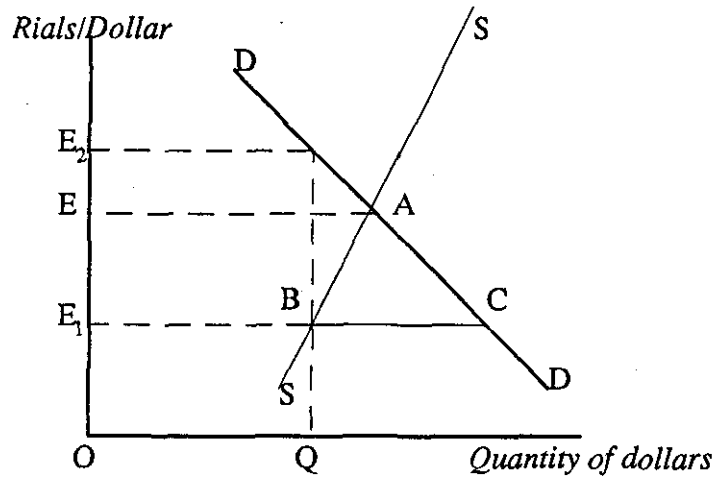
4.3.1 The theory of the black market for foreign currency

From a theoretical standpoint, whenever any domestic or international policies cause a divergence between the equilibrium and observed exchange rates, a black market in foreign currency is likely to emerge. Figure 4.3 shows the traditional supply and demand for foreign exchange, (for instance, for the US. dollars in the Iranian foreign exchange market).

⁶ In this study, collected data on the black market refers to the nominal exchange rate with respect to the US dollar.

Figure 4.3

The ordinary supply and demand for foreign currency



As the curves are drawn, the equilibrium point is labelled A. At this point the quantity of dollars supplied equals the quantity of dollar demanded. Hence, the exchange rate E is the equilibrium rate determined by the level of income, preferences, and the purchasing power parity of the domestic economy.

Let us investigate the effect of a displacement of the exchange rate from its equilibrium E to E_1 by the government's decision to predetermine the nominal exchange rate at this level. The exchange rate E_1 shows the domestic currency (rial) is overvalued with respect to the US dollar. Normally, a domestic currency appreciation results in an excess demand, BC , for foreign exchange. An excess demand for an asset will generally result in a further price increase.

A crucial question is how can the government institute this decision? Basically, two solutions face the monetary authorities. First, they can maintain the exchange rate E_1 if they satisfy the excess demand BC by using international reserves. Second, if the international reserves are not large enough to cover BC , a rationing scheme must be imposed. In the case of low international reserves, the restriction of foreign exchange have to be introduced.

In the case of Iran, a black market for foreign exchange has arisen in response to the government controls on access to foreign currencies. Typically, the controls have been imposed to protect the country's limited stock of international reserves.

The need for this protection, in fact, has been caused by trade deficits and capital flight that had created an excess demand for foreign currency. When the government started imposing the limitation on the allocation foreign exchange and on transferring it abroad, naturally, demand for an alternative source of the foreign currency arose. In response to such circumstances, the black market for foreign currency took place.

Although using the disequilibrium exchange rate has helped the government to make income distribution more equal, the system misallocated resources towards the sector which, from the social point of view, wasted scarce resources. Because such policies created windfall economic rents for those sectors that used the imported factors of production specified to activities receiving special protection. In addition to this problem, the rationing of foreign exchange by quotas, licences and other absolute restrictions, created a huge bureaucracy in order to control the situation. This system, in turn, not only increased the government's current expenditure but also opened the door to corruption. Moreover, the overvalued rial, in fact, operated as a tax on the economic activities that provide foreign exchange income. So as to avoid paying such taxes, importers and exporters found a way to misinvoice the right value of the trade. This process, as expected, led to a decline in the government's foreign exchange revenue, generating a decrease in the supply of foreign exchange at the official rate. In consequence, when the government has not been able to satisfy the existing demand for foreign currency at the official rate, the people who needed foreign currency and were not able to obtain all they desired from official sources, had an incentive to find an alternative source by paying more.

According to Figure 4.3, with the assumption that the government is not able to satisfy the excess demand BC, the rate of black dollar will be higher than the official rate and somewhere between E and E_2 . That is because, in most cases the black market for foreign currency is illegal, thus non-economic events play a fundamental role in determining this rate. The expectation, cost of detection, and even political events have significant effect on the size of this market.

4.3.2 Inflation and black market

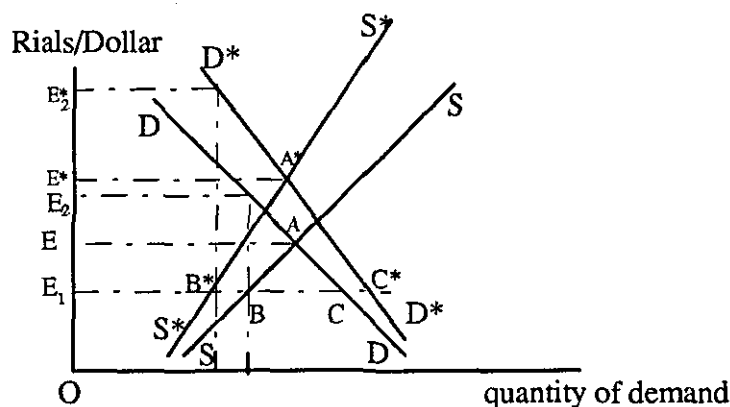
Changes in the relative price levels between the countries alters the relative attractiveness of foreign and domestic goods in the countries. Since the demands for and supply of foreign currency are a result of the export and import of

commodities, this process eventually leads to a shift in the demand and supply curves for foreign currency.

We now assume that the domestic economy experiences a demand-pull inflation, and that the price levels in the trading partners remain constant. If the government does not change the official exchange rate, the equilibrium nominal exchange rate is expected to increase by the same proportion as the domestic inflation rate.⁷ But, the black market exchange rate will increase by more than the rate of domestic inflation. The analysis of such an influence is straightforward and may best be illustrated by the shortage of foreign currency supplied under the rationing scheme. As before, Figure 4.4 shows the market for US dollars in the Iranian economy. Domestic inflation (assuming no other changes) causes the demand curve to shift upwards from DD to D^*D^* and the supply curve shifts upwards to the left from SS to S^*S^* . As a result, the equilibrium rate E shifts to E^* , and the black market rate goes up to E_2^* . As assumed, if all other variables including the official rate are held constant, the ratio $E_2E_2^*/OE_2$, (percentage change in the black market rate) should be greater than EE^*/OE , (percentage change in the equilibrium nominal exchange rate).

Figure 4.4

Black market exchange rate and a rise in inflation



In fact the demand-pull inflation, under the most plausible conditions, will generates a real appreciation. In principle, not only inflation but also any other policies that create

⁷ Based on the PPP rule, the equilibrium exchange rate can be defined as $E = P/P^*$ or $\hat{E} = \hat{P} - \hat{P}^*$, (P and P^* are domestic and foreign price levels, and $\hat{}$ denotes the percentage changes). Accordingly, if the foreign price is constant, the percentage changes in equilibrium nominal exchange rate will be equal the percentage changes in the domestic price.

the black market for foreign currency, in turn, may produce a real appreciation. Based on this, a positive correlation between the premium in the black market for foreign currency and the real exchange rate misalignment (persistent overvalued real exchange rate) could exist.⁸

4.3.3 Black market and an extra real appreciation

The development of a black market is dependent on unofficial supplies of foreign exchange supplied by various illegal or legal sources created by faking trade invoices. As mentioned previously, misinvoicing of trade transactions implies that the government receives less than the full expected foreign exchange income. The immediate implication of this foreign exchange deficit, under a predetermined nominal exchange rate, is that the existing level of imports cannot be financed by the government at the official rate. This, thus, forces the policy makers to impose extra trade restrictions, which brings with it an additional depreciation of the black market exchange rate.⁹ With this assumption that economic activity which is performed through the black market channel is quite a significant factor, as occurs in the Iranian economy, such a depreciation is anticipated to raise the price of importable goods in the home country. Since the production in developing countries depends mostly on imported goods, as a consequence, import prices enter into the domestic price indices. The process of such an affect is that, as prices of imported inputs rise, the cost of the relevant domestically produced goods will increase and hence other product prices may increase as well. Following the increases in the domestic price level, the work force may press for higher wages that is spreads inflation to other sectors of the economy. Accordingly, inflation, in turn, promotes further official real exchange rate appreciation.

4.3.4 Black market and real exchange rate misalignment

Due to the adoption of a predetermined exchange rate by most developing countries, policy makers in such countries have to try to reduce the degree of their real exchange rate misalignment by appropriate exchange rate policies. A perennial problem associated with the implementation of such policies is that the degree of overvaluation (or undervaluation) of a specific currency is very difficult to measure. This is because

⁸ In this investigation, it is implicitly assumed that the undervalued real exchange rate is less common and less destructive to economic activities than an overvalued one.

⁹ Nominal depreciation of the domestic currency could be an alternative policy in order to increase export competitiveness and reduce import dependence. But in the Iranian economy, it has effectively never been used.

the equilibrium level of the real exchange rate is unobservable and depends on a range of fundamental and macroeconomic factors. As a result of such difficulties, economists have been looking at this issue by using some indirect methods. One of these methods is based on information from the black market for foreign currency in order to measure the extent of real exchange rate misalignment. The black market premium indicates that there is an excess demand for foreign currency at the official rate. Such excess demand, in turn, is interpreted as a result of an overvaluation of the domestic currency at the prevailing official exchange rate. Edwards (1989) and Kamin (1993) have investigated the impact of unsustainable financial policies on the real exchange rate misalignment and the black market premium. The main finding from this analysis is that, during the adjustment process, overvalued real exchange rates are accompanied by a high black market premium. They have also pointed out, the black market premium often rises very rapidly in the period preceding a massive nominal devaluation, and then falls off quite drastically immediately after the devaluation. As a consequence, the existence of such positive correlation between the premium on foreign exchange in the black market and the divergence of the actual real exchange rate from its long-run equilibrium value supports the view that there is a positive correlation between them. In spite of this empirical support, some authors believe that there are analytically some doubts about the reliability of the premium as a useful indicator of real exchange rate misalignment. They rely on the fact that the black market premium is an asset price, and is expected to exhibit much greater volatility than the official real exchange rate, particularly, by responding to temporary shocks that do not affect the equilibrium real exchange rate.

Montiel and Ostry (1994) have investigated this issue in the context of a fully optimising model of a developing country that simultaneously determines the degree of misalignment of the real exchange rate and the premium in the black market. This analysis has suggested that the informational content of the premium may be limited, since in response to a shock the premium is both positive and negative at various times along the adjustment path, while the degree of overvaluation of the currency is always positive for a negative shock and always negative for a positive shock. Consequently, the black market premium can not by itself provide reliable information about the sign and magnitude of a real exchange rate misalignment. However, the premium may provide useful information about the relationship between the real exchange rate and its equilibrium level, but it is dangerous to draw inferences about the deviation of the actual exchange rate from its equilibrium level based on an observation of the premium at a given moment in time.

Although their intuitions are analytically supported by a quite comprehensive model, the case for treating the premium in the black market for foreign currency as an unreliable indicator of the sign and magnitude of a real exchange rate misalignment just by relying on the different behaviour of these two variables at various times during the adjustment process seems to be far from conclusive. The difference between them does not arise from the difference between the nature of these two variables. In other words, it cannot be said that under all circumstances such differences exist. It depends directly on the source of the shocks and also on the structure of the economy in which the adjustment takes place. Under some conditions, a specific shock can impose a similar influence on both the official and the black market exchange rates. It means, even a negative shock may have a negative effect on both of them, and vice versa.

For example, a worsening in the country's external terms of trade, say due to a permanent increase in the foreign price of importable goods, will depreciate the official real exchange rate, this has a negative effect on the overvalued real exchange rate.¹⁰ On the other hand, the terms of trade deterioration may reduce the black market exchange rate through at least two channels. First, the increase in the foreign price of importable goods is expected to reduce the return derived from holding foreign currency as an asset, resulting in a decrease in stock demand for foreign currency in the black market. Second, the negative income effect and high level of foreign prices depress the flow demand in that market. Therefore, it can be concluded that an international negative shock may have similar effects on both the black market and the official exchange rates misalignment (overvalued real exchange rate).

4.3.5 Black market real exchange rate behaviour

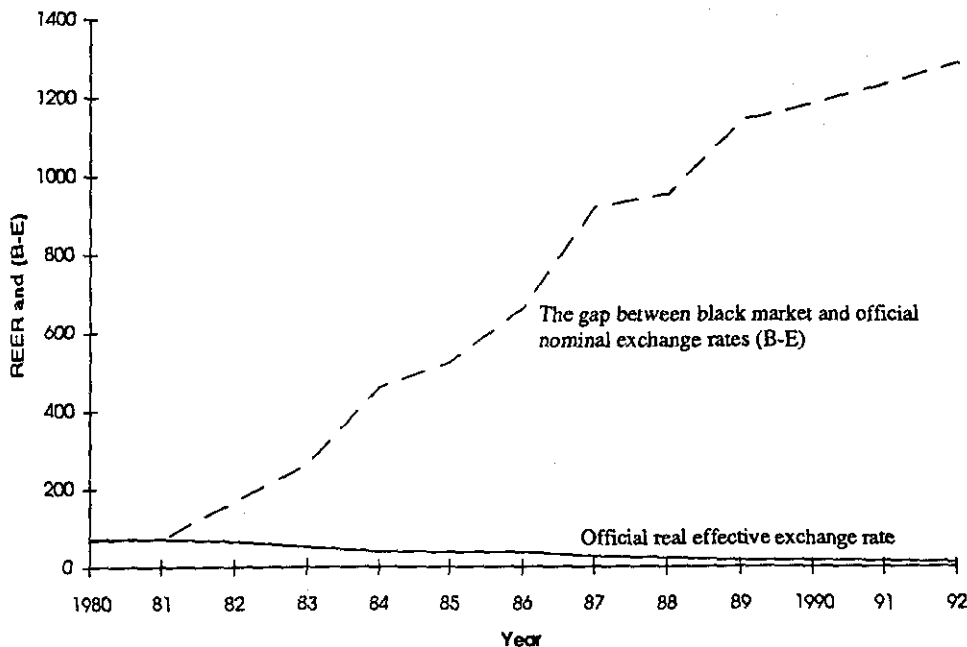
The trends in the black market exchange rate for the Iranian rial with respect to the US dollar over 1980-92 period are depicted in Figure 4.5. It is immediately apparent that the strong upward trend of the black market exchange rate indicates a massive depreciation of the domestic currency (rial) in that market. This fact accompanied by a downward trend in the official real exchange rate provides an important insight as regards the correlation between the black market premium and misalignment. As can be seen from the figure, the increase in the black market exchange rate is associated

¹⁰ As investigated in Chapter 3, the final effect of the terms of trade deterioration (or improvement) on the real exchange rate are ambiguous and depends on whether the income effect dominates the price effect. If the income effect dominates (as some empirical studies suggest) this result will take place.

with the decreases in the official real effective exchange rate.¹¹ We therefore have some evidence to confirm that the conventional positive relationship between the departure of the actual official REER from its equilibrium value and the black market exchange rate.

Figure 4.5

The black market exchange rate for US dollar and the official real effective exchange rate in the Iranian economy (1961-1992)



To support this view, the coefficient of correlation between these two variables is estimated over the period 1980-92. The correlation coefficient is about -0.99. This statistical result supports the existence of a strong negative correlation between the two variables. As a consequence, under these circumstances, the black market premium can be accepted as an indicator of the sign and the magnitude of the real exchange rate misalignment.

¹¹ Generally, any change in the real exchange rate does not necessarily mean a deviation of actual rate from its equilibrium value. Under some conditions, it may lead to a new equilibrium level. But in the case of our study, the existence of a significant black market for foreign currency confirms a disequilibrium condition in the official foreign exchange market. So any increases in the official real rate can be treated as an extra overvaluation or misalignment.

To understand what will happen to the real exchange rate for an economy subject to a black market exchange rate, it helps to consider the common case in a developing country pointed out in the previous section. That is, under a predetermined nominal exchange rate, an increase in the domestic credit that exceed the growth of the demand for domestic money will result in a reduction of the government's international reserves and a high price for nontradable goods. On the basis of prior investigations, it is expected that the high price of nontradables generates a real appreciation. But in the case of the black market where the rate of foreign currency is freely determined by the supply and demand mechanism, the final result may be different and depends on whether, as a result of increases in domestic credit, the black market exchange rate will rise by less or more than the price of nontradable goods. If the black market exchange rate increases by more than the price of domestic goods, the real exchange rate applicable to this type of goods will depreciate.

This is possible at least in the short-run, because the black market rates and domestic price levels adjust to shocks at different speeds. The black market exchange rate as an asset price is expected to respond to changes in expectation and to the availability of new information very rapidly. In contrast, goods markets usually react much more slowly than exchange rates due to their adjustment costs. Furthermore, according to earlier discussions regarding the impact of inflation on the black market premium, if the government, for any reason, is not able to use its international reserves, the increases in domestic credit will sharply raise the black market premium through the creation of inflation. In this case, the behaviour of the black market real exchange rate (BRER) will be anticipated to be different from the official one.

The possibility of having the black market real exchange rate moving in an opposite direction with respect to the official index, can be easily examined by substituting the black market rate instead of the official rate in the main mathematical formula. Thus the equation for constructing the new index can be written as;

$$BRER_t = \frac{B_t (WPI)_t^{US}}{(CPI)_t} \quad (4.3)$$

BRER = the black market real exchange rate index

B = the Iranian black market nominal exchange rate with respect to the US. dollar

(WPI)^{US} = the US. wholesale price index

(CPI) = the domestic (Iranian) consumer price index

Figure 4.6 and Tables 4.5 and 4.6 depict the trend behaviour of the Iranian real exchange rate index which is constructed by using the black market data. Normally, with a sharp increase in the black market exchange rate, it seems highly likely that the BRER would have depreciated over this period. As may be seen from Figure 4.6 this index, as expected, exhibits an upward trend up to 1985, but since 1985 it tends to move in the same direction as the overvalued official index, indicating a real appreciation in the black market. This observed decline in the black market index is in the opposite direction to what one would have expected from the high level of the nominal rate in the black market. The reason behind this unexpected result is that the effect of a rising black market exchange rate is neutralised by the high rate of domestic inflation. An important finding that emerges from this figure is that, any attempt to eliminate the exchange rate misalignment by bringing about a nominal depreciation of the domestic currency without appropriate macroeconomic policies is unlikely to be efficient.

Figure 4.6

The black market real exchange rate (with respect to the US dollar) and official real effective exchange rate for the Iranian rial

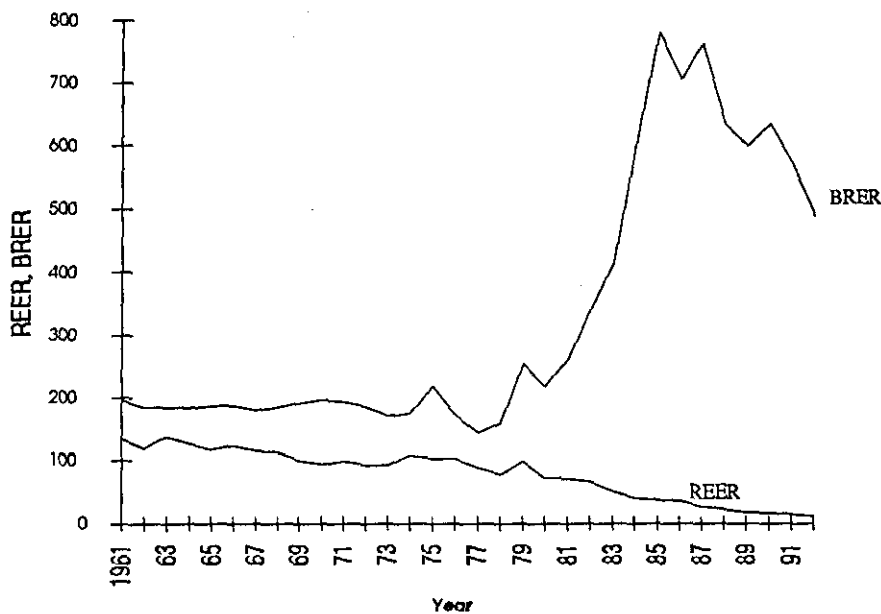


Table 4.5

Black market real exchange rate (BRER) for the Iranian rial

Year	$BRER_t = \frac{B_t (WPI)_t^{US}}{(CPI)_t}$	BRER (1980=100)
1961	195.5	90.3
62	183.3	84.7
63	183.6	84.8
64	182.4	84.3
65	185.7	85.8
66	186.9	86.3
67	177.9	82.2
68	183.1	84.6
69	190.8	88.2
1970	195.4	90.3
71	192.8	89.1
72	184.9	85.4
73	169	78.1
74	173.3	80.1
75	218.3	100.9
76	172.3	79.6
77	142.9	66
78	158.5	73
79	253.5	117.1
1980	216.9	100
81	262	121.1
82	340	167.1
83	415	191.7
84	598	274.9
85	780	360.4
86	705.3	325.8
87	762.6	352.3
88	632.6	292.2
89	599.4	276.9
1990	633.4	292.6
91	571.6	264.1
92	489.2	226

Table 4.6
Basic statistical results of black market real exchange rate

	Mean	Standard deviation	Coefficient of variation	Range
1961-92	329.25	210.32	63.88	637.7
1961-70	186.46	5.78	3.10	17.6
1971-80	188.24	33.01	17.54	110.6
1981-92	565.79	161.58	28.56	518

4.4 Stationarity of the real exchange rates and deviations from PPP

The absolute version of purchasing power parity (PPP) asserts that real disturbances are not important sources of the real exchange rates variability. Therefore, any deviation of actual real exchange rate prevailing at any time from its PPP level is temporary and has no effect on the forecast of the long-run level of real exchange rate. This hypothesis statistically implies that the log of the real exchange rate has to be a trend-stationarity and characterised by a white noise process. On the other hand, if long-run movements in the real exchange rate are found to be inconsistent with PPP, this would imply that real sources of variability could be important and any deviations of the actual real exchange rate from its PPP constant equilibrium level will not necessarily reflect exchange rate misalignment. Rejection or acceptance of such a hypothesis, therefore, has important implications for analysing and policy targeting the real exchange rate.

To test the PPP hypothesis, we test for stationarity of REER, RER and BRER by using the Augmented Dickey-Fuller tests.¹² Table 4.7 reports the results for unit root tests on REER, RER and BRER. As can be seen, the logarithms of real exchange rates are non-stationary in their levels since the null hypothesis of non-stationary is not rejected. In addition Figure 4.7 shows the evolution of logarithm of these variables. This figure also confirms these findings that these variables are clearly not mean-reverting. Therefore, contrary to the purchasing power parity theory, some of the variation in the Iranian real exchange rate can be attributed to

¹² This technique will be explained in the next chapter. See also Dickey and Fuller (1976).

movements due to real shocks. Moreover, when the RERs is non-stationary, the standard regressions are not able to explain the long-run relationship of these variables with their real determinants. Another econometric technique is required to identify the underlying real shocks that explain the long-run movements of the RERs and to determine their relative importance with respect to temporary shocks.

Table 4.7

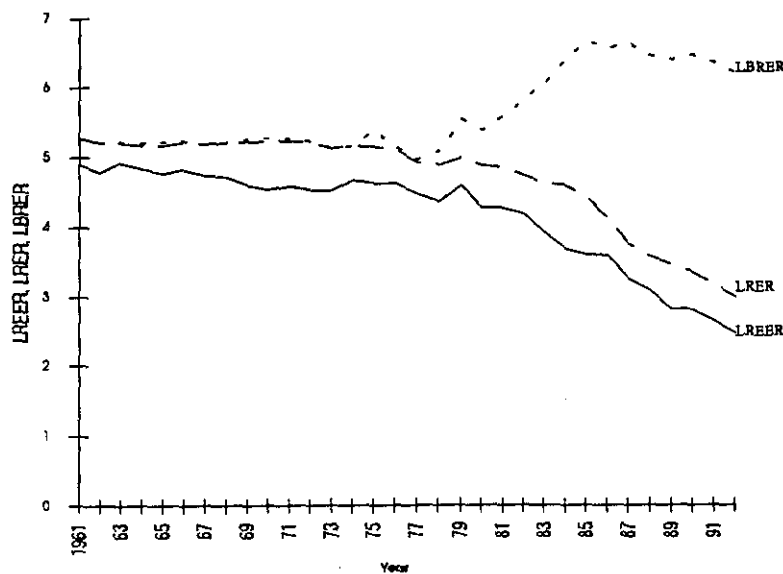
Augmented Dickey-Fuller (ADF) tests for unit roots in REER, RER, and BRER for the Iranian rial

Variable	ADF
Real effective exchange rate (REER)	-0.13
Real exchange rate (RER)	-0.23
Black market real exchange rate (BRER)	-1.68

Critical value reported by Engle and Granger (1987) is -3.57 at the 5% level, Fuller (1976)

Figure 4.7

The trends of log of real effective exchange rate, real exchange rate, and black market real exchange rate for the Iranian rial



4.5 Conclusion

In this chapter we aimed to provide a preliminary information of the trends and variability of the Iranian real exchange rates. For this reason, we started to compute two indices of real and real effective exchange rates. Both indices show a sharp downward increase in the real value of the official exchange rate or real appreciation. Then, due to the importance of the black market exchange rate in the Iranian economy, we continued our investigation with black market real exchange rate behaviour. The results show that for a short period the official and black market real exchange rates have moved in opposite direction, but, otherwise despite their different levels, both have moved in the same way. This is an important result, since it indicates that under inconsistent accompanying policies, a nominal devaluation cannot help to eliminate the real exchange rate misalignment.

Finally, stationary tests for official and black market real exchange rates indicate that, contrary to purchasing power parity theory, these indices are not characterised as a white noise process in the Iranian economy. The interpretation of this result is that real variables play a significant role in determining of the movements of the real exchange rates. These will be investigated in the next chapter.

5

An Empirical Analysis the Dynamic Process of Iranian Real Exchange Rate Behaviour

5.1 Introduction

The theoretical discussion on real exchange rate determination in Chapter 3 indicates that, there is a list of relevant real and nominal variables to incorporate in the analysis of short-run and long-run behaviour of real exchange rates. These variables can be classified as:

1) Fundamental factors; factors which not only determine the equilibrium real exchange rate over the long-run, but also affect the real exchange rate prevailing at any point in time. To the extent that there are long-run changes in any of the fundamental factors, under an equilibrium condition, there will be changes in the real exchange rate to reflect a new equilibrium. The speed at which such adjustment actually takes place depends on various institutional factors including the extent of capital mobility and other variables that can reduce the relative price of the domestically produced goods.

Changes in the fundamentals have two separate effects: temporary and permanent effects. There is no reason to emphasise that these two effects are the same and both can lead to a new equilibrium situation. If the real exchange rate is overvalued at the initial point, any changes in the fundamental determinants may not necessarily lead to a new equilibrium level. Therefore, the view that any changes in the fundamentals will result in an equilibrium real appreciation or depreciation has to be supported by an assumption that the initial situation is one of the equilibrium points

or by accompanying policy is consistent with fundamental changes. In the absence of such assumptions, one cannot make a clear judgement about the effect of fundamental variable changes, at least in the short-run.

II) Macroeconomic policy; in the context of a predetermined exchange rate, inconsistent macroeconomic policies put some pressure on domestic prices, resulting in a potential real exchange rate misalignment. Excessive monetary expansion or loose fiscal policy is reflected in an excessive expansion of domestic credit, which in turn, leads to a temporary real appreciation. A monetary impact associated with an inconsistent set of other macroeconomic policies, however, is short term, it can persist over the long period. As a result, such policies may easily dominate the fundamental long-run effects, generating an increasing degree of misalignment in the short to medium run.¹

It can be understood from the investigation that the real exchange rate responds differently to different types of variables, and in certain instances the short-run response is not necessarily the same as the long-run response. The long-run real exchange rate is affected by real variables only, while the prevailing real exchange rate responds to both real and nominal variables. When there is a long-run relationship between two variables, an important issue is the need to integrate short-run dynamics with long-run equilibrium. Consequently, an efficient technique should be employed to estimate consistently both long-run parameter vectors and the parameters associated with the short-run dynamic adjustment process.

The traditional approach to the modelling of short-run disequilibrium is the partial adjustment model. However, while the empirical evidence and economic interpretation are in favour of this model, during recent years an extension of partial adjustment model, namely the Error Correction Model (ECM), has become popular in empirical work. As will be demonstrated later, an ECM, which gives the short-run dynamics of the long-run relationship, makes up one case of systematic disequilibrium adjustment process through which two variables (dependent and explanatory) are prevented from drifting too far apart. In such a process, the dependent variable changes in response to changes in the explanatory variables, and in addition some proportion of any disequilibrium between equilibrium and actual values is made up in any period.

¹ Another important determinant of RER movements is related to the nominal devaluation of domestic currency. Since this policy has not effectively been used in the Iranian economy, it is not considered in this empirical study.

In this chapter we test the roles played by fundamental and nominal factors in real exchange rate behaviour for the Iranian economy over the 1961-92 period by using annual data. We use cointegration techniques to address this issue and focus on whether stable long-run relationships exist between the real exchange rate and its fundamental determinants.

In section 2, the cointegration technique will be briefly explained. Section 3 introduces the set of variables used in the cointegration test. In section 4, we establish the presence of the unit root in the real exchange rate and its fundamental determinants in order to indicate the existence of a long-run (cointegrating) relationship between the variables under consideration. This section also presents the results and investigates how the cointegrated system can present an error correction model, and then analyses the adjustment path of the real exchange rate following various exogenous shocks through time. Section 5 interprets the estimated long-run and short-run parameters. The final section summarises the results and concludes.

5.2 The cointegration technique

As mentioned above, in order to examine whether there is a stable long-run relationship between the real exchange rate and its determinants, following the methodology of recent empirical studies, the cointegration technique is employed. This technique in its simple version can be of the following form. A non-stationary time series variable say X_t is said to be integrated of order d , if it has to be differenced d times before becoming stationary. If we consider two variables (X and Y) which are both integrated of order 1, then according to Granger (1986) and Engle and Granger (1987), it is generally true that a linear combination of these variables, $U_t = X_t - \alpha Y_t$, will also be integrated of order 1. If a constant like α exists, so that U_t is integrated in order 0, then X and Y are said to be cointegrated.²

A number of approaches have been developed to examine whether stable long-run (cointegration) relationships exist between non-stationary variables and to estimate these relationships. The most widely used is Engle and Granger (1987) method. This method has the advantage of being straightforward to apply, as it relies on the single equation method of ordinary least squares. In spite of this advantage, it has a major limitation. This limitation may arise when the attention turns to behavioural relationship between more than two variables. In this case, there may be more than

² In this case (two variables), α is the constant of cointegration, but in the case of more than two variables, it becomes the cointegrating vector, [see Holden and Thompson (1992)].

one cointegrating relationship between the variables and this method does not provide a way for examining this issue.

For instance, consider three variables Y , X , and Z (where we assume that they are integrated in order 1) in the following system:

$$\begin{aligned} Y_t &= \alpha_0 + \alpha_1 X_t + \alpha_2 Z_t + U_{1t} \\ X_t &= \beta_0 + \beta_1 Y_t + \beta_2 Z_t + U_{2t} \\ Z_t &= \delta_0 + \delta_1 Y_t + \delta_2 X_t + U_{3t} \end{aligned} \quad (5.1)$$

writing in a matrix form gives:

$$\Phi \cdot W = U_t \quad (5.2)$$

where Φ is a 3×3 matrix of coefficients, W is a 3×1 vector of variables and U is a 3×1 vector of residuals. The rank of the cointegration matrix, Φ , comprises the cointegrating vectors of the system. One possibility is that there may be a single cointegrating vector relating all three variables, and the cointegration matrix consists of a set of reported identical vectors. Another possibility is that there are three distinct long-run relationships among the three variables. The Engle-Granger method assumes just one vector. Therefore, it is unclear a priori which one should be found if several vectors exist.³

To avoid such a problem, Johansen (1988) has developed an important method to examine how many cointegrating vectors are available for a set of variables.⁴ In addition, the Johansen approach can be used for obtaining maximum likelihood estimates of the cointegrating vectors and adjustment parameters.⁵

To determine the number of cointegrating vectors by using the Johansen procedure, the following stages will be followed:

- I) On the basis of the theoretical discussion a set of important variables will be selected.
- II) All variables used in the estimation will be tested for deterministic and stochastic non-stationarity.

³ In spite of this problem, there are some special cases where the EG approach can be justified. For example, if there is only a single, or from an economic prospective only one accepted, cointegrating vector and if all other cointegrating variables are exogenous with respect to the dependent variable, then testing for cointegration using the EG method could be the same as other approaches. Moreover, if it is proved that the EG method estimates a combination of the existing cointegrating vectors in a system, that limitation may not be overcome.

⁴ Of course, when more than one cointegrating vector is identified, interpretation of them is not so clear. This is because the estimated relationships are not unique, as any linear combination of the estimated relationships is also a cointegrating relationship, [see Gruen and Wilkinson (1994)].

⁵ For further information, see Holden and Thompson (1992).

III) If the hypothesis of stationarity is rejected for the level forms of variables, and if the same hypothesis is accepted for the first difference of them, then the Johansen procedure will be used to determine the number of cointegrating vectors among the variables and to estimate their values.⁶

As a result, the following section introduces the variables of interest that seem to play a significant role in determining the long-run movement of the real exchange rate in the Iranian economy.

5.3 Definitions and sources of the variables used in estimation

The long-run equilibrium real exchange rate is assumed to respond to real variables categorised as external and internal fundamental variables. The fundamentals considered in this study are the major factors identified in the theoretical literature as being amended to empirical analysis. They are:

I) Terms of trade (TOT): For the terms of trade index, we use the price of exported goods, P_x , divided by the price of imported goods, P_M . Since the economy under consideration is a small open economy and therefore a price-taker on the international markets, then the terms of trade changes are exogenous shocks and their relationship with real exchange rate can be interpreted as a causal link. To examine the fundamental role of TOT changes, the data on the export and import prices were obtained from the various issues of International Trade and Development of the UNCTAD.

II) Trade policy (TP): The trade policy variable is used as a proxy for the major policies affecting trade in general. A good proxy for trade policy does not exist, so some experimentation is necessary. The following proxies have been used in a number of empirical work. (a) The ratio of income over the sum of exports plus imports [see Cottanie et al. (1990)]; In some sense it could be a good indicator with respect to export and import policies, but such an indicator is usually affected by international shocks and also domestic non-trade policies. Furthermore, the effect on the real exchange rate of exports increases are completely different from the effect of import increases, but their roles in this index are the same and they are expected to have similar effect on the real exchange rate. b) The gap between the black market and official exchange rates; in spite of the fact that expectations and some other non-trade factors may affect the size of this gap, it seems to be consistent with the conceptual view of the Iranian economy and to have many

⁶ This procedure can be easily tested by a number of regression packages such as Microfit, RATS and PC FMIL.

characteristics of a good proxy with respect to exchange, trade and capital controls in this economy. Importantly, basic data is available from domestic publications. Therefore, due to these advantages, the latter proxy will be used in this estimation.

III) Investment (I): To determine the potential role of real investment we have used the ratio of gross fixed capital formation to GDP. Data for this variable has been obtained from *International Financial Statistics*, IFS.

IV) Real income (y): To capture the influence of real income changes, we include a measure of this variable, that is real GDP.

Eventually, the equation can be arranged in the following mathematical form to define the changes in the long-run equilibrium real exchange rate.⁷

$$\ln REER_t = \alpha + \beta \ln TOT_t + \delta \ln TP_t + \phi \ln I_t + \kappa \ln y_t + \nu D_t + U_t \quad (5.3)$$

where REER is real effective exchange rate and D is a dummy variable that attempts to capture the impact of revolution, war and their consequences. It is equal to one in 1978-92 and zero for the rest of the period.

5.4 Econometric results

5.4.1 Unit-root tests

Before embarking on the cointegration analysis it is necessary to test the order of integration of all variables used in this estimation. The common tests to carry out this exercise are Dicky-Fuller (DF) and the Augmented Dicky-Fuller (ADF) tests.⁸

⁷ Two points should be noted in this regard: first, such an estimation of the real exchange rate, particularly for developing countries, faces some data unavailability. Therefore, we had to ignore some of the variables such as capital flights, technological progress, and the composition of the government spending, which certainly have significant effects on the real exchange rate behaviour in the Iranian economy. Second, as with any empirical equation, the choice of variables and the measurement of their value may be open to debate. However, we have tried to introduce some variables that seem to be more relevant to the economy under study, changing the number of variables or introducing different proxies for them may alter the final result of this empirical work.

⁸ For a time series variable, for example Y, the AD and ADF tests for unit root involve estimating the following equations by using ordinary least square estimator:

$$\text{For DF test } \Delta Y_t = a + bY_{t-1} + U_t$$

$$\text{For ADF test } \Delta Y_t = a + bY_{t-1} + \sum_{i=1}^k c_i \Delta Y_{t-i} + U_t$$

where Δ is the first difference operator, a, b, and c are the parameters to be estimated, and U is an error term which is serially uncorrelated random term. The terms of ΔY_{t-1} are included by ADF to ensure that U is a white noise residual.

If $b > 1$, Y is non-stationary or integrated of order higher than 1. It means that a displacement in year $t-1$ is followed by an even larger displacement in year t.

The results of these tests are presented in Table 5.1. As shown in the table, the conclusion is that, when applied to the levels of all variables, the null hypothesis of unit root tests cannot be rejected, but we reject the null hypothesis for the first differences. Consequently all of these variables are valid candidates for inclusion in a cointegrating vector.

Table 5.1
Unit root tests

Variable	Level		First difference	
	DF	ADF	DF	ADF
ln REER	-0.40	-0.14	-7.43	-4.75
ln TOT	-1.12	-1.15	-5.20	-3.67
ln TP	-2.69	-2.27	-7.37	-4.96
ln I	-2.15	-2.14	-5.42	-3.41
ln y	-1.14	-1.86	-4.76	-3.44

The critical value for DF and ADF from the Fuller (1976) table is -3.56 and -3.57 at 5% level of significant, and -3.18 and -3.19 at 10% level.

5.4.2 Cointegration results

The next step is to examine whether the non-stationary series identified above are cointegrated. We test for the existence of such a relationship using the Maximum Likelihood cointegration technique developed by Johansen (1988) and Johansen and Juelius (1990).

The results are presented in Tables 5.2 and 5.3. In the case where there is more than one cointegrating vector, we interpret only the vector which is consistent with our theoretical discussion. The results in Table 5.2 provide significant evidence of

If $b = 1$, Y is non-stationary with integration of order 1 and Y is a random walk with drift.

If $0 < b < 1$, Y is stationary. It means a displacement in year $t-1$ is followed by a smaller displacement in year t .

If $-1 < b < 0$, Y is stationary, but the adjustment process is not smooth as in the previous case.

If $b \leq -1$, Y is non-stationary. In this case, the fluctuation around the long value are constant ($b = -1$) or continuously widening ($b < -1$).

In this and next chapters such equations (with intercept and trend) will be estimated for each variable.

cointegration. It is also clear from Table 5.3 that coefficient estimates are all of the expected sign.

Table 5.2

Tests for the number of cointegrating vectors

Real exchange rate equation: $\ln REER_t = \alpha + \beta \ln TOT_t + \delta \ln TP_t + \phi \ln I_t + \kappa \ln y_t + \nu D_t + U_t$

Cointegration LR test based on Maximal Eigenvalue of the stochastic matrix

Null	Alternative	Statistic	95% critical value ⁽¹⁾
$r = 0$	$r = 1$	56.11	40.30
$r \leq 1$	$r = 2$	42.17	34.40
$r \leq 2$	$r = 3$	21.65	28.14

Cointegration LR test based on Trace of the stochastic matrix

Null	Alternative	Statistic	95% critical value
$r = 0$	$r \geq 1$	151.31	102.14
$r \leq 1$	$r \geq 2$	95.20	76.07
$r \leq 2$	$r \geq 3$	53.03	53.12

(1) Critical value taken from Osterwald-Lenum (1992), Table 1.

Table 5.3

Estimated cointegrated vectors in Johansen estimation

Variable	$\ln REER$	$\ln TOT$	$\ln TP$	$\ln y$	$\ln I$	D	Intercept
Accepted vector	0.86 (-1.00)	-0.63 (0.73)	0.26 (-0.31)	0.74 (-0.85)	-0.39 (0.45)	0.41 (-0.48)	-8.01 (9.34)

The result in Table 5.3 implies that the estimated long-run equation for real exchange rate is given by:

$$\ln REER_t = 9.34 + 0.73 \ln TOT_t - 0.31 \ln TP_t - 0.85 \ln y_t + 0.45 \ln I_t - 0.48 D_t \quad (5.4)$$

5.4.3 Error correction specification

Engle and Granger (1987) and Granger (1986) have demonstrated that if a number of variables are cointegrated, then there exists a valid error correction model relating to all variables. For instance, if there is a system of variables Y which are cointegrated with cointegrating vectors given by a matrix Φ , an error correction model exists of the following form, [see Holden and Thompson (1992)]:

$$\Delta Y = \omega \cdot (Y_{t-1} \cdot \Phi) + K_t \cdot \beta + \varepsilon_t \quad (5.5)$$

where Δ is the first difference operator, K is a vector of stationary variables, $Y_{t-1} \cdot \Phi$ indicates the deviation of the system from its equilibrium level, and ω provides the speeds of adjustment towards the equilibrium level for each variable.

The specification of the error correction model is now quite straightforward. Utilising the general to specific methodology and successively omitting variables which are statistically insignificant, and considering the first difference of the cointegrated and other $I(1)$ variables suggested by economic theory together with the lagged residual from the long-run vector was the dynamic error correction model estimated for real exchange rate as follows:

$$\begin{aligned} \Delta \ln REER_t = & A + \alpha_1 \Delta \ln TOT_{t-1} + \alpha_2 \Delta \ln TP_t + \alpha_3 \Delta \ln y_{t-1} + \alpha_4 \Delta \ln I_t \\ & + \alpha_5 \Delta \ln DC_t + \alpha_6 \hat{U}_{t-1} + \alpha_8 D_{ii} + \alpha_7 D_{t2} + V_t \end{aligned} \quad (5.6)$$

TOT, TP, y and I have been previously defined. DC is the ratio of domestic credit over GDP that measures government fiscal and monetary policy.⁹ U_{t-1} is the lagged value of the estimated residuals derived from the cointegration equation.¹⁰ D_1 and D_2 are dummy variables which measure the impact of revolution and war, where D_1 is equal 1 in 1978 and 1979 and zero otherwise, and D_2 is equal 1 in 1980-88 and zero for the rest of the period.

⁹ The estimated value of DF and ADF tests are -2.34 and -2.49 for the level of DC, and -6.93 and -3.85 for the first difference of DC. This means that DC is $I(1)$.

¹⁰ Since the error correction model describes the mechanism of adjustment to long-run equilibrium embodied in the cointegration regression, the coefficient of the lagged value of estimated residuals derived from that regression measures the single period response of the actual real exchange rate to departures from its equilibrium value. Therefore, the sign of this coefficient should be negative. The high negative value of it, i.e. closer to -1, indicates that in the absence of other intervention, any deviation of actual rate from its equilibrium value will be mostly eliminated in one period. In the other words, if the actual rate is above its equilibrium level, the negative coefficient of lagged residuals implies that the actual rate will decline in next period. This what would be expected if the RER deviated from its long-run equilibrium. In general, the existence of such a deviation states that there is an actual level that may be higher or lower than the equilibrium level, depending on the direction of deviation. The error correction mechanism works to converge the actual rate towards its equilibrium level.

The ratio of domestic credit to GDP is included to capture the impact of fiscal and monetary policy. In practice, probably the most commonly used measure of the (proxy of) macroeconomic policy is the excess domestic credit which is given by $[\Delta(\text{DC})_t/(\text{DC})_{t-1}] - \Delta \log y_t$. In addition to this common proxy we have used several alternative proxies to estimate the impact on the real exchange rate of macroeconomic policy, such as the rate of growth of domestic credit and even the level of the domestic credit. Unfortunately, their estimated coefficients are too small, around -0.003, and statistically insignificant. This means that inconsistent macroeconomic policies even for a period of 10 years does not result in a substantial disequilibrium. In this sense, the level of the coefficient of macroeconomic policy cannot support the common view that in the Iranian economy, particularly in last two decades, inconsistent fiscal and monetary policy generated pressures that ultimately created a situation of real exchange rate disequilibrium. Table 5.4 presents the econometric results estimated by the Ordinary Least Squares (OLS) techniques for the period 1961-92, using annual data.

Table 5.4

Error correction model estimates:

$$\Delta \ln \text{REER}_t = A + \alpha_1 \Delta \ln \text{TOT}_{t-1} + \alpha_2 \Delta \ln \text{TP}_t + \alpha_3 \Delta \ln y_{t-1} + \alpha_4 \Delta \ln I_t + \alpha_5 \Delta \ln \text{DC}_t \\ + \alpha_6 \hat{U}_{t-1} + \alpha_7 D_{11} + \alpha_8 D_{12} + V_t$$

Regressor	Coefficient	Standard error	T-ratio	Significance level
A	0.06	0.044	1.27	0.220
$\Delta \ln \text{TOT}_{t-1}$	0.32	0.083	3.87	0.001
$\Delta \ln \text{TP}_t$	-0.06	0.024	-2.36	0.029
$\Delta \ln y_{t-1}$	-0.72	0.324	-2.22	0.038
$\Delta \ln I_t$	-0.61	0.112	-5.45	0.000
$\Delta \ln \text{DC}_t$	-0.29	0.142	-2.02	0.057
U_{t-1}	-0.17	0.095	-1.80	0.087
D_1	-0.11	0.061	-1.76	0.093
D_2	-0.11	0.047	-2.36	0.029
R-Squared 0.76		DW-statistic 2.5		
Diagnostic Tests;				
Serial Correlation	CHI-SQ (1) = 3.30 (0.069)		F (1, 19) = 2.44 (0.135)	
Functional form	CHI-SQ (1) = 0.76 (0.382)		F (1, 19) = 0.51 (0.482)	
Normality	CHI-SQ (1) = 3.91 (0.142)		---	
Heteroscedasticity	CHI-SQ (1) = 0.11 (0.737)		F (1, 27) = 0.11 (0.748)	

As may be seen from this table, the overall performance of this model is satisfactory. The signs of all estimated coefficients are according to the theoretical expectation.

The result of various diagnostic tests to detect functional specification are also given in the table. Firstly, the F-test for serial correlation suggest that the estimated residual do not exhibit serial correlation. Secondly, despite the data unavailability for some variables, Ramsey's Reset Test, which uses the square of the fitted value, indicates that the coefficients of omitted explanatory variables are not quite significant. Thirdly, the Lagrange multiplier Test suggested that it is not possible to reject the hypothesis of normality of the error term.

5.4.4 Adjustment path of the real exchange rate

The distributed lag effect of a unit change in one of the explanatory variables on the dependent variables is one of the major shortcomings of the standard linear regression model. The error-correction equation, that specifies a causal relationship between the real exchange rate and its determinants, states that a unit change in one of the explanatory variables can result in a change in the real exchange rate only during the period specified by the model. In practice, changes in, for example, the country's terms of trade may affect real exchange rate over various periods.

This section aims to develop our findings from the previous section by estimating the adjustment path of the real exchange rate following various exogenous shocks. Generally, two different exogenous shocks can be applied to equation 5.6: a temporary (once-and-for-all) and a permanent (continuous) change in the explanatory variables.

5.4.4.1 The time path of the real exchange rate following a temporary exogenous shock

Representing our error correction model as:

$$\Delta Y_t = \beta_0 + \beta_1 \Delta X_t + \delta \hat{U}_{t-1}$$

where (from the long-run equation) $\hat{U}_{t-1} = (Y - \alpha_0 - \alpha_1 X)_{t-1}$

$$\text{then } \Delta Y_t = \beta_0 + \beta_1 \Delta X_t + \delta (Y_{t-1} - \alpha_0 - \alpha_1 X_{t-1}) \quad [5.7]$$

$$\text{and } Y_t = (\beta_0 - \delta \alpha_0) + (1 + \delta) Y_{t-1} + \beta_1 X_t - (\beta_1 + \delta \alpha_1) X_{t-1}$$

Thus the impact effect of a one-unit, once-and-for-all, increase in X_t on Y_t would be β_1 . In the second period ($t + 1$) the effect will be:

$$\begin{aligned}
 Y_{t+1} &= \beta_1(1+\delta) - (\beta_1 + \delta\alpha_1) = \delta(\beta_1 - \alpha_1) \\
 Y_{t+2} &= (1+\delta)\delta(\beta_1 - \alpha_1) \\
 Y_{t+3} &= (1+\delta)^2\delta(\beta_1 - \alpha_1) \\
 &\vdots \\
 Y_{t+n} &= (1+\delta)^{n-1}\delta(\beta_1 - \alpha_1)
 \end{aligned} \tag{5.8}$$

Above discussion presented the estimation of the distributed lag effect starting from the time of change in the explanatory variable. As can be seen from the error correction model, there are some independent variables which have negligible effect on the short-run behaviour of the real exchange rate for the time of changes in those variables, but after one period their effects are felt. This form of distributed lag effects can be estimated easily by using a similar approach employed above. Consider the following form of error correction model:

$$\begin{aligned}
 \Delta Y_t &= \beta_0 + \beta_1 \Delta X_{t-1} + \delta \hat{U}_{t-1} \\
 \text{as before; } \hat{U}_{t-1} &= (Y - \alpha_0 - \alpha_1 X)_{t-1} \\
 \text{then } \Delta Y_t &= \beta_0 + \beta_1 \Delta X_{t-1} + \delta(Y_{t-1} - \alpha_0 - \alpha_1 X_{t-1}) \\
 \text{and } Y_t &= (\beta_0 - \delta\alpha_0) + (\beta_1 - \delta\alpha_1)X_{t-1} - \beta_1 X_{t-2} + (1+\delta)Y_{t-1}
 \end{aligned} \tag{5.9}$$

In this case, the impact effect of a one-unit, once-and-for-all, increase in X_{t-1} on Y_t would be $(\beta_1 - \delta\alpha_1)$. In the next periods the effect will be:

$$\begin{aligned}
 Y_{t+1} &= \delta(\beta_1 - \alpha_1 - \delta\alpha_1) \\
 Y_{t+2} &= (1+\delta)\delta(\beta_1 - \alpha_1 - \delta\alpha_1) \\
 Y_{t+3} &= (1+\delta)^2\delta(\beta_1 - \alpha_1 - \delta\alpha_1) \\
 &\vdots \\
 Y_{t+n} &= (1+\delta)^{n-1}\delta(\beta_1 - \alpha_1 - \delta\alpha_1)
 \end{aligned} \tag{5.10}$$

The effect of a temporary unsustainable macroeconomic policy can also be estimated as;

$$\begin{aligned}
 \Delta Y_t &= \beta_0 + \beta_1 \Delta X_t + \delta \hat{U}_{t-1} \\
 \text{in this case, } \hat{U}_{t-1} &= (Y - \alpha_0 - \alpha_1 Z)_{t-1} \\
 \text{then } \Delta Y_t &= \beta_0 + \beta_1 \Delta X_{t-1} + \delta Y_{t-1} - \delta\alpha_0 - \delta\alpha_1 Z_{t-1} \\
 \text{and } Y_t &= (\beta_0 - \delta\alpha_0) + \beta_1 X_t - \beta_1 X_{t-1} + (\delta + 1)Y_{t-1} - \delta\alpha_1 Z_{t-1}
 \end{aligned} \tag{5.11}$$

The effect of a temporary increase in X_t on Y_t would be β_1 . In the next period the effect of X on Y can be estimated as:

$$\begin{aligned}
 Y_{t+1} &= (\delta + 1)\beta_1 - \beta_1 = \delta\beta_1 \\
 Y_{t+2} &= (\delta + 1)(\delta\beta_1) \\
 Y_{t+3} &= (\delta + 1)^2(\delta\beta_1) \\
 &\vdots \\
 Y_{t+n} &= (\delta + 1)^{n-1}(\delta\beta_1)
 \end{aligned}
 \tag{5.12}$$

By substituting the previously estimated values of parameters in these expressions, we can have the time profile of the estimate of the underlying distributed lag effects of each explanatory variable on the real exchange rate. The results are shown in tables 5.5, 5.6, 5.7, and 5.8, and Figures 5.2-5.6 also depict this results. The conclusion from these experiments can be summarised as follows:

(i) A temporary increase in the exogenous variables creates a departure of actual RER from its initial equilibrium level.

(ii) In all cases except trade policy, the current situation plays a significant role in the determination of the real exchange rate in the Iranian economy. In the case of trade policy, due to the proxy used for this variable (the gap between black market and official nominal exchange rate), a temporary shock is likely to affect the future expectation distributing the effect of this policy through time.

(iii) Figures 5.4 and Table 5.7, which show the effects on RER of a temporary increase in real income, indicate that the marginal propensity to consume of temporary income should be quite significant in this economy. As a result of this fact, any temporary increase in real income stimulates aggregate demand immediately. The likely interpretation of this behaviour may be the growing rate of inflation in the Iranian economy which causes people to protect their money by purchasing durable goods.

(iv) The impact effect of a temporary increase in real investment is different from the other shocks. An increase in investment of unity causes the real exchange rate to appreciate at once by 60 percent of the amount of that shock. In second period, the forces of self-adjustment accompanied by long-run positive effect of a temporary investment shock depreciate the RER. Then total adjustment will be completed over 5 years.

(v) In the case of macroeconomic policy, Table 5.9 and Figure 5.6, a temporary expansionary monetary policy, for example, appreciates the real exchange rate by 29 percent of that shock immediately. When this unsustainable policy is halted, the automatic adjustment forces cause the real exchange rate to depreciate by 34

percent. Because of this overshooting in the second period, full adjustment is not achieved until over 10 years.

This process can be illustrated by Figure 5.1. An expansionary monetary policy shifts the budget line from II to $I'I'$. The equilibrium point of consumption will be, for example, point F . At this point we have an excess demand for all goods, including nontradables. The excess demand for nontradables causes the OC to shift to OC' . In the second period when the expansionary monetary policy is halted, the budget line will shift from $I'I'$ to $I''I''$. The consumption point will be at F' in which we will have an excess supply for nontradable goods. The only way to eliminate this excess supply is to reduce the relative price of nontradables. It means, OC' shifts towards OC and $I'I'$ to II . This is the process that will lead to equilibrium over 10 years.

Figure 5.1

The impact effect of a temporary expansionary monetary policy on the real exchange rate

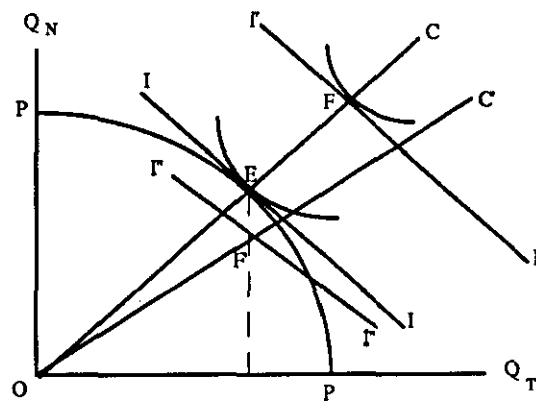


Table 5.5

Distributed lag effect on real effective exchange rate of one-unit, once-and-for-all, increase in the terms of trade

Time period t	$\ln REER_t$	$\ln TOT_t$	$\ln TOT_{t-1}$
0	0	0	0
1	0	1	0
2	0.444	0	1
3	0.049	0	0
4	0.041	0	0
5	0.034	0	0
6	0.028	0	0
7	0.023	0	0
8	0.019	0	0
9	0.016	0	0
10	0.013	0	0

Figure 5.2

Time profile for real effective exchange rate following a temporary change in the terms of trade

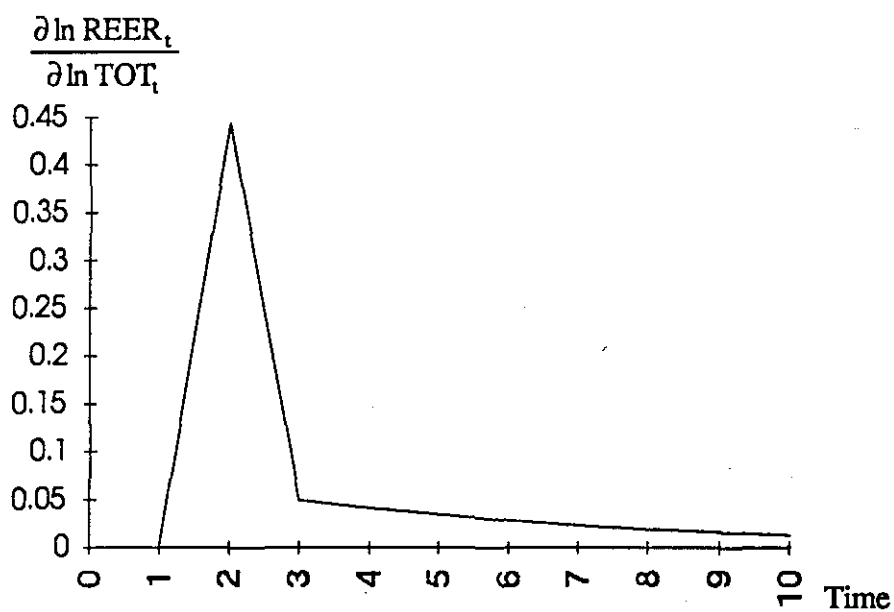


Table 5.6

Distributed lag effect on real effective exchange rate of one-unit, once-and-for-all, increase in (restricted)trade policy

Time period t	LnREER_t	LnTP_t
0	0	0
1	-0.060	1
2	-0.043	0
3	-0.036	0
4	-0.030	0
5	-0.025	0
6	-0.021	0
7	-0.017	0
8	-0.014	0
9	-0.012	0
10	-0.010	0

Figure 5.3

Time profile for real effective exchange rate following a temporary change in trade policy

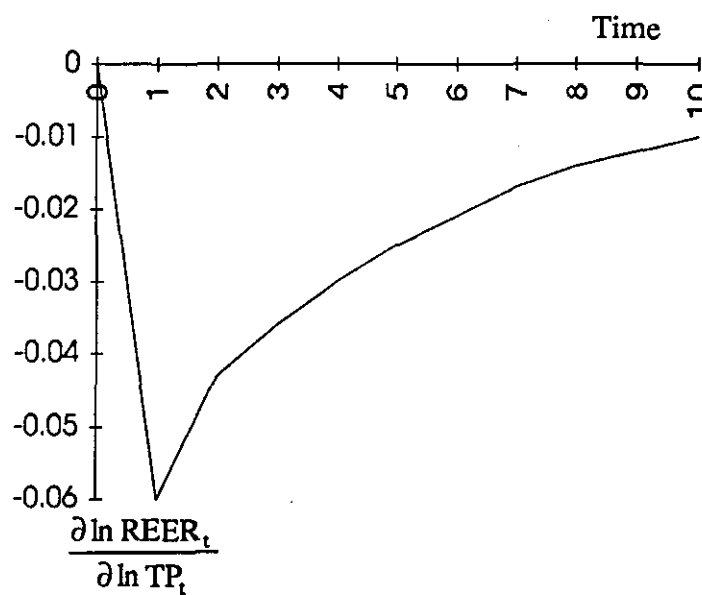


Table 5.7

Distributed lag effect on real effective exchange rate of one-unit, once-and-for-all, increase in real income

Time period t	LnREER_t	$\ln y_t$	$\ln y_{t-1}$
0	0	0	0
1	0	1	0
2	-0.868	0	1
3	-0.0017	0	0
4	-0.0014	0	0
5	-0.0011	0	0
6	-0.0009	0	0

Figure 5.4

time profile for real effective exchange rate following a temporary change in real income

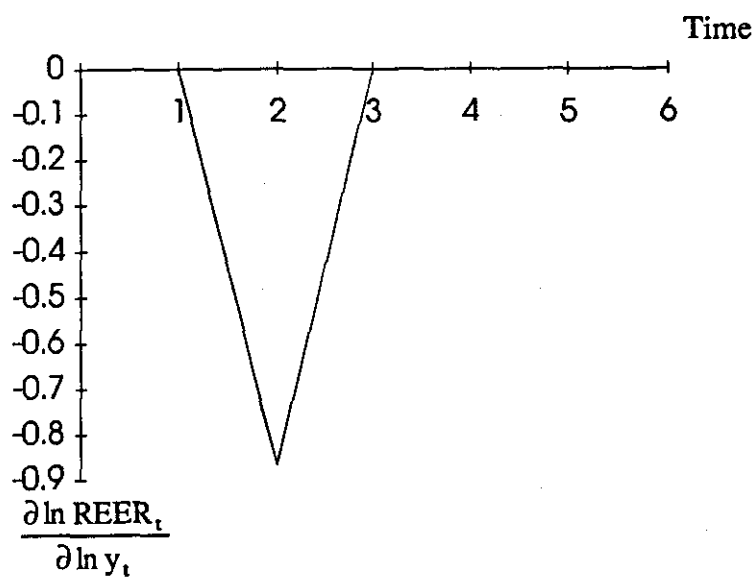


Table 5.8

Distributed lag effect on real effective exchange rate of one-unit, once-and-for-all, increase in investment

Time period t	$\ln REER_t$	$\ln I_t$
0	0	0
1	-0.61	1
2	0.18	0
3	0.13	0
4	0.11	0
5	0.009	0

Figure 5.5

Time profile for real effective exchange rate following a temporary change in investment

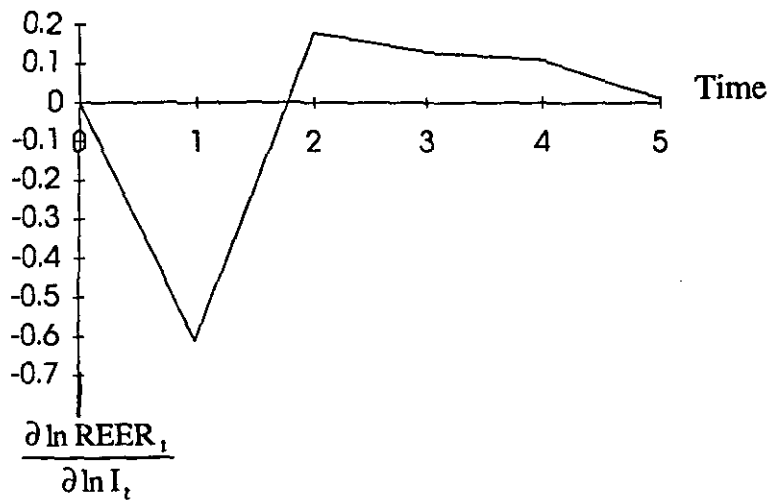


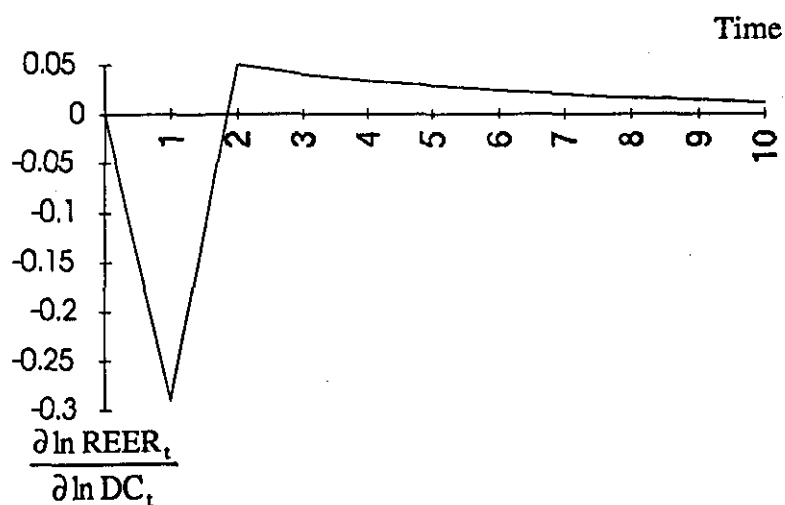
Table 5.9

Distributed lag effect on real effective exchange rate of one-unit, once-and-for-all, increase in inconsistent macroeconomic policy.

Time period t	$\ln REER_t$	$\ln DC_t$
0	0	0
1	-0.29	1
2	0.05	0
3	0.04	0
4	0.034	0
5	0.029	0
6	0.024	0
7	0.020	0
8	0.016	0
9	0.014	0
10	0.011	0

Figure 5.6

Time profile for real effective exchange rate following a temporary change in (unsustainable) macroeconomic policy



5.4.4.2 The time path of the real effective exchange rate following a permanent exogenous shock

Consider the case in which any change in the explanatory variables has an effect on the behaviour of the dependent variable for the time of changes in those variables.

From equations [5.7] we have;

$$Y_t = (\beta_0 - \delta\alpha_0) + (1+\delta)Y_{t-1} + \beta_1 X_t - (\beta_1 + \delta\alpha_1)X_{t-1}$$

$$\text{if } X_t = X_{t+1} = X_{t+2} = \dots = X_{t+n} = 1$$

$$\text{then } Y_t = \beta_1$$

$$Y_{t+1} = (1+\delta)\beta_1 - \delta\alpha_1 \quad [5.13]$$

$$Y_{t+2} = (1+\delta)^2 \beta_1 + \left[\frac{(1+\delta)^2 - 1}{\delta} \right] (-\delta\alpha_1)$$

$$Y_{t+3} = (1+\delta)^3 \beta_1 + \left[\frac{(1+\delta)^3 - 1}{\delta} \right] (-\delta\alpha_1)$$

⋮

$$Y_{t+n} = (1+\delta)^n \beta_1 + \left[\frac{(1+\delta)^n - 1}{\delta} \right] (-\delta\alpha_1)$$

For variables whose effects are felt after one period we will have: Reconsider equations [5.9];

$$Y_t = (\beta_0 - \delta\alpha_0) + (\beta_1 - \delta\alpha_1)X_{t-1} - \beta_1 X_{t-2} + (1+\delta)Y_{t-1}$$

$$\text{if } X_t = X_{t+1} = X_{t+2} = \dots = X_{t+n} = 1$$

$$\text{then } Y_t = \beta_1 - \delta\alpha_1$$

$$Y_{t+1} = (1+\delta)(\beta_1 - \delta\alpha_1) - \delta\alpha_1$$

$$Y_{t+2} = (1+\delta)^2 (\beta_1 - \delta\alpha_1) + \left[\frac{(1+\delta)^2 - 1}{\delta} \right] (-\delta\alpha_1) \quad [5.14]$$

⋮

$$Y_{t+n} = (1+\delta)^n (\beta_1 - \delta\alpha_1) + \left[\frac{(1+\delta)^n - 1}{\delta} \right] (-\delta\alpha_1)$$

For a permanent increase in nominal variables such as macroeconomic policy we will have: Consider equations [5.11];

$$Y_t = (\beta_0 - \delta\alpha_0) + \beta_1 X_t - \beta_1 X_{t-1} + (1 + \delta) Y_{t-1} - \delta\alpha_1 Z_{t-1}$$

$$\text{if } X_t = X_{t+1} = X_{t+2} = \dots = X_{t+n} = 1$$

$$\text{then } Y_t = \beta_1$$

$$Y_{t+1} = (1 + \delta)\beta_1 \quad [5.15]$$

$$Y_{t+2} = (1 + \delta)^2 \beta_1$$

$$\vdots$$

$$Y_{t+n} = (1 + \delta)^n \beta_1$$

By using the estimated values of parameters in these equations, we can present the time path of the REER following various permanent exogenous shocks. The results are reported in Tables 5.10-5.14 and in Figures 5.7-5.11. The central findings of this analysis can be summarised as follows:

(i) A permanent increase in the explanatory variables leads to a continuous change in the REER, albeit with different proportions. In consequence, if the system is left on its own, there is no a substantial autonomous tendency for the system to offset any unsustainable changes.

(ii) In the case of macroeconomic policy, an inconsistent set of macroeconomic policies, however is short term, the result implies that if such policies are maintained for several years, it can generate a substantial disequilibrium.

Table 5.10
Distributed lag effect on real effective exchange rate of a permanent increase
in the terms of trade

Time	$\ln REER_t$	$\ln TOT_t$	$\ln TOT_{t-1}$
0	0	0	0
1	0	1	0
2	0.45	1	1
3	0.49	1	1
4	0.54	1	1
5	0.26	1	1
6	0.59	1	1
7	0.62	1	1
8	0.64	1	1
9	0.65	1	1
10	0.67	1	1

Figure 5.7
Time profile for real effective exchange rate following a permanent increase
in the terms of trade

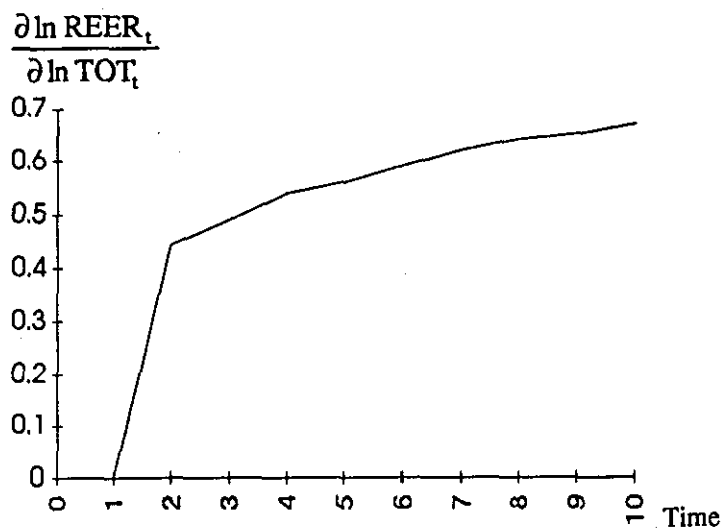


Table 5.11

Distributed lag effect on real effective exchange rate of a permanent increase
in (restricted) trade policy

Time	$\ln REER_t$	$\ln TP_t$
0	0	0
1	-0.06	1
2	-0.10	1
3	-0.13	1
4	-0.16	1
5	-0.18	1
6	-0.20	1
7	-0.22	1
8	-0.24	1
9	-0.25	1
10	-0.26	1

Figure 5.8

Time profile for real effective exchange rate following a permanent increase
in (restricted) trade policy

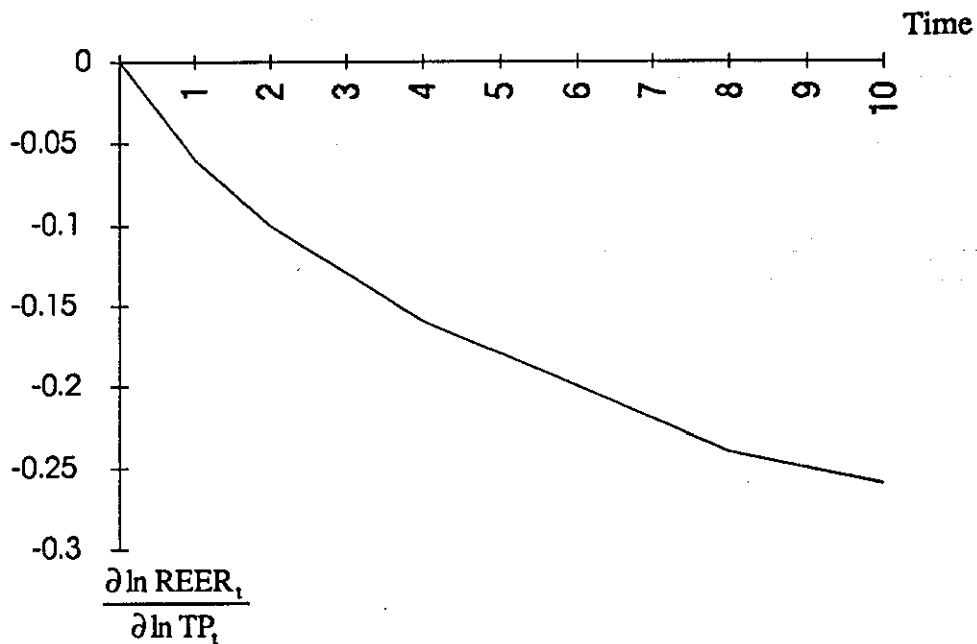


Table 5.12
Distributed lag effect on real effective exchange rate of a permanent change
in the real income

Time	$\ln REER_t$	$\ln y_t$	$\ln y_{t-1}$
0	0	0	0
1	0	1	0
2	-0.865	1	1
3	-0.863	1	1
4	-0.860	1	1
5	-0.859	1	1
6	-0.858	1	1
7	-0.856	1	1
8	-0.855	1	1
9	-0.854	1	1
10	-0.853	1	1

Figure 5.9

Time profile for real effective exchange rate following a permanent increase in real
income

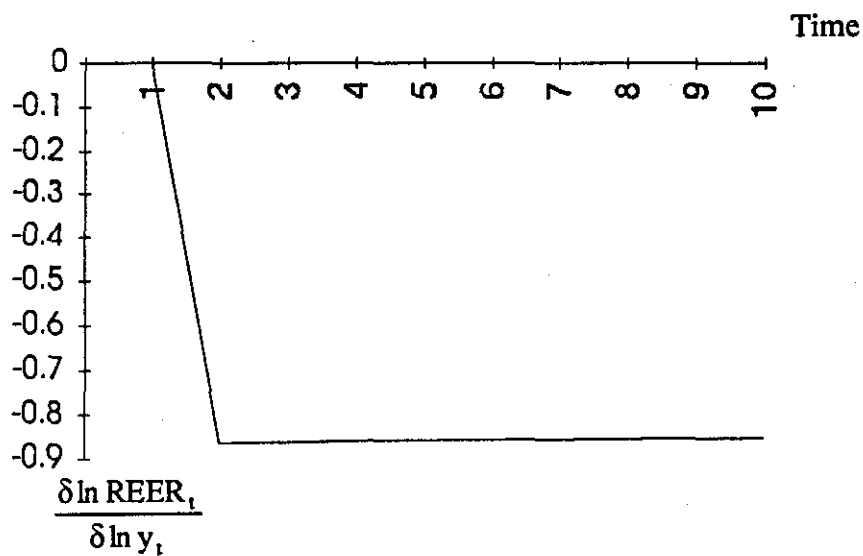


Table 5.13

Distributed lag effect on real effective exchange rate of a permanent increase in investment

Time	$\ln(\text{REER})_t$	$\ln I_t$
0	0	0
1	-0.61	1
2	-0.43	1
3	-0.27	1
4	-0.15	1
5	-0.04	1
6	0.05	1
7	0.12	1
8	0.18	1
9	0.22	1
10	0.27	1

Figure 5.10

Time profile for real effective exchange rate following a permanent increase in investment

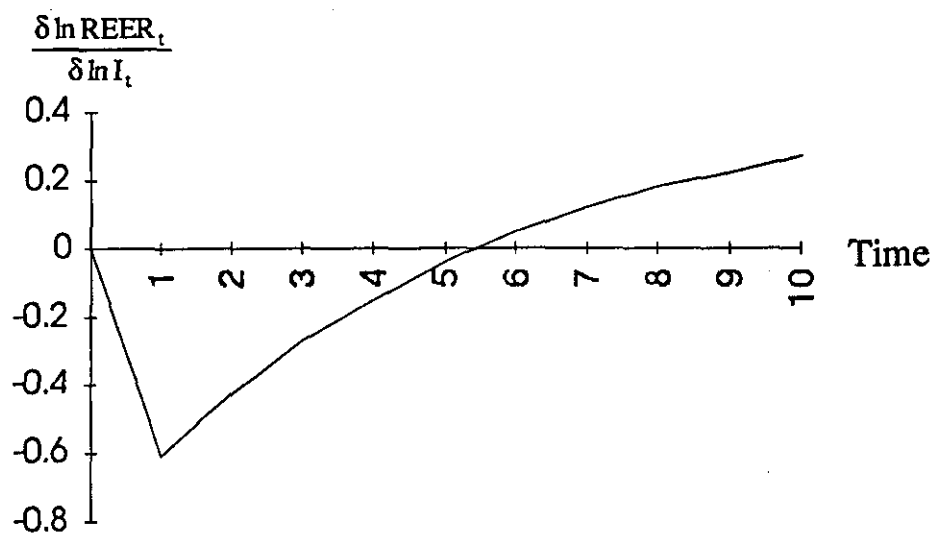
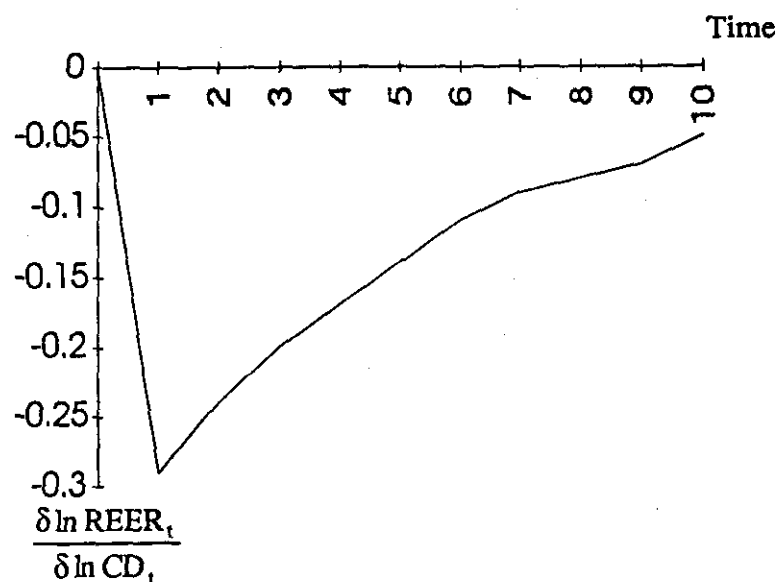


Table 5.14
Distributed lag effect on real effective exchange rate of a permanent increase
in (inconsistent) macroeconomic policy

Time	$\ln(\text{REER})_t$	$\ln \text{CD}_t$
0	0	0
1	-0.29	1
2	-0.24	1
3	-0.20	1
4	-0.17	1
5	-0.14	1
6	-0.11	1
7	-0.09	1
8	-0.08	1
9	-0.07	1
10	-0.05	1

Figure 5.11
Time profile for real effective exchange rate following a permanent increase
in (inconsistent) macroeconomic policy



5.5 Interpretation of the results

Let us now consider the impact of various real and monetary shocks on the real exchange rate behaviour, using the point estimates of the parameters presented in the previous sections.

5.5.1 *Changes in the terms of trade*

The empirical results show that the coefficient of the terms of trade has the expected sign and is statistically significant. An improvement in the terms of trade leads to an increase in the real exchange rate (real depreciation). As is well known, changes in the terms of trade can result from changes in export prices or import prices. However, although the final effect of increases (decreases) in the export price or decreases (increases) in the import price is the same, the process through which they depreciate (appreciate) the real exchange rate is different. The outstanding feature of a change in the export price is that it alters a nation's disposable income. It means, for example, when the price of exports improves, a country may consume more than it could previously without increasing its debt. On the contrary, when the price of exports declines, a country must spend less than it could previously. Of course, it is possible that the reduction in spending may be postponed through borrowing, but eventually it has to fall into line with new lower income. In spite of this fact, the positive sign of the terms of trade suggests that a deterioration in the price of exports, other things given, will result in a real appreciation. This result is different from those found in other recent empirical work.¹¹

In the case of Iran, it has resulted from a combination of several factors. First, gains or losses in national income generated by changes in the price of exports are not directly met with changes in domestic consumption expenditure. This is because Iranian exports rely on one primary commodity (oil) for national income and foreign exchange which is completely under government ownership. Even a large part of the government non-export revenues over recent years comes from the sale of foreign exchange in the black market and from the taxes on the domestic production and trade which are directly linked to oil income. Therefore export revenues play an important role in the government budgetary provision. In consequence, a reduction in export prices may increase the government budget deficit. Since this budget deficit is almost entirely financed by borrowing from the central bank, the decrease in export prices can generate an

¹¹ See Cottani et. al. (1990) and Edwards (1989a).

inflationary situation through increasing domestic credit. Such a situation under a predetermined nominal exchange rate leads to a real appreciation.

Secondly, with the increases in the value of export revenues, imports of intermediate and manufactured goods, were allowed to expand to meet higher aggregate demand. With the fall in such export revenue, restrictions on imported goods arose. This means that the decline in exports was more or less matched by a decrease in imports, increasing the net impact on the excess demand. This, in turn, raised the domestic price level, generating a real appreciation. As a result of such policies, it can be well illustrated that there is a positive relationship between the export price and real exchange rate in the Iranian economy.

Another reason why the foreign exchange crisis contributed to the real appreciation was the role of government as the biggest supplier of foreign currencies in the black market. Over the past few years, a large part of the government's non-oil revenues has been achieved from the sale of foreign exchange in the black market. Foreign currencies sold by the government at the highly devalued black market rates to the domestic importers, travellers and other customers. Under the foreign exchange crisis, the government was not able to satisfy the existing demand in that market. Therefore, an extra devaluation in the black market rate and a high level of domestic price have been experienced. Another point in this regard is that, as pointed out by some Iranian economy experts, this policy provided a successful meaning of unannounced nominal devaluation that mopped up the overhang of the domestic currency. Foreign exchange shortages prevented this clean-up operation.

In contrast, an improvement in oil export revenues has provided a different story from what would have normally been expected. With substantial increases in oil revenues, borrowing by the government from the banking system was reduced. This reduction offset a substantial part of the monetary stimulus arising from the net foreign asset and precluded rises in the money supply.

Another major reaction of the government was a relaxation of some restrictions on imports. When oil export revenues increased from \$11.7 billion in 1980 to over \$21 billion in 1984, imports were allowed to rise from nearly \$11 billion to \$18 billion in the same period. Following the sharp decrease in oil export revenues to nearly \$6 billion in 1986, the volume of imports was gradually reduced to \$10.5 billion in 1989. With an improvement in annual foreign exchange receipts, the import controls were liberalised and merchandise imports moved towards \$25 billion in 1992. Therefore, a rise in imports has reduced the inflationary pressures

by increasing aggregate supply and accelerated domestic investment that has in turn, had a positive effect on the real exchange rate movements.

On the other hand, the analysis for the case in which the deterioration of the terms of trade is the result of an increase in the price of importables is quite different. When the change in the terms of trade is brought about by an increase in price of importables, it may be associated with an increase or a decrease in the long-run equilibrium of the real exchange rate, depending on; i) the magnitude of the income effect provided by the terms of trade deterioration, ii) the relative magnitude of the intertemporal elasticity of substitution between importable and domestically produced goods, iii) the dependency of domestic production on the imported inputs. In the case of the economy under consideration, however, domestic manufactured goods are not a good substitute for imported commodities, the domestic production is highly related to imported raw materials. In consequence, the high import prices directly enter into the domestic price level resulting in a real appreciation.

5.5.2 Changes in the trade policy

The index proxying trade policy, the gap between the black market and official exchange rate is significantly negative, indicating that a relaxation of the extent of impediments to international trade generates a real depreciation. This result provides evidence in support of the view that restricted trade policy can indeed be a quite powerful cause for real exchange rate appreciation.

In the case of Iran, the mix of trade and exchange rate policies did not have any well-defined economic purposes, at least during the crises that created an abrupt and substantial loss in the foreign exchange revenue. Under these crises, the response of the government was to resort to direct control of imports through quantitative restriction. Whereby imports were programmed annually in a foreign exchange revenue to match the government's expected annual foreign exchange income. As a result of such policy, imports were largely determined by the expected availability of foreign exchange reserves and did not necessarily respond to the prevailing demand condition. Moreover, in some cases, the authorities preferred import quotas to the other restriction instruments. Although finding reasons for such a preference is difficult, it may be based on the most common misunderstanding about import quotas. The view is that, unlike other restriction policies such as tariffs, quotas do not raise domestic prices. In practice, by restricting the supply of imported goods to the domestic market, the domestic price has been raised as much as the public were willing to pay for essential and

scarce imported goods. Following this policy, when the imported goods have been sold on the domestic market at a price higher than their purchase price, the right to import restricted goods have become valuable. Then, to administer a quota, the government has allocated the right to import through the system of import licences. These licences, as expected, generate some benefit to particular groups. Unfortunately, these benefits were a function of the policy rather than of the groups' actual contribution to the economy. Anyone who received a licence, purchased imports at world price by using government's credit subsidies and overvalued exchange rate (cheap foreign currency) and sold them at a higher price internally. This situation encouraged the wasteful diversion of resources from productive use to rent seeking to obtain licence to import. In consequence, trade restriction policies not only provided no improvement in the country's balance of payments, but also resulted in macroeconomic imbalances through a massive real appreciation.

5.5.3 Changes in the real investment

With respect to the variability of real investment, the long-run estimated coefficient is positive. This indicates that in Iran increases in real investment result in long-run real depreciation. The positive sign of this coefficient, however, supports the long term supply effects of investment. There are a number of reasons that should be taken into account to give a better explanation of the role of this variable in the Iranian economy.

According to the theoretical discussion, the effect of investment on the long-run real exchange rate behaviour depends on factor intensity and, consequently, on whether it takes place in the tradable or nontradable goods sector. In the case of our study, however, there is no data on investment in tradable or nontradable sectors. It can be claimed that the composition and amount of aggregate investment were affected by some factors outside the government's control, particularly, the volatile of oil revenue. In a simple version, if it is accepted that the investment on the machinery equipment can be treated as a proxy for investment on tradables, and the investment on the construction for nontradables, official data demonstrates that during the period of our study, 1961-92, the share of nontradables dominated the share of tradables. It means, any decrease in the aggregate investment leads to a real appreciation by decreasing the supply of domestic goods.

On the other hand, the Iranian government, after the 1974 oil boom, concentrated the investment on large scale projects in oil and non-oil sectors. If those

investments had met standard profitability criteria, using the true opportunity cost of capital, this strategy could have fostered the country's aim of development with a sustainable level of the real exchange rate. Unfortunately, the full potential was not realised, because the investment had been managed and developed by the multinational corporations and integrated into their international network, with few linkages in the Iranian economy. Therefore, inappropriate use of foreign technology and expertise, imported raw materials, and processed goods created a system of assembly-plant operation and fragile dependent capitalism at the mercy of external crises. Since 1980, the post-revolutionary government has been bent on radically altering the previous industrialisation drive, without appropriate substitution. As a result of such policies, accompanied by several factors outside the control of government, industry was surrounded by many incapacitating problems. Manufacturing enterprises experienced an accelerated decline in capacity utilisation, due mostly to disruption of supplies and a drop in sales. Furthermore, a large number of projects that had been started prior to the revolution and had absorbed substantial investment were left unfinished. Another important point should be pointed out in this regard is that, while industry's total share of long-run real investment declined, the relative share of services improved. Such an improvement was due to the high possibility of making a quick and remarkable profit under uncertain situations and the easier availability of credits from the banking sector.

In sum, reduction of real investment in nontradable sector, large investment on the large-scale projects by using dependent technology without improving domestically produced commodities, and a notable shift of resources from productive endeavours to quick and high profit (mostly inefficient from social point of view) activities put some pressure on the aggregate supply, generating a real appreciation.

Another point should be mentioned about the relationship between real exchange rate and investment is the negative sign of the short-run coefficient of investment variable. The likely explanation for this is that the investment has two channels of influence on the real exchange rate. The first is the positive long-run supply effect explained above. The second is the negative short-run demand effect which, in turn, causes the sign of short-run estimated coefficient to be negative.

5.5.4 Changes in the real income

Movements in the real exchange rate may also result from real income changes. According to the empirical results, real income correlates inversely to the real

exchange rate. It means that an increase in y tends to appreciate the real exchange rate by increasing spending in all goods including nontradables.

Data published by the United Nation and the World Bank, based on information received from Iranian authorities, show that the per capita consumption has increased during recent years. However, this general observation cannot offer a certain specific indication of changes in the income status of various social groups, the post-revolutionary government's national welfare policy in general, and its immediate social welfare engineering in particular, exhibited a clear populist slant and a strong lower-income bias. In this case, even if we accept that the real income over a given period remained constant, the government redistribution policy could affect public aggregate consumption. This, naturally, tends to increase the price of home goods, and hence favours an appreciation of the real exchange rate.

5.5.5 Macroeconomic policy

The indicator of macroeconomic policy, the ratio of domestic credit on the gross domestic product, negatively influences the real exchange rate. However, this coefficient appears slightly smaller than the expected level for the economy under consideration. In fact it indicates that inappropriate macroeconomic policy maintained for a few years can generate substantial real exchange rate changes.

In the case of Iran, during our study period, the public sector deficit swelled from slightly over 8 percent of the government expenditure to about 50 percent, mostly financed by monetary emission of the central bank. This policy, as expected, has increased the stock of domestic credit which, in turn, provided an initial monetary stimulus and created an excess real balance in the system. Such a process, put pressure on the domestic prices and entailed a fall in the real exchange rate.

5.6 Conclusion

The question of how the real exchange rate empirically responds to external and domestic shocks in the Iranian economy has been investigated in this chapter. To understand properly the behaviour of the real exchange rates over time, this study has examined the long-run as well as the short-run dynamic responses of the real exchange rates to a variety of exogenous and policy-induced shocks. The results show that a deterioration in the terms of trade leads to a real appreciation, indicating that, for example, the increase in the domestic price of importables will

induce a higher demand for nontradable goods, which, in turn, rises their price and creates a real appreciation. On the other hand, increases in the world price of an exportable primary commodity, such as oil, however, are expected to have a positive income effect for the primary-commodity-exporting economy, but in the economy under study, it has been found that the RER responds positively to such effects and generating a real depreciation. These results also confirm the significant roles played by the external shocks (forces beyond the control of the Iranian policy makers) in the movement of the Iranian real exchange rate. A policy implication of such results is that the Iranian government may be unable to stimulate economic performance by policy reform without considering the international economic situation.

We find that, a restricted trade policy would result in an appreciation of the real exchange rate. Increasing the artificial barriers on trade has been associated with a lower import and a higher domestic price of these goods that resulted in a higher domestic price level or real appreciation.

Changes in real income tend to appreciate the real exchange rate by increasing spending in all goods including nontradables. This result is, of course, quite familiar and does not provide any new insights. The response to an increase in investment depends on the period of study. Long-run effect of investment causes the RER to tend to depreciate, but when the short run effect is concerned, the demand effect of investment appreciates the real exchange rate.

The estimated error correction equation shows that in this economy, as suggested by the theoretical discussion, short-run real exchange rate behaviour responds to both real and nominal disturbances. The results indicate that, in all cases, the distinction between short-run and long-run effects is meaningful. They also show that the role played by fundamental variables in the long-run is bigger than their short-run effect. The likely implementation of this result is that it provides some doubt on the relative importance of intertemporal effect with respect to income or intratemporal effects.

In the area of macroeconomic policy, an expansive monetary policy (or loose fiscal policy) generates real exchange rate overvaluation. The magnitude and significance of the coefficient on this variable confirms that macroeconomic instability has been one of the major forces that influences the real exchange rate.

6

Real Exchange Rate and Economic Performance in the Iranian Economy: A Partial Equilibrium Approach

6.1 Introduction

Although there are several ways through which policy-makers can affect economic performance, the real exchange rate is likely to be one of the main transmission mechanisms. An environment of low and variable real exchange rates represent greater uncertainty with respect to relative prices. The result are greater risk, interest rate volatility, and high adjustment costs. Such an unstable situation deters productive economic activity and leads to a basic malfunctioning of the economy.

Previous empirical work in Chapters 4 and 5, has investigated the relationship between the real exchange rate and its main determinants in the Iranian economy. An important result emerged from there is that, depending on the values of a variety of elasticities and the types of disturbance under consideration, movements in the real exchange rate have been substantial. A direct implication of this finding is that policies affecting the real exchange rate may prevent the establishment of macroeconomic equilibrium. In spite of the fact that such a correlation is widely accepted, there is no empirical evidence to support its importance in the Iranian economy. Therefore, this chapter aims to examine the long-run and short-run dynamic relationships between the real exchange rate and some important macroeconomic variables, namely imports, exports, and output gap which seem to play a significant role in the country's external and internal situation.

The empirical methodology applied throughout this chapter is (as before) the cointegration technique proposed by Johansen (1988) and Johansen and Juselius (1990) to estimate the long-run relationship between the variables under

consideration. Essentially, this approach involves estimating a long-run equation on an underlying hypothesis, supplemented by an error-correction equation to determine the short-run dynamic structure and the extent to which deviation from the long-run path are being adjusted. Before tackling this issue, it is necessary to mention that, based on our purpose of this study which lies primarily in the exploration of real exchange impact on the economic performance, the interpretation of the empirical results will be focused on the long-run and short-run relationship between the real exchange rate and the variables named above.

This chapter is organised as follows: Section 2 analyses how an overvalued real exchange rate affects the country's external sector. In this section the elasticity of both imports and exports with respect to the long-run as well as short-run movements of the real exchange rate will be estimated. In section 3, the relationship between real exchange rate movement and the output gap will be investigated. Finally section 4 presents the main conclusions.

6.2 Real effective exchange rate and external sector

To determine how changes in the real exchange rate affect the country's external sector, we have to analyse first how it affects both exports and imports. In an open economy, a rise in the domestic price level is likely to push up the relative price of national outputs. This rise in domestic prices compared with foreign prices makes it more expensive to buy domestic goods and relatively less expensive to buy foreign goods. When this happens, domestic consumers will respond to this price shift by cutting back on their purchases of domestic goods and start to import more units of the less expensive foreign products. Such a response does not, however, imply that imports must rise, because a rise in the domestic price level tends to decrease the value of each unit of import in terms of domestic output units. Imports measured in foreign output units may rise as a result of a decline in the real exchange rate, but the imports may fall when measured in domestic output units, Krugman and Obstfeld (1991). The value of imports can therefore rise or fall when the real exchange rate falls, in consequence, the effect of the real exchange rate on the current account and hence on the country's external sector is ambiguous. Improvement or worsening of current account depends on whether that import demand is elastic, then the volume effect of domestic consumer spending shifts on import quantities will outweigh the value effect indicating that a real appreciation

of the domestic currency depresses the current account and a real depreciation improves the current account.¹

6.2.1 Export and import equations

Assuming that imports and exports are imperfect substitutes for nontradable goods makes it easy to construct the empirical equation to analyse trade performance. Most empirical estimates of exports and imports rely on the following basic equation in analysing a country's trade with the rest of the world, Goldstein and Khan (1985).

$$x = f(y^*, P^*, P_x/E) \quad f_1 > 0 \quad f_2 > 0 \quad f_3 < 0 \quad (6.1)$$

$$m = g(y, P, EP_m^*) \quad g_1 > 0 \quad g_2 > 0 \quad g_3 < 0 \quad (6.2)$$

where

x = volume of non-oil exports from home country,²

y^* = foreign real income, measured as $\sum_{i=1}^n w_i E_i y_i^*$, (w_i is the share of country i in the home country's total exports, E_i is the nominal exchange in units of domestic currency per unit of country i 's currency, y_i^* is income level of country i , $n=10$ the home country's ten largest trading partners),

P^* = foreign price level, measured as $\sum_{i=1}^{10} w_i E_i P_i^*$,

P_x = export price measured in the currency of the home country,

E = domestic nominal exchange rate,

$P_x/E = P_x^*$ = export price in terms of foreign currency,

m = volume of imports by home country,

y = domestic income (in real terms),

P = domestic price level,

P_m^* = import price measured in the currency of the home country's ten largest trading partners, that is $\sum_{i=1}^{10} w_i E_i P_{mi}^*$.

Based on these expressions, the export and import behaviour (in real terms) can be approximated by a log-linear specification and written as:

¹ To find the final impact of real exchange rate changes on the current account, one needs to extend the same argument for foreign consumers.

² Due to the fact that oil exports do not respond to changes in the real exchange rate, it is excluded from this estimation.

$$\ln x_t = a_0 + a_1 \ln y_t^* + a_2 \ln \text{REER}_t \quad a_1, a_2 > 0 \quad (6.3)$$

$$\ln m_t = b_0 + b_1 \ln y_t + b_2 \ln \text{REER}_t \quad b_1 > 0, b_2 < 0 \quad (6.4)$$

6.2.2 Econometric results

6.2.2.1 Unit root tests

In attempting to explain the long-run behaviour of exports and imports, an important question should be determined at the outset. That is whether the stochastic process of each variable contains a unit root. If so, then we can use the cointegration method to model their long-run behaviour. In this regard, a group of models have been developed to test the existence of unit roots. As before, chapter 5, we used the Dickey-Fuller (DF) test and its augmented version (ADF). Table 6.1 presents the appropriate results for the unit root test in the logarithm of the considered variables in equation (6.3) and (6.4). As indicated in the table, on the basis of both test statistics, (DF and ADF), when applied to the levels of variables, the null hypothesis of a unit root cannot be rejected. But the same null hypothesis is rejected when the tests are applied to the first difference of variables. This implies that some combination of the levels series may be cointegrated.

Table 6.1
Export and import equations
Unit root tests⁽¹⁾

Variables	Levels		First difference	
	DF	ADF	DF	ADF
$\ln x$	-1.5	-1.9	-4.3	-3.3
$\ln y^*$	-2.7	-2.6	-6.2	-4.4
$\ln \text{REER}$	-0.4	-0.13	-7.4	-4.8
$\ln m$	-1.5	-2.4	-3.3	-3.2
$\ln y$	-1.1	-1.9	-3.5	-3.7

(1) The relevant critical values at 5 percent level for DF and ADF are 3.56 and 3.57, and for 10 percent level are about 3.18, Fuller (1976).

6.2.2.2 Cointegration results

The next step is to determine whether the non-stationary variables identified above are cointegrated. This attempt helps us to explore the long-run relationship between real exchange rate movements and the country's current account

behaviour, and to specify an easily interpreted form for import and export equations to find the short-run coefficient of the real exchange rate.

We test for cointegration by using the more familiar systems approach developed by Johansen (1988). As pointed out in Chapter 5, in the context of more than two variables and when some of these cointegrating variables are not exogenous with respect to the dependent variable under consideration, tests of long-run relationship that employ the Engle and Granger two step method cannot explain whether we are attending to a unique cointegrating vector or a linear combination of all the existing cointegrating vectors which exist within the system. But using the Johansen approach determines estimates of all the cointegrating vectors that are available for the set of variables under consideration, causes an improvement in efficiency and simplifies inference.

Tables 6.2 and 6.3 report the results of cointegration of import and export equations. The Johansen method suggests that there may be one cointegration relationship for import equation and two for the export equation. In this case, the interpretation of exports behaviour is not straightforward and needs further discussion because the estimated cointegration relationship is not unique. However the first vector seems to be more realistic, we have made a further attempt to test both vectors in the second stage of this procedure. Finally it has been found that vector two cannot really interpret the relationship between variables considered in the export equation.

Table 6.2

Tests for the number of cointegration vectors

$$\text{Import equation: } \ln m_t = b_0 + b_1 \ln y_t + b_2 \ln \text{REER}_t + U_t^m$$

Cointegration LR test based on Maximal Eigenvalue of the stochastic matrix

Null value ⁽¹⁾	Alternative	Statistic	95 % critical
$r = 0$	$r = 1$	22.16	22.00
$r \leq 1$	$r = 2$	7.06	15.67
$r \leq 2$	$r = 3$	6.33	9.24

Cointegration LR test based on Trace of the stochastic matrix

Null	Alternative	Statistic	95 % critical value
$r = 0$	$r \geq 1$	35.56	34.91
$r \leq 1$	$r \geq 2$	13.40	19.97
$r \leq 2$	$r = 3$	6.33	9.24

Estimated cointegrated vectors in Johansen estimation

Variables	$\ln m$	$\ln y$	$\ln e$	intercept
Accepted vector	0.38 (-1.0)	-0.63 (1.67)	0.047 (-0.13)	2.7 (-7.2)

(1) Critical value taken from Osterwald-Lenum (1992), Table 1.

Table 6.3

Tests for the number of cointegration vectors

$$\text{Export equation: } \ln x_t = a_0 + a_1 \ln y_t^* + a_2 \ln \text{REER}_t + U_t^x$$

Cointegration LR test based on Maximal Eigenvalue of the stochastic matrix

Null	Alternative	Statistic	95% critical value
$r = 0$	$r = 1$	24.48	22.00
$r \leq 1$	$r = 2$	17.29	15.67
$r \leq 2$	$r = 3$	3.67	9.24

Cointegration LR test based on Trace of the stochastic matrix

Null	Alternative	Statistic	95% critical value
$r = 0$	$r \geq 1$	45.44	34.91
$r \leq 1$	$r \geq 2$	20.96	19.96
$r \leq 2$	$r = 3$	3.67	9.24

Estimated cointegration vectors in Johansen estimation

Variables	$\ln x$	$\ln y^*$	$\ln e$	intercept
Accepted vector	-0.33 (-1.0)	1.5 (4.4)	0.38 (1.1)	-15.1 (-45.8)

Turning to the estimation results, equation (6.5) and (6.6) show that the estimated parameters have their expected signs.

$$\ln m_t = -7.2 + 1.7 \ln y_t - 0.13 \ln REER_t \quad (6.5)$$

$$\ln x_t = -45.8 + 4.4 \ln y_t^* + 1.1 \ln REER_t \quad (6.6)$$

Taking all these result into account, there appears to be a long-run relationship between imports and real exchange rate, and also between exports and real exchange rate.

6.2.3 Error correction specification

As discussed in Chapter 5, the Engle and Granger representation theorem [Engle and Granger (1987)] implies that any system of cointegrated variables have a valid error correction model relating to these variables. The lagged values of the estimated residuals derived from the accepted cointegration vectors should be included in order to construct dynamic short-run error correction equations. The methodology of general-to-specific has been used to derive the preferred short-run dynamic equation. The final results are given in Tables 6.4 and 6.5. However, such a short-run dynamic specification is usually employed to measure the speed of adjustment of the actual value to its equilibrium level in the aftermath of a shock. We, in addition to this fact, will pay more attention to the short-run coefficient of the real exchange rate.

Table 6.4

An error correction model for imports

$$\Delta \ln m_t = c_0 + c_1 \Delta \ln y_t + c_2 \Delta \ln REER_t + c_3 U_{t-1}^m + c_4 D^{(1)}$$

Regressor	Coefficient	T-Ratio
intercept	-0.04	-.52
$\Delta \ln y$	1.5	3.1
$\Delta \ln REER$	-0.43	1.1
U_{t-1}^m	-0.22	-1.9
D	-0.29	-2.3
R- Squared = 0.47		DW-Statistic = 2.07
<i>Diagnostic tests:</i>		
Serial correlation	CHI-SQ (1) = 0.06	F (1 , 23) = 0.05
Functional form	CHI-SQ (1) = 0.47	F (1 , 23) = 0.4 E-4
Normality	CHI-SQ (2) = 0.39	--
Heteroscedasticity	CHI-SQ (1) = 0.5	F (1 , 27) = 0.5 E-5

(1) Where, as before, D is a dummy variable that measures the impact of the 8 years war. It equals 1 over the period 1980-88, and zero over the rest period. The reason why the dummy variable has not been included in the cointegration equation is that, the Johansen statistics indicate that there is no acceptable cointegrating vector when the dummy is included. But in the error correction equation, as can be seen, it's coefficient is statistically significant and negative as the war reduced imports into the Iranian economy.

Table 6.5

An error correction model for exports

$$\Delta \ln x_t = d_0 + d_1 \Delta \ln y_t^* + d_2 \Delta \ln REER_t + d_3 \Delta \ln REER_{t-1} + d_4 U_{t-1}^* + d_5 D \quad (1)$$

Regressor	Coefficient	T- Ratio
Intercept	0.13	2.06
$\Delta \ln y_t^*$	2.03	3.57
$\Delta \ln REER_t$	1.07	2.98
$\Delta \ln REER_{t-1}$	0.78	1.98
U_{t-1}^*	- 0.61	- 4.91
D	- 1.06	- 6.54
R-Squared = 0.69		DW-Statistic = 1.6
<i>Diagnostic tests:</i>		
Serial correlation	CHI-SQ (1) = 1.36	F (1 , 22) = 1.08
Functional form	CHI-SQ (1) = 0.03	F (1 , 22) = 0.02
Normality	CHI-SQ (2) = 3.19	--
Heteroscedasticity	CHI-SQ (1) = 0.45	F (1 , 27) = 0.43

(1) As expected, the coefficient of dummy variable in the export equation is very significant, indicating that the Iranian exports are more sensitive than its imports with respect to war.

The results in Tables 6.4 and 6.5 imply that the estimated short-run equation for imports and exports are given by;

$$\Delta \ln m_t = -0.04 + 1.5\Delta \ln y_t - 0.43\Delta \ln REER_t - 0.22U_{t-1}^m - 0.29D \quad (6.7)$$

$$\Delta \ln x_t = 0.13 + 2.03\Delta \ln y_t^* + 1.07\Delta \ln REER_t + 0.78\Delta \ln REER_{t-1} - 0.61U_{t-1}^x - 1.06D \quad (6.8)$$

The aim of constructing these equations has been to use them to specify the correlation between real exchange rate and current account movements. In the next section we will tackle this subject in detail.

6.2.2.4 The time path of the imports and exports following a temporary and a permanent change in the real exchange rate

(i) Imports

The impact effect of a one-unit, once-and-for-all, increase in real effective exchange rate on imports is presented in Table 6.6 and Figure 6.1.³

³ See subsection 5.4.4 in Chapter 5.

Table 6.6
Distributed lag effect on imports of one-unit, once-and-for-all, increase in the real effective exchange rate

Time	$\ln m_t$	$\ln REER_t$
0	0	0
1	-0.43	1
2	0.066	0
3	0.052	0
4	0.040	0
5	0.031	0
6	0.024	0
7	0.019	0
8	0.015	0
9	0.012	0
10	0.009	0

Figure 6.1
Time profile for imports following a temporary change in the real effective exchange rate

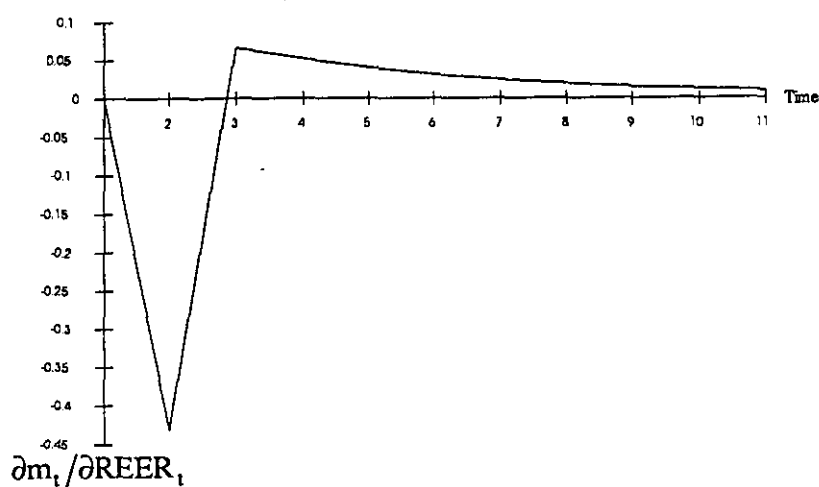
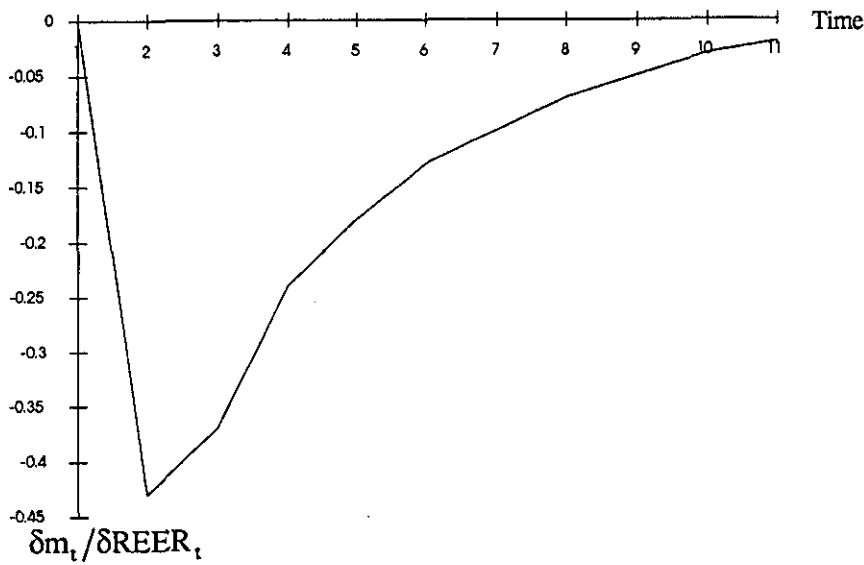


Table 6.7 and Figure 6.2 also show the effect on import of a permanent increase in the real effective exchange rate.

Table 6.7
Distributed lag effect on imports of a permanent increase
in the real effective exchange rate

Time	$\ln m_t$	$\ln REER_t$
0	0	0
1	-0.43	1
2	-0.37	1
3	-0.24	1
4	-0.18	1
5	-0.13	1
6	-0.10	1
7	-0.07	1
8	-0.05	1
9	-0.03	1
10	-0.02	1

Figure 6.2
Time profile for imports following a permanent change
in the real effective exchange rate



(i) Exports

The relationship between real exchange rate and exports is different from the relationship between real exchange rate and imports. Therefore, we need to explain how a temporary and a permanent change in the real exchange rate can affect the exports.

Reconsider our error correction model as:

$$\Delta Y = \beta_0 + \beta_1 \Delta X_t + \beta_2 \Delta X_{t-1} + \delta \hat{U}_{t-1}$$

$$\text{then } Y_t = (\beta_0 - \delta \alpha_0) + \beta_1 X_t + (\beta_2 - \beta_1 - \delta \alpha_1) X_{t-1} - \beta_2 X_{t-2} + (1 + \delta) Y_{t-1} \quad (6.1)$$

The impact effect of a temporary (one unit) change in the X_t on Y_t would be β_1 .

Then for next periods we will have:

$$\begin{aligned} Y_{t+1} &= \delta \beta_1 + \beta_2 - \delta \alpha_1 \\ Y_{t+2} &= (1 + \delta)(\delta \beta_1 + \beta_2 - \delta \alpha_1) \\ Y_{t+3} &= (1 + \delta)^2 (\delta \beta_1 + \beta_2 - \delta \alpha_1) \\ &\vdots \\ Y_{t+n} &= (1 + \delta)^{n-1} (\delta \beta_1 + \beta_2 - \delta \alpha_1) \end{aligned} \quad (6.2)$$

and also for a permanent increase in real effective exchange rate, we will have:

$$\begin{aligned} X_t &= X_{t+1} = \dots = X_n = 1 \\ \text{then } Y_t &= \beta_1 \\ Y_{t+1} &= (1 + \delta)\beta_1 + (\beta_2 - \delta \alpha_1) \\ Y_{t+2} &= (1 + \delta)^2 \beta_1 + \left[\frac{(1 + \delta)^2 - 1}{\delta} \right] (\beta_2 - \delta \alpha_1) \\ Y_{t+3} &= (1 + \delta)^3 \beta_1 + \left[\frac{(1 + \delta)^3 - 1}{\delta} \right] (\beta_2 - \delta \alpha_1) \\ &\vdots \\ Y_{t+n} &= (1 + \delta)^n \beta_1 + \left[\frac{(1 + \delta)^n - 1}{\delta} \right] (\beta_2 - \delta \alpha_1) \end{aligned} \quad (6.3)$$

Table 6.8 and Figure 6.3 indicate the effect of a temporary change in the real effective exchange rate, and also Table 6.9 and Figure 6.4 show the effect of a permanent increase in the real effective exchange rate on exports.

Table 6.8

Distributed lag effect on exports of a temporary (one unit, once-and-for-all)
increase in the real effective exchange rate

Time	$\ln x_t$	$\ln REER_t$
0	0	0
1	1.07	1
2	0.80	0
3	0.31	0
4	0.12	0
5	0.05	0
6	0.02	0
7	0.01	0
8	0.002	0

Figure 6.3

Time profile for exports following a temporary change
in the real effective exchange rate

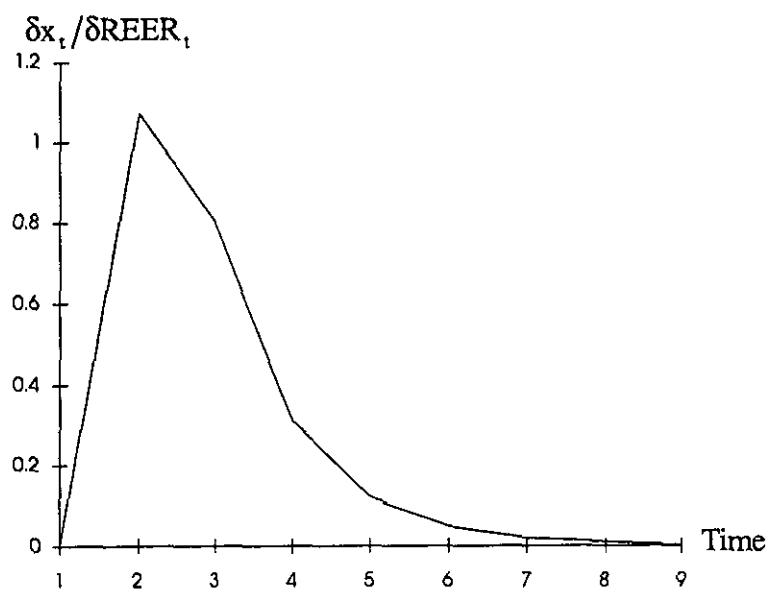


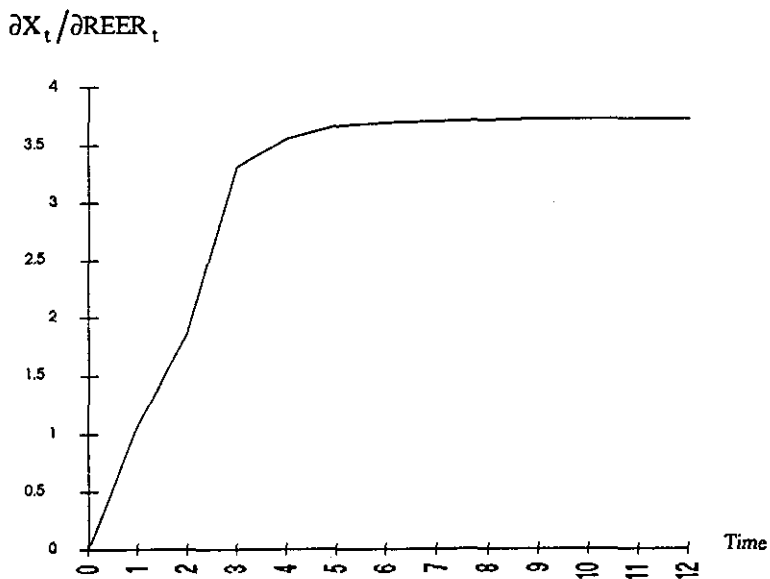
Table 6.9

Distributed lag effect on exports of a permanent increase in the real effective exchange rate

Time	$\ln x_t$	$\ln REER_t$
0	0	0
1	1.07	1
2	1.87	1
3	3.31	1
4	3.55	1
5	3.66	1
6	3.69	1
7	3.70	1
8	3.71	1
9	3.72	1
10	3.72	1
11	3.72	1
12	3.72	1

Figure 6.4

Time profile for exports following a permanent changes in the real effective exchange rate



6.2.3 Interpretation of the econometric results

We now proceed to explain the econometric results and to address how such a correlation between real exchange rate and current account has existed in the Iranian economy.

6.2.3.1 Import sector

The results of the estimation displayed in Tables 6.2 and 6.4 show that all the estimated coefficients, except the short-run coefficient of the real exchange rate, are statistically significant and (all of them) have the expected signs. The results of various diagnostic tests, which detect functional mis-specification, suggest that the overall performance of the model is quite satisfactory.

From the estimated equations (6.5) and (6.7) the elasticity of import demand with respect to the real exchange rate is low, indicating that the long-run dynamic relationship (as well as short-run) between these two variables is weak. A 1 percent decrease in real exchange rate (real appreciation) results in a 0.12 percent increase in the long-run (and 0.43 percent in the short-run) import demand. The relatively low elasticity may be a reflection of the importance of the following factors:

1) The economy's dependence on the external sector;

By far the most vexing problem for the Iranian economy is related to its extreme vulnerability to external shocks which reflects the economy's dependence on foreign goods and services. This dependence is more pronounced for the medium and large-scale manufacturing enterprises than for the rest of the economy. Because, these industries have been primarily established by multinational companies and are integrated into their global network, without many linkages in the domestic economy. Therefore, any project funded by the private or public sector are highly import intensive explaining the close match between the development plan and imported inputs. The import dependence of the Iranian economy, however, has been continually increasing since the early 1960s, it has not been reduced in the post-revolutionary period. Official statistics reported in table 6.6 indicate that the level of manufacturing outputs is closely related to the imported raw material and capital goods. As may be seen from the table, each 100 rials of manufacturing outputs (in constant price, 1985 = 100) between 1973-78 required, an annual average, 0.56 dollars (or nearly 40 rials) of imported capital and primary goods. This figure increased to 0.69 dollars (or 48 rials) in 1979-

1992.⁴ Taking all this into account, the import dependence of the Iranian industrial sector becomes even more evident. It is therefore, intuitively appealing that imports (particularly raw material, semi-finished goods, and capital goods) have become essential commodities that are normally inelastic with respect to relative price changes.

II) The government subsidies to the imported goods;

Adopting a fixed exchange rate associated with a growing rate of domestic inflation caused the imported goods become more attractive compared to the domestically produced goods. Since the first oil boom, as the government increased development spending and allowed more imports, the unlimited supply of imported goods has inevitably led to satisfied consumer demand at the price dictated by the official exchange rate. However, after the revolution, such a price advantage held by imports has been offset by the problem of obtaining imports because of foreign exchange shortage and the quantitative restriction on imports, the high level of domestic price still makes it cheaper to buy imported goods. The unavoidable result has been the loss of competitiveness of commodities produced in the home country with respect to foreign goods. This situation encouraged the government to protect the Iranian industry by allocating cheap foreign currency to import primary inputs with minimum barriers, banking credit with the lowest interest rate, quantitative restrictions on the final goods, and other facilities.⁵ In consequence, it is not far from expectation that econometric results show a low elasticity of imported demand with respect to relative price changes.

⁴ These rial values have been accounted by using the official nominal exchange rate that seems to be unrealistically overvalued. Therefore, if we used, for example, the black market exchange rate, these values would be much higher.

⁵ According to the Statistic Centre of Iran (National Statistic Yearbook, various issues), during the 1980s, more than 70 percent of the total value added of industrial sector have been produced by the large state managed manufacturing industries and hence supported by the government.

Table 6.10
Dependence of the " Manufacturing sector "
on imported capital and intermediate goods

Year	1- Dollar value of imported capital goods in per 100 rials of manufacturing outputs.*	2- Dollar value of imported primary and intermediate inputs in per 100 rials of manufacturing outputs.*	(1 + 2)
1973	0.06	0.14	0.20
1974	0.09	0.31	0.40
1975	0.22	0.39	0.61
1976	0.23	0.40	0.63
1977	0.20	0.39	0.59
1978	0.58	0.34	0.92
Average	0.23	0.33	0.56
1979	0.12	0.36	0.48
1980	0.12	0.44	0.56
1981	0.16	0.59	0.75
1982	0.16	0.47	0.63
1983	0.28	0.69	0.97
1984	0.25	0.54	0.79
1985	0.16	0.50	0.66
1986	0.21	0.52	0.73
1987	0.14	0.35	0.49
1988	0.12	0.30	0.42
1989	0.17	0.45	0.62
1990	0.20	0.55	0.75
1991	0.35	0.58	0.93
1992	0.36	0.48	0.79
Average	0.24	0.49	0.69

* The ratio of dollar value of imported "capital goods" and "primary and intermediate inputs" used for manufacturing and mining on the constant value (1985 = 100) of industrial outputs, (multiplied by 100).

III) Imperfect substitutability between domestic and imported goods;

Cheap imported goods may not be the only reason why the developing countries prefer to consume foreign commodities. Imperfect substitutability between domestic and imported goods could be another factor that makes these countries use foreign commodities even without considering the level of relative prices. Theoretically, the number of substitute goods for a particular commodity has a positive correlation with the price elasticity of demand for that commodity. Lack of modern technology in developing countries has made them unable to produce the import substitution goods. That, in turn, enforced these countries to import some essential goods to satisfy the domestic demand. Generally, in such cases, the level of relative price does not play an important role to determine the import demand.

In the case of Iran, demand for foreign commodities, particularly after the revolution, has been limited to the basic essential goods are not totally produced by domestic economy and some of them are not enough to satisfy the existing demand. Therefore, the insignificant impact of the relative price (real exchange rate) on the Iranian import demand is quite justifiable.

IV) Import restriction policies

During the last two decades, the overvalued real exchange rate with a high rate of domestic inflation has led to a severe balance of payment crisis. The immediate response of the government was to introduce controls on imports through quantitative restrictions and the rationing of foreign exchange. Based on this policy the imports were influenced mainly by the availability of foreign exchange coming from oil and non-oil exports. Obviously, in this circumstance, the import decision is largely affected by the expected availability of foreign exchange reserves and does not necessarily respond to the prevailing relative prices.

It can be concluded, therefore, that the import demand in the Iranian economy has been in the least affected by the real exchange rate movements.

6.2.3.2 Export sector

Econometric results from Tables 6.3 and 6.5 show that, over the 1961-92 period the movements of non-oil exports from the home country are well explained by changes in the effective real exchange rate and foreign income. The long-run equation as well as the short-run equation has a reasonable fit and passes all the diagnostic tests. Estimated coefficients, as expected, are significant suggesting that foreign demand for Iranian non-oil exports are highly affected by their real income

and relative prices. An obvious finding from these empirical results is that any attempt to realign the real exchange rate will tend to reduce the external imbalance. But with respect to the Iranian economy, this result is controversial and needs more clarification.

It is often argued that, the main product in Iranian total exports, namely oil exports, are not affected by the exchange rate or the level of domestic prices. That is because the export price of oil is determined by the international market and does not reflect the production cost and the domestic price of oil. Therefore, a change in the nominal exchange rate or domestic price level will not have any effect on the country's foreign exchange earnings from oil (Behdad, 1988). Therefore, since the share of non-oil exports in the country's total exports is small (about 10 percent of total exports), this along with low elasticity of imports with respect to the real exchange rate changes reveals the fact that real exchange rate targeting policy can do little to restore external balance.

In sum, it can be claimed that the current account has been adversely affected by the overvalued real exchange rate. A rapid appreciation of real exchange rate in 1973-92, primarily as a result of domestic cost increases, has led to a squeeze on the tradable sectors with resulting current account deficit.

6.3 Real exchange rate and the output gap

Within macroeconomic analysis, economic performance is measured not only in terms of the general trend of actual output, but also in terms of whether the output gap is increasing or decreasing. The smaller the gap is, the more successful of the economic performance. From this standpoint, the measurement of the output gap as a difference between potential and actual has a very significant practical implication. Since some unemployment of labour and other factors of production is normal, the actual output is generally lower than its potential level, but in practice, there is no standard procedure to estimate the natural size of the gap. The concept of potential output, that is used to represent the level of output that the economy can reach when all production factors, especially labour, are at their fully employed level, is not measurable. In spite of this empirical problem, economists have employed an indirect method to analyse output gap behaviour. The rate of unemployment and its fluctuation are commonly accepted as a key variable in explaining this subject.⁶ The higher the rate of unemployment is, the bigger the

⁶ See Layard et al. (1991) and Saches and Larrain (1993).

deviation of actual output from its potential level. Following this method, a further attempt has been made to estimate the effect of variability of real exchange rate on the rate of unemployment in the economy in question.

6.3.1 Unemployment equation

According to the labour market equilibrium condition [see Saches and Larrain (1993)], we have:⁷

$$L = f(W/P) + k(r, y^o) \quad \frac{\partial L}{\partial (W/P)} < 0, \frac{\partial L}{\partial r} < 0, \frac{\partial L}{\partial y^o} > 0 \quad (6.12)$$

Naturally, at any given period, an increase in the number of employed workers results in a decrease in the rate of unemployment. Thus, the unemployment function can be written as:

$$U = g(W/P) + h(r, y^o) \quad \frac{\partial U}{\partial (W/P)} > 0, \frac{\partial U}{\partial r} > 0, \frac{\partial U}{\partial y^o} < 0 \quad (6.13)$$

On the other hand, the equilibrium wage (W) can be defined as a homogeneous function of the output price, P^d , and consumption price level, P .⁸

$$\ln W = (1 - \alpha) \ln P^d + \alpha \ln P \quad 0 < \alpha < 1$$

Some manipulations and defining $\ln P = (1 - c) \ln P^d + c(\ln E + \ln P^*)$ or $\ln P^d = \frac{1}{1 - c} \ln p - \frac{c}{1 - c} (\ln E + \ln P^*)$, give us:

⁷ In the capital market, capital can be allocated on two different ways to transfer purchasing power across time. It can be allocated in financial markets at the interest rate r , or it can be invested to increase future output. Therefore, the intratemporal choice that how to divide capital between financial asset and production sector depends on the level of interest rate and the marginal productivity of capital. If production side is chosen to maximise total wealth, then the capital stock should be set up at the level of K at which its marginal productivity is greater or equal to the interest rate.

In the case of Iran, It should be noted that, because of high dependence of the private and public investment on the imported inputs, foreign exchange incomes that almost entirely come from oil exports play a significant role in this regard. To summarise, the desired amount of capital can be determined as a function of interest rate r (in real term), and real income of oil y^o . That is:

$$\ln K_t = \kappa_1 \ln r_t + \kappa_2 \ln y_t^o \quad \kappa_1 < 0, \kappa_2 > 0$$

⁸ Given the capital stock and the assumption that the labour market is perfectly competitive, we can derive the demand and supply of labour as:

$$\ln L^d = -d(\ln W - \ln P^d) \quad \text{and} \quad \ln L^s = s(\ln W - \ln P)$$

We can solve the labour market equilibrium condition ($L^d = L^s$) for the equilibrium wage rate, then we will have:

$$\ln W = \frac{d}{d + s} \ln P^d + \frac{s}{d + s} \ln P \quad \text{and} \quad \frac{d}{d + s} = 1 - \frac{s}{d + s}$$

$$\ln W - \ln P = (1 - \alpha) \left[\frac{1}{1 - c} \ln P - \frac{c}{1 - c} (\ln E + \ln P^*) \right] + (\alpha - 1) \ln P$$

$$\ln W - \ln P = -\frac{c - \alpha c}{1 - c} (\ln E + \ln P^* - \ln P)$$

where $\ln W - \ln P = \ln w$ and $\ln E + \ln P^* - \ln P = \ln RER$, then we will have:

$$\ln w = -\frac{c - \alpha c}{1 - c} \ln RER \quad \frac{c - \alpha c}{1 - c} > 0 \Rightarrow \frac{\partial w}{\partial RER} < 0 \quad (6.14)$$

While unemployment is a function of real wage, a rise in the real exchange rate will decrease the level of unemployment. Considering this relationship and using the capital market equilibrium condition gives the following expression:

$$\ln U = v \ln RER + \omega \ln r + \gamma \ln y^o \quad v, \gamma < 0 \quad \omega > 0 \quad (6.15)$$

where U is the ratio of number of unemployed workers on labour force, RER is real exchange rate, r is real interest rate, and y^o is real income of oil.

6.3.2 The cointegration equation

To get started on the analysis of the long-run relationship between the variables under consideration, two important points should be noted. First, due to the lack of reliable data on population, labour force, and the employed workers, both official and non-official estimates of unemployment are subject to a great deal of guesswork. However, unofficial estimates of unemployment have always been measurably higher than the official figures, all of these state the same story about the trend of unemployment in Iran, [see, for example, Amirahmadi (1990) and Amozegar (1993)]. Therefore, the results may not show the complete and real situation. Second, in the specific case of Iran, we are faced with the different scenario regarding the interest rate. The story is that, interest rates in this economy, as in some developing countries, do not play a significant role. Particularly since 1980, due to the Islamic revolution, the Iranian banking system and other monetary institution have been changed by the interest-free system.

On the other hand, before that time we had also encountered a disequilibrium interest rate due to government policy which imposed a low interest rate on lending institutions partly to support the favoured sector of the economy. With a high rate of domestic inflation, as can be seen from the table 6.11, the real interest rate had become negative.

Table 6.11
Real interest rate (1970-79)

Year	Nominal interest rate	Inflation	Real interest rate
1970	8	2	6
1971	7	4	3
1972	7.5	6	1.5
1973	9	10	-1
1974	9	15	-6
1975	8	13	-5
1976	8	11	-3
1977	8	28	-20
1978	10	12	-2
1979	9	11	-2

Source; *International Financial Statistics (IFS)*, yearbook 1993.

The natural consequence of such a policy is that private investment demand tends to exceed the supply of saving and therefore, firms who wanted to borrow to make investment are rationed. Under this circumstance, when investors are simply not able to borrow at the market interest rate, their ability to finance investment will depend on their internal resources and on their rationed investable funds. The critical implication of such policies is that, the capital stock in every period may be different from its optimal level determined by the market interest rate and the marginal productivity of capital. Furthermore, on the basis of both DF and ADF test statistics when applied to the level of real interest rate, the null hypothesis of a unit root is rejected, implying that this variable is integrated of order 0 and hence is not a valid candidate for inclusion in a cointegrating vector⁹. As a result, the long-run empirical equation of unemployment (with imposing a dummy variable to measure the impact of the revolution and its aftermath and real effective exchange rate instead of real exchange rate) has been constructed as:

$$\ln U_t = \lambda + v \ln REER_t + \gamma \ln y_t^o + \omega D_t + \varepsilon_t \quad (6.16)$$

⁹ The estimated DF and ADF statistics are -3.70 and -4.33 respectively when applied to the level.

6.3.3 The cointegration result

6.3.3.1 Unit root tests

Table 6.12 presents the results of unit root tests based on the standard DF and ADF test statistics. They show that all variables in question are integrated of order 1, and hence there is a long-run relationship among them.

Table 6.12
Unemployment equation, unit root tests

Variables	Level		first difference	
	AD	ADF	AD	ADF
ln U	-1.60	-2.67	-4.42	-3.93
ln REER	-0.40	-0.13	-7.43	-4.75
ln y^o	-1.17	-1.50	-4.43	-3.29
D	-2.06	-2.06	-5.38	-3.73

The relevant critical values at 5 percent level for DF and ADF are about 3.56 and for 10 percent level are about 3.18. Fuller (1976).

6.3.3.2 Cointegration results

As a second step we test for cointegration using the Johansen method. The results are given in Table 6.13. From this table, there are three cointegrating vectors, but among them only the first vector has the expected theoretical sign.

Table 6.13
Tests for the number of cointegrating vectors
Unemployment equation: $\ln U_t = \lambda + v \ln REER_t + \gamma \ln y_t^o + D_t + \epsilon_t$

Cointegration LR test based on Maximal Eigenvalue of the stochastic matrix

Null	Alternative	Statistic	95 % critical value ⁽¹⁾
$r = 0$	$r = 1$	36.59	28.14
$r \leq 1$	$r = 2$	32.82	22.00
$r \leq 2$	$r = 3$	15.26	15.67
$r \leq 3$	$r = 4$	5.62	9.24

Cointegration LR test based on Trace of the stochastic matrix

Null	Alternative	Statistic	95 % critical value
$r = 0$	$r \geq 1$	90.27	53.12
$r \leq 1$	$r \geq 2$	53.68	34.91
$r \leq 2$	$r \geq 3$	20.86	19.96
$r \leq 3$	$r = 4$	5.62	9.24

(1) Critical value taken from Osterwald-Lenum (1992), Table 1.

Estimated cointegrated vectors in Johansen estimation (normalised in brackets)

Variable	Accepted vector
$\ln U$	-.4913 (-1.0000)
$\ln REER$	-.10943 (-.22272)
$\ln y^0$	-.020055 (-.04082)
D	.62490 (1.2719)
Intercept	1.5018 (3.0569)

Then, the estimated equation will be:

$$\ln U_t = 3.1 - 0.22 \ln REER_t - 0.04 \ln y_t^0 + 1.3D_t \quad (6.17)$$

6.3.4 Interpretation of the results

According to these estimated results, several sources of long-run variation in the output gap can be identified:

(i) *Non-economic factors*: The Iranian economy has suffered from a set of political, social, and other non-economic problems that have directly or indirectly determined the size of the output gap. During the 1978-92 period, the behaviour and performance of the domestic economy has been influenced by the revolution and its aftermath namely, war, sanction, and so on. Most of these factors were

outside the government control and their negative effect on the output gap, as the estimated results show, have been quite significant.

(ii) *Oil export earnings*: There is no doubt that oil incomes are the most important variable in the Iranian economy. In fact, it is almost impossible these days to discuss behaviour and performance of the domestic economy without considering the oil export incomes. The results obtained from this regression confirm our main finding, in the previous chapter, that higher oil export earnings (or higher foreign exchange income) lead to higher opportunity for domestic economy to make good performance and consequently to smaller output gap.

(iii) *Real exchange rate*: Another interesting point can be made about the results in Table 6.13 is that, for all three vectors the sign of the coefficient of the real exchange rate is negative indicating that a real appreciation has positive effect on the number of unemployed workers and hence on the output gap. The estimated long-run effects suggest that a 10 percent real appreciation leads to a 2.2 percent increase in the ratio of the number of unemployed workers on the labour force. The result will be more interesting when we consider that during the 1961-92 period, the Iranian real exchange rate has appreciated more than 90 percent. It means that the unemployment ratio has been increased more than 19 percent.

6.4 Conclusion

This chapter has investigated the relation between the extent of the real exchange rate movement and economic performance in the Iranian economy. The results indicate that a strong relationship exists between real exchange rate and output performance indicators.

In the external sector, non-oil exports are positively affected by real exchange rate movements, while imports respond negatively to such movements. The absolute effect of the real exchange rate on the imports is lower than its effect on non-oil exports. There are at least two reasons why such a difference could exist. First, the low elasticity of imports demand with respect to real exchange rate movements is the restrictions given by the government to non-essential imports. Second, due to unsustainable real exchange rate movements may result in a circle in which a deterioration in export earnings decreases the ability of the country's to pay for imports (positive effect of overvalued real exchange rate on imports).

Output performance is positively correlated with the real exchange rate behaviour. However, this result does not imply that real exchange rate behaviour is the main

determinant of output performance, but it confirms that inappropriate real exchange rate policies in recent years have played a significant role in the poor performance of the economy under study. Therefore, the effect on the output gap of real exchange rate movements is negative, indicating that an overvalued real exchange rate leads to a higher output gap. This result supports the positive relationship between output growth and the real exchange rate.

Real Exchange Rate Targeting

7.1 Introduction

So far the analysis has been confined to an examination of actual movements in the real exchange rates, their causes and their effects on the economic performance in the Iranian economy. The findings from these investigations demonstrate that the real exchange rate is an important variable which responds to both exogenous and policy-induced disturbances and has a strong correlation with performance indicators. A direct implication of these results is that while a low and volatile real exchange rate may inhibit economic growth, its stability could be fundamental in promoting economies expansion. This is especially true for the situation where it is accepted that the real exchange rate is one of the main transmission mechanisms between policy and performance. Thus policies that aim to stabilise the real exchange rate around a sustainable level will directly affect economic growth through this mechanism.

A policy of real exchange rate targeting requires a special combination of economic policies affecting the nominal exchange rates, the domestic price level, and foreign price shock. Such a strategy involves a variety of macroeconomic policies that is beyond the scope of the current research. The purpose of this chapter, however, is not to present a complete catalogue of the related policies, it is organised to examine critically the rationales behind some alternative approaches and to identify those features that make the policy of the real exchange rate targeting more effective, in the context of the Iranian economy.

This chapter is organised as follows. Section 2 investigates the stabilisation policies for reducing real exchange rate volatility. In this section, the relative importance of temporary and permanent shocks to the Iranian real effective exchange rate are estimated in order to provide a frame of references for subsequent policy discussion. Second, we critically examine a number of alternative stabilising policies which are expected to be appropriate for reducing real exchange rate volatility. In this part special emphasis will be put on the ability of nominal devaluation in bringing stability in the foreign exchange market. Section 3 addresses empirically the effectiveness of the exchange rate based reform in the Iranian economy. The final section summarises the main conclusions.

7.2 Stabilisation policies for reducing real exchange rate variability

Consider the estimated equations 5.3 and 5.6 from Chapter 5:

$$\ln \text{REER}_t = 9.34 + 0.73 \ln \text{TOT}_t - 0.31 \ln \text{TP}_t - 0.85 \ln y_t + 0.45 \ln I_t \quad (5.3')$$

$$\begin{aligned} \Delta \ln \text{REER}_t = & 0.06 + 0.32 \Delta \ln \text{TOT}_{t-1} - 0.06 \Delta \ln \text{TP}_t - 0.72 \Delta \ln y_{t-1} \\ & - 0.61 \Delta \ln I_t - 0.29 \Delta \ln \text{DC}_t - 0.17 \hat{U}_{t-1} - 0.11 D_1 - 0.11 D_2 \end{aligned} \quad (5.6')$$

From these estimated equations, several sources of variation in the real effective exchange rate can be identified. The REER appreciates with; (i) a deterioration in the terms of trade, (TOT), (ii) an increase in the (restricted) trade policy variable, (TP), (iii) a rise in real income, (y), (iv) a decrease in (long-run) investment, (I), and (v) an expansionary monetary or loose fiscal policy, (DC).

As can be seen, the real exchange rate variability in the Iranian economy resulted from a complex combination of several elements, some of which were external to this economy, and thus beyond the control of the government, while others were the direct result of economic policies pursued by the government. Experience shows that the Iranian economy has serious difficulty with respect to the external shocks unless it finds some institutional independence from its external sector. Despite this structural problem, some inappropriate domestic policies aggravated the real exchange rate variability. Therefore, however, stopping the negative effect of external shocks on the domestic economy, at least in the short-run, is far from expectation, a combination of the appropriate domestic policies may be able to reduce the growing rate of real appreciation. Since most of such policy-induced shocks have two different (temporary and permanent) effects, now a crucial question is that which dimension of such shocks is more important and therefore has to be focused on by policy-makers. The empirical results presented in the

previous chapters did not tackle this issue. In consequence, more definitive analysis along with previous empirical work is required to estimate the relative importance of temporary shocks versus permanent disturbances.

7.2.1 Relative importance of the temporary and permanent shocks to the real effective exchange rate

Following Calvo et al. (1995) Cochrane's methodology [Cochrane (1988)] is used to determine how significant is the role played by temporary and permanent shocks in explaining the Iranian real exchange rate. Cochrane's methodology measures the size of a random walk component in a variable from the variance of its long differences. As an illustration of this point consider, for example, the variable Y has the following simple representation:

$$Y_t = \alpha Y_{t-1} + U_t \quad \text{Where } U \sim N(0, \sigma^2) \quad (7.1)$$

If the value of α is equal to 1, Y is a pure random walk. Then the variance of its K -differences grows with the difference K :

$$\text{var}(Y_t - Y_{t-K}) = K\sigma_U^2 \quad (7.2)$$

On the other hand, if the value of α is less than one, Y is stationary. In this case, the variance of its K -difference is given by:

$$\text{var}(Y_t - Y_{t-K}) = \sigma_U^2 (1 - \alpha^{2K}) / (1 - \alpha^2) \quad (7.3)$$

Now consider the ratio $\frac{1}{K} \text{var}(Y_t - Y_{t-K}) / \text{var}(Y_t - Y_{t-1})$. If Y follows random walk process (in which case Y is not stationary and therefore the temporary disturbances are not an important source of variability), the ratio would be equal to one. If Y is stationary, then this ratio would be between one and zero. The closer the ratio to zero, the higher is the relative importance of permanent shocks.

Table 7.1 contains the main results. With different values of K , temporary disturbances to the Iranian real exchange rate are as significant as permanent shocks. As can be seen, in all cases the ratio converges to 0.5. This means, any attempt to keep the real exchange rate close to its sustainable level, it is necessary to establish a policy package that resolves the fundamental causes of the real exchange rate variability and corrects some of the temporary disturbances introduced domestically.

Table 7.1

Stationary and random walk component of the Iranian real exchange rate

K	Relative importance of temporary shocks %
2	40
3	51
4	48
5	53
6	49
7	53
8	55
9	51
10	53

In Chapter 2, it has been investigated that under a predetermined nominal exchange rate when the real exchange rate misalignment takes the form of real overvaluation, the only possible way to return rapidly to the real exchange rate equilibrium is a reduction in the price of nontradable goods. Such a reduction in the nontradables price can be achieved automatically or by government's intervening policies. In the following sub-sections we will briefly consider that how effective are these alternative ways to reduce the real exchange rate misalignment in the Iranian economy.

7.2.2 Automatic adjustment

Generally, there is an autonomous tendency for the actual real exchange rate to converge to its equilibrium level. When domestic prices are fully flexible, automatic adjustment will eliminate the deviation between actual and equilibrium rate with little cost. The adjustment problem will be compounded when the price of nontradables is rigid downwards and the full or high employment level of income is introduced as a desirable policy target. In the case of Iran, as most developing countries, domestic prices and wages are not fully flexible, therefore, the self-correcting process can generate additional costs in the form of unemployment and reduced domestic output.

The estimated value of the coefficient of lagged residuals in our error-correction model (Chapter 5) confirms the limits of automatic adjustment in the Iranian economy. A value of -0.17 of the speed of adjustment implies that the restoration of the real exchange rate equilibrium without accompanying instruments

(intervening policy) can be very slow and costly. Moreover, in recent years, unsustainable fundamental shocks (such as deterioration in the terms of trade) and nominal disturbances (such as inflationary financing of the budget deficit and expansionary monetary policy) have prolonged for a long period of time. Therefore, even if the speed of adjustment was closer to one, the system on its own would not be able to eliminate the real exchange rate misalignment. It means, under these circumstances, the real exchange rate equilibrium can be attained only by accompanied by a number of complementary policies.

7.2.3 Nominal devaluation

Under a predetermined nominal exchange rate regime, the most common stabilisation policy for offsetting temporary distortions and hence reducing swings in real exchange rate relates to stabilisation of the nominal exchange rate.

The effect of a nominal devaluation on the real exchange rate depends to a large extent on the initial condition of the economy and the accompanying macroeconomic policies.¹ When the domestic price, for example, is not rapid to adjust, then a nominal devaluation may be successful to result in a real exchange rate devaluation. To some extent the degree of effectiveness of a nominal devaluation can be broadly measured by the elasticity of the real exchange rate with respect to the nominal devaluation. A value of closer to unity of this index indicates that the nominal exchange rate devaluation has been mostly transferred into a real devaluation. The overall value of this index is highly dependent on the response of the domestic price levels including the price of nontradable goods to the nominal devaluation.

According to the empirical definition of the real exchange rate, EP_T^*/P_N , the numerator of this ratio will rise in proportion to nominal exchange rate changes. While the price of nontradables, P_N , can be affected by more direct and indirect channels. The first channel by which the nominal exchange rate directly affects nontradables price is through imported intermediate goods. To put this in a functional form, consider a simple model in which price of nontradables is supply determined. P_N can then be constructed as:

$$\hat{P}_N = v\hat{W} + \omega\hat{P}_I \quad 0 < v, \omega < 1 \quad (7.4)$$

¹ For further information see Edwards (1989a), chapter 6-8.

where $P_I = EP_I^*$, W is nominal wage, P_I is domestic price of imported intermediate goods, E is nominal exchange rate, P_I^* is foreign price of imported intermediate goods, and the sign $(\wedge)$ indicates the percentage changes in the variable.

According to typical models of wage setting, wages in high-inflation economies are often linked to the inflation rate.² Therefore, we can formalise this idea that the changes in nominal wages depend on the domestic price level.

$$\hat{W} = \kappa \hat{CPI} \quad 0 < \kappa \leq 1 \quad (7.5)$$

where CPI is the domestic consumer price index.³ The consumer price index is usually constructed as a geometric average of the price of different consumption goods and services. Thus the CPI can be generally given as:

$$\hat{CPI} = \alpha \hat{P}_d + (1 + \alpha) \hat{P}_F \quad 0 < \alpha < 1 \quad (7.6)$$

where $P_F = EP_F^*$, P_d is price of domestically produced goods, P_F is the domestic price of imported final goods, P_F^* is the foreign price of imported final goods, and α and $(1 - \alpha)$ are the weights attached to domestic goods and foreign goods, respectively, in the domestic consumption basket.

Equation (7.6) indicates that even if the prices of domestically produced goods are not subject to purchasing power parity, that part of consumer price index made up of imported final goods is directly affected by the nominal exchange rate changes. But, in practice, nominal exchange rate changes are likely to affect directly the price of domestically produced goods through the highly tradables commodities in the economy. That is:

$$\hat{P}_d = \beta \hat{P}_N + (1 - \beta) \hat{P}_T \quad 0 < \beta < 1 \quad (7.7)$$

where $\hat{P}_T = EP_T^*$, P_T is domestic price of tradable goods, P_T^* is foreign price of tradable goods, and β and $(1 - \beta)$ are the weights of domestic nontradables and tradables in P_d .

Combining equation (7.4) through (7.7), we capture the final overall equation for the price of nontradable goods:

² Such an adjustment has been a common policy pursued by the Iranian government in recent years.

³ In this study, changes in consumer price index has been considered as a proxy for domestic inflation.

$$\begin{aligned}\hat{P}_N = & \frac{v\kappa\alpha(1-\beta)}{1-v\kappa\alpha\beta}\hat{P}_T^* + \frac{v\kappa(1-\alpha)}{1-v\kappa\alpha\beta}\hat{P}_F^* + \frac{\omega}{1-v\kappa\alpha\beta}\hat{P}_I^* \\ & + \left(\frac{v\kappa\alpha(1-\beta)}{1-v\kappa\alpha\beta} + \frac{v\kappa(1-\alpha)}{1-v\kappa\alpha\beta} + \frac{\omega}{1-v\kappa\alpha\beta}\right)\hat{E}\end{aligned}\quad (7.8)$$

Equation (7.8) indicates that the nominal exchange rate changes can affect the price of nontradable goods through three different channels; (i) through price of domestic tradable goods measured by $\frac{v\kappa\alpha(1-\beta)}{1-v\kappa\alpha\beta}$, (ii) through price of imported final goods measured by $\frac{v\kappa(1-\alpha)}{1-v\kappa\alpha\beta}$, (iii) through price of imported intermediate goods which is measured by $\frac{\omega}{1-v\kappa\alpha\beta}$. If the term $\left(\frac{v\kappa\alpha(1-\beta)}{1-v\kappa\alpha\beta} + \frac{v\kappa(1-\alpha)}{1-v\kappa\alpha\beta} + \frac{\omega}{1-v\kappa\alpha\beta}\right)$ is equal to one, it means that the nominal exchange rate adjustment has been fully eroded. If this term is less than unity, it is expected that the effectiveness index of nominal exchange rate to be positive.

This is not the end of story. The above discussion has considered only the supply effect of nominal devaluation on the price of nontradables. With the assumption that nontradables are normal goods and the cross-price elasticity between nontradables and foreign goods (whether imported final goods, imported intermediate goods, or exportables) is positive, then the rate of changes in the price of nontradables is equal to the supply effect plus the intratemporal substitution effect of the depreciation of the domestic currency. Therefore, the final effect of changes in E on P_N may be greater than the coefficient of E in equation (7.8).

Despite the data unavailability, a further attempt has been made to estimate the value of the coefficient of $\hat{E}$. From equation (7.4) through (7.7) along with the assumptions that price of imported intermediate goods (P_I) and price of imported final goods (P_F) are a function of price of importable goods, then we can summarise the relationship between $\hat{P}_N$ and $\hat{E}$ and $\hat{P}_T^* = \eta\hat{P}_X^* + (1-\eta)\hat{P}_M^*$. In this case, the price of nontradables is defined as a function of exportables price and importables price as following:

$$P_N = f(P_X, P_M) \quad \partial P_N / \partial P_X \text{ and } \partial P_N / \partial P_M > 0 \quad (7.9)$$

If $P_X = EP_X^*$ and $P_M = EP_M^*$ then;

$$\hat{P}_N = \phi\hat{P}_X^* + \varphi\hat{P}_M^* + (\phi + \varphi)\hat{E} \quad (7.10)$$

As can be seen from equation (7.10), the sum of coefficient of foreign price of exportables and importables is equal to the coefficient of the nominal exchange rate changes. Consequently, in a predetermined nominal exchange rate regime where $\hat{E} = 0$, the estimated coefficients of the exportables price and importables price can be used to predict the effect of changes in E on the P_N .

Obviously, the value of this coefficient measures, in a very broad sense, what percentage of E translated into the P_N . The reason why this estimation gives us an inaccurate measure of the relationship between E and P_N is that: First, it is based on the assumption that the other relevant variables are constant. Secondly, the overall values of P_X^* and P_M^* used in this estimation are unlikely to be the precise ones. Thirdly, due to the lack of data, the effect of the trade policy is not considered.

To proceed with estimation, we have used the consumer price index as a proxy for P_N , $P_X^* = \sum_{i=1}^n w_i P_{Xi}^*$ and $P_M^* = \sum_{i=1}^n w_i P_{Mi}^*$, where w_i is the weight of country i in the Iranian total trade. As can be seen from Table 4.1 (in Chapter 4), during the period of our study, more than 60 percent of Iran's trade has been done with five major industrial countries (namely Japan, Germany, France, UK and USA). For this reason and for simplicity, the price of importables and exportables of these five countries have been used in this estimation.⁴ Therefore, $i=1,2,\dots,5$. Annual data and ordinary least squares technique were used.

Table 7.2 reports the econometric results. The overall performance of the equation is quite satisfactory. The sign of the estimated coefficients of $\hat{P}_X^*$ and $\hat{P}_M^*$ is positive and statistically significant. These results provide something quite remarkable regarding nominal exchange rate stabilisation in the Iranian economy. The overall estimated value of this coefficient which contains the supply and substitution effects of nominal devaluation is closer to one (0.88), indicating that the total price effect of a nominal devaluation in this economy does not allow the nominal devaluation to translate fully into the real devaluation. In other words, wide swings in the Iranian real exchange rate and the implications that they have for patterns of output and trade (see Chapter 6) cannot be ended by just an appropriate exchange rate policy. It is necessary for accompanying macroeconomic policies to be consistent with the adopted nominal exchange rate policy in order to keep the growth rate of domestic price level substantially less than the rate of nominal devaluation. In the absence of such policies, the result will be a severe

⁴ In view of further simplifying, the trade weight of 1990 has been used.

disequilibrium with an increasing rate of inflation. As a result, the whole effect of nominal devaluation may be eroded so that the real exchange rate may go back to the below of its previous value.

Table 7.2

Impact effect of foreign price on the domestic price of nontradable goods
in the Iranian economy 1961-92

Regressor	Coefficient	T-ratio
$\hat{P}_X^*$	0.76	4.49
$\hat{P}_M^*$	0.12	5.72
R-squared = 0.70	DW-statistic = 1.25	
<i>Diagnostic tests:</i>		
Serial correlation	CHI-SQ (1) = 3.98	F (1 , 27) = 4.12
Functional form	CHI-SQ (1) = 4.67	F (1 , 27) = 4.97
Normality	CHI-SQ (2) = 1.18	--
Heteroscedasticity	CHI-SQ (1) = 1.16	F (1 , 29) = 1.13

7.2.4 Commercial policy and real exchange rate stability

The evidence from the empirical results in Chapter 5 can be used to assess the effect of commercial policy interventions on the real exchange rate stabilisation in the Iranian economy. The negative sign of the estimated coefficient of trade policy (TP) indicates that a relaxation of impediments to trade will result in a real exchange rate depreciation. However, the degree of importance of temporary shocks in determining the behaviour of the real exchange rate is as significant as permanent shocks, a number of points need to be noted about such a relationship as it relates to changes in the trade policy.

As may be seen from equation (5.4'), the magnitude of the estimated coefficient of the temporary effects of trade policy on the real exchange rate is somewhat small (0.06). Such a small value, thus, can be taken as evidence that influences of any temporary relaxation of barriers to trade are not important as a factor in real exchange rate behaviour. On the other hand, the high degree of magnitude of permanent trade policy on the real exchange rate (0.43) indicates that a continued

decrease in barriers to trade may result in a substantial real exchange rate depreciation. Therefore, if the government aims to stabilise the real exchange rate by reducing some impediments to international trade, it is necessary to concentrate on the permanent relaxation of trade barriers.

In sum, reducing quantitative restriction on trade can be one policy option to help stabilising the real exchange rate. In the case of Iran, the prospect of immediately eliminating all quantitative trade restrictions is unlikely to be efficient. The trade system in this economy is so restrictive that sudden removal of quotas or licensing requirements will lead to a large and rapid increase in imports. Rapid increase in imports can aggravate external imbalances if it happens before the stabilised real exchange rate has a chance to improve the international competitiveness of the country's export industries.

Therefore, removing artificial barriers to trade in a way designed to avoid very large shifts in the volume of imports seems to be efficient to make the real exchange rate adjustment more successful and less costly. It means that gradual, but continual removal of quantitative restrictions could be a possible component of an alternative policy for targeting the real exchange rate in the Iranian economy.

7.2.5 Nominal exchange rate regime and real exchange rate stability

Successful real exchange rate targeting requires another ingredient, that is the appropriate nominal exchange rate regime adopted along with the stabilisation programme. Black (1976) and Williamson (1982) have suggested that a more flexible exchange rate arrangement may provide for greater real exchange rate stability. However, some of the recent empirical studies indicate that over the longer run, a flexible exchange rate policy may be more successful in stabilising the real exchange rate [Savvides (1990)], it is also claimed that, where monetary disturbances predominate, a fixed exchange rate regime can provide a stable real exchange rate [Fisher (1977)]. In general, there is one point in which there is almost complete agreement. That is, in an economy (such as Iran) with inefficient domestic financial markets, imperfect capital mobility, a thin foreign exchange market, and monopolistic supply of foreign currency by the government, adoption of a flexible exchange rate system would be a mistake. In addition, in a situation where the government policy is totally dependent on what happens in the economy and fundamental factors such as the terms of trade and other external shocks which vary significantly, there will be little opportunity to anticipate the government's responses and to guess what the future situation will be. It is clear that, in this case the economy does not have a stable stabiliser and thus any level of prices and

exchange rates are possible. In such a case, any flexible exchange rate can be very volatile. Consequently, the case for bringing stability in the Iranian foreign exchange market, a flexible exchange rate seems to be implausible.

According to the empirical results, when devaluation results in higher inflation, adopting a less flexible system such as crawling peg regime, that make the authorities impose further devaluation the domestic currency in magnitudes approximately equal to the inflation differential between domestic and foreign prices leads to an explosive and non-convergent process, which partially demolishes the real effect of any exchange rate based stabilisation. Of course, if the government is able to direct the economy towards a mild rate of inflation by imposing rational fiscal and monetary policies and let the economy move on the basis of its own fundamental realities, a crawling peg regime could be an alternative scenario which may help to reduce volatility in the Iranian foreign exchange market.

The alternative solution thus will be a choice between unified fixed rate and a dual-rate system. On the basis of the Iranian economy experiences, adopting a unified fixed exchange rate when the government is unable to support the exchange rate market properly and satisfied even the essential demand for foreign currency at official rate with uncertainty in foreign currency earnings may be very costly and dangerous.⁵

Consequently, the inability of holding a unified fixed rate makes the case for dual exchange rate system which has only two rates; a fixed official rate that is applies to some trade transactions and a free rate at which capital flows and the rest of transactions take place. A major problem associated with dual exchange rates is a misallocation of production resources. That would seem to make some misjudgement about the appropriateness of this system. In some sense it could be true, but when the domestic price level is highly responsive to movements in the nominal exchange rate and the control of capital flights is nearly impossible, a well-managed dual system is supposed to be the only appropriate practical arrangement.

Under this system, when the economy encounters a permanent disturbance in its capital account or a permanent deterioration in its main foreign exchange earnings,

⁵ It should be noted that, one of the principles of any adjustment policy is that the exchange system should be directed toward a single rate. This fact is now widely accepted by policy-makers and recommended by many economists. But, Iran is faced with a crucial problem as there are huge differences between official and non-official exchange rates. Implementation of a exchange rate unification policy at least requires a situation in which there is no shortage of foreign exchange. With such problems, unification policy is unable to go a right way.

as occurred in the Iranian economy, a partial and stepwise devaluation of the official rate and a shift of a number of transactions from the fixed rate to the free rate can satisfy the need to eliminate the volatility in the foreign exchange market. Of course, as mentioned several times, any attempt to bring down volatility and improve the external balance at the time of stabilisation must be accompanied by sustainable fiscal and monetary policies that support these objectives. Lack of sustainable accompanying policies may lead to the appearance of a large gap between fixed and free exchange rates and hence further distortions.

7.2.6 Macroeconomic policies and real exchange rate stability

So far some of the important real exchange rate stabilisation instruments have been discussed. In this section, we shall investigate the different interlocking policies whose consistency can strengthen the government's ability to stabilise the foreign exchange market and hence improve economic performance in the long-run.

It is understood from the analyses in the previous chapters that under a predetermined nominal exchange rate the price level is the only channel through which the fundamental and nominal factors can affect the real exchange rate behaviour. If a stabilisation programme such as nominal devaluation is used to help bring about stability in the real exchange rate market, it is crucial that a real devaluation takes place. A real devaluation cannot obtain unless the domestic price is not allowed to increase in line with nominal devaluation. That is why the most fundamental step in reducing the real exchange rate volatility is to eliminate the underlying source of inflation. Inconsistent budgetary plans in the Iranian economy has been one of the these problems that led to the high inflation in the first place. By controlling the budget deficit the money supply may be more readily controlled and inflation may also be brought under control. Some authors, [see for example Greider (1987)], argue that, in order to resist pressures to inflationary finance of the government budget deficit, a necessary step is to increase the political independence of the central bank. They argue that, if the central bank has enough power to establish its independence and refuse to finance budget deficit by money creation, the government will have to find new non-money means of finance or cuts its spending.

Notice that, in an inflationary situation it is not sufficient to stop inflationary financing of the government budget deficit, it is also vital to improve the underlying budget situation. The high dependence of the budget on oil revenue must be decreased. To bring about a fundamental change in the composition of the government revenues in favour of non-oil revenues requires rises in tax revenue.

However, in the post-revolutionary period the proportion of government spending financed by taxes has increased, the damage done to the tax system has not yet been amended. Lack of an efficient tax system has weakened the system of tax administration and therefore tax revenues have been in fact falling in real terms in recent years. In consequence, a comprehensive tax reform is necessary with stabilisation program in the Iranian economy.

Other measures to improve the fiscal situation in the short-run include the elimination of unnecessary expenditure by accelerating the privatisation programme both through speeding up the direct sales of inefficient state-owned enterprises and by improving the activities of the domestic stock markets. A properly executed privatisation policy can be a key part of macroeconomic stabilisation. It can reduce excess money stock, reduce the government fiscal deficit and offer very direct incentives for the reactivation of domestic production.

Another policy measure that can improve the fiscal situation is the reduction of the direct subsidies. The popular form of the Iranian government subsidy has been the allocation of cheap foreign currency between private consumers and also the allocating of credit to private sector at highly negative real interest rates. There is no doubt that such subsidies as quasi-fiscal expenditure has made the government face the huge budget deficit and its grave consequences. Although, by some exchange rate policies the former form of subsidy has been reduced, subsidised credit to state-owned and private enterprises has still drained the resources. Successful stabilisation programs have to eliminate such a misallocation of resources.

Moreover, we have started our analysis in this chapter with a wage adjustment policy and found that such a policy plays an important role in determining the overall nontradables price level. Therefore, even under tight fiscal and monetary policy, wage adjustment (whether full or partial) makes it possible for nontradable prices to rise. Under this circumstance, the tightening monetary policy and government budget adjustment may not be sufficient to restore the real exchange rate equilibrium. To control the rate of inflation and its aftermath, a consistent ceiling on wages and prices at the start of the stabilisation is required. The positive effect of this policy, if successful, may be a direct impact on enforcing wage restraint and a further effect on both the inertia and people's inflationary expectations.

In spite of the rationale behind incomes policies, if they are not well managed, they will have a number of limitations. Recent experience in the year before the

government reform policy provides some useful lessons on the use of income policy. Since incomes policy naturally involved some undesirable distributional consequences, the government had designed to have subsidiary objectives in the areas of distribution in order to protect equity among people and neutral the negative effects of such policies. This, in fact, was an inconsistent policy which could damage the credibility of the incomes policy.

Furthermore, in every period of the price control, the rate of inflation stayed down only a few months, and then returned with renewed strength. That was because, the price controls were difficult to enforce beyond every group of commodities. These difficulties and lack of administrative ability made many of the controls ineffective.

In sum, the authorities should take special care in imposing an incomes policy. The character of a particular economy may not be able to sustain any kind of control policy. It must be recognised that the incomes policy is unlikely to be successful, unless it is matched with the other principal targets and the fundamental realities of the economy.

To correctly assess the contribution of above mentioned policies, we need to compare the actual situation of the economy after imposing such policies with the situation that might have prevailed without these programmes. However, such an empirical assessment seems to be impossible, at least for the economy under consideration, evaluating the recent attempts of the Iranian government to stabilise the exchange rate market may provide some useful evidence to our discussions.

7.3 Evidence from nominal exchange rate reform in the Iranian economy

After the cease-fire between Iran and Iraq in 1988, the Iranian government embarked on a five-year reconstruction and development plan with the principle objective of transforming the economy into a normal and more efficient system. As part of this general objective, concerted efforts have been made to eliminate the gap between official and black market exchange rates and to bring stability in this market by unifying the exchange rates. At the beginning of 1993 the government officially devalued the domestic currency. Although, at the beginning of this policy, liberalisation of the exchange rate system by adopting a flexible regime was announced by the government as the chief target of this policy, in practice due mainly to inconsistency between this policy and the structure of the Iranian economy, the government had to reverse the announced policy and set a new official rate much higher than the previous rate. It is, however, too early to make a

comprehensive judgement about the final effects of the 1993 exchange rate reform, although analysing the initial response of the economy may provide a useful insight into the likely outcome of this reform.

With this in mind, in an attempt to analyse the consequences of the 1993 exchange rate policy reform, this section consists in analysing in detail the evolution of a number of key variables during the one year preceding and the two years following the exchange rate reform. A well-known shortcoming of this type of analysis is that the nominal devaluation is only a part of the government stabilisation programme and is always accompanied by other macroeconomic policies. The comparison of the level of a particular variable before and after the event, on one hand, does not take into account the possible impact of other factors on the behaviour of this variable, and on the other hand, it cannot separate the effect of the devaluation itself from others effects. Consequently, it is not easy to evaluate empirically whether the government exchange rate policy has indeed been successful or not. On the positive side, this study allows us to infer at least some general ideas that indicate the relative ability of a common instrument of stabilisation policy in the Iranian economy.

With this regard, we have concentrated on the behaviour of domestic price level, foreign exchange market, real exchange rate and macroeconomic policy (fiscal and monetary policy) during the period from one year before and two years after the devaluation.

7.3.1 Nominal devaluation and domestic price level

Normally, in the absence of a tightening fiscal and monetary policy, there will be a direct relationship between devaluation and domestic price movements. The data presented in the Table 7.3 indicates that domestic price levels exhibit a remarkable increase in the year prior to the devaluation, experiencing an upward trend in the two years after the devaluation.

As can be seen from the table, the devaluation episode was followed by an increase in domestic inflation of at least 21% p.a. (in both wholesale and consumer price indices).⁶ Aggregate demand may be depressed by the rising domestic price level, but the adverse effect of this sharp price rise on real exchange rate becomes apparent. In spite of the fact that a nominal devaluation has to be accompanied by

⁶ Official data on domestic prices reflects the price movements in the controlled markets. Therefore, the published figures measurably underestimated the real rise in prices and cannot give us a complete picture of the real situation.

a contractionary fiscal and monetary policy in order to offset the inflationary effect of the devaluation, the Iranian government, as can be seen in the next sub-sections, has not imposed consistent macroeconomic policies appropriately. According to the data in this table, the inflation rate in 1993, the year of devaluation, is lower than the rate in the second year after devaluation. As it is well known, the immediate effect of devaluation on the price level reveals during the year of devaluation, and then a tightening fiscal and monetary policy with accompanied by expansionary effect of devaluation on domestic price levels is expected to lead to a reduction in real expenditure and prevent the further increases in the price level.

Table 7.3
Inflation rate before and after the nominal exchange rate reform
1985=100

Year	Before devaluation				After devaluation									
	1992				1993				1994				1995	
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II
Inflation rate	8.5	8.2	2.2	2.3	7	6.9	2.7	5.7	9.3	8.7	5.8	8.7	13	-
	21.2				22.3				32.5				-	

Source; International Financial Statistics, Yearbook, (August 1995)

Moreover, following the nominal exchange rate reform, the government announced price increases in some goods and services that have been produced by state. On the other hand, as a supplementary policy to reduce the negative effect of the stabilisation policy on social welfare, the government has increased the minimum wage of the state employees, and has applied the previous official exchange rate to the sums allocated to imports of some basic essential goods. Such a large expenditure allocation, as government budget in the years after the reform indicates, has not been offset by appropriate expenditure cuts elsewhere in the budget. In consequence, the inflationary impact has become further aggravated.

7.3.2 Nominal devaluation and black market exchange rate

One of the main purposes of the 1993 devaluation was to reduce the huge gap between official and the black market exchange rates so as to alleviate the high

cost of multiple exchange rates. Table 7.4 contains data on the evolution of these variables.

Table 7.4

Trends in the gap between the official and the black market exchange rates (Rials per US dollar)in the period before and after the nominal exchange rate reform

Year	Before devaluation				After devaluation									
	1992				1993				1994				1995	
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II*
Gap	1377	1390	1426	1489	51	41	77	420	581	901	1051	1451	3551	4752
	1419				147.2				996					

* In the middle of this period the current exchange rate policy has been changed and the black market for foreign currencies has become illegal.

As may be seen from Table 7.4, the gap between the two rates had begun growing rapidly the before of devaluation and declined sharply during the months immediately following the devaluation. The downward trends were short-lived and after six months the gap started to increase. This indicates that a nominal devaluation as a short-term policy however has its own initial positive effect on the exchange rate market, remaining on the predetermined exchange rate system with limited international reserves causes the exchange control and capital movements to be restricted. On the basis of the previous experiences, individuals would naturally expect that such restrictive policies, accompanied by other inconsistencies might result in a worse situation in the foreign exchange market. The freely determined black market exchange rates hence start to respond to this situation by deviating from the predetermined official rate. This process inevitably led to a new multiple exchange rate with a massive gap between the official and black market rates and also a high domestic price level with its grave consequences.

7.3.3 Nominal devaluation and real exchange rate

There are a number of possible criteria that can be used to determine the effectiveness of a nominal devaluation, its impact on the behaviour of the real exchange rate is increasingly accepted as a useful indicator of the effectiveness of a nominal devaluation [Edwards and Montiel (1989)]. Through this channel a

devaluation can change the patterns of domestic demand and production which in turn help to restore the country's internal and external equilibrium. According to the findings from the previous chapter, with an unsustainable real exchange rate there will be forces at work that will tend to deteriorate the domestic output market equilibrium and the current account balance. Therefore, if a nominal devaluation sustains the real exchange rate, an important channel to obtain the ultimate targets will appear. As pointed out earlier [and also see Edwards (1989a)], the elasticity of the real exchange rate with respect to the nominal devaluation can be treated as an effectiveness index of devaluation that is measured in the following form;

$$Z_t = \frac{(\hat{R\acute{E}ER})_t}{\hat{E}_t}$$

Z = effectiveness index of nominal devaluation

$\hat{R\acute{E}ER}$ = percentage change in the real exchange rate

$\hat{E}$ = percentage changes in the nominal exchange rate

t = refers to the years (or months) after the devaluation

Table 7.5 presents the estimated value of this index for three years after the devaluation. These data show that after the devaluation the real exchange rates became higher than their value before the devaluation. But this positive effect also seems to be short-lived. As the effectiveness index shows, the effect of nominal devaluation has increasingly being wiped out during three years after the event. At the beginning of the devaluation year (1993), the effectiveness index was 0.62 and has had a decreasing trend in the following years. This means that the real devaluation in the economy in question has been achieved at the cost of significant increases in the domestic inflation. A potential problem with this policy is that this situation unavoidably leads to a higher nominal devaluation and consequently higher inflation with its negative aftermath on the real exchange rate.⁷

Table 7.5
effectiveness index of nominal devaluation

1990 = 100													
Year	Before devaluation				After devaluation								
	1992				1993				1994				1995
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I
Effectiveness index	-				.62	.58	.54	.53	.50	.44	.40	.34	.28

⁷ In the middle of 1995 the Iranian government has devaluated the domestic currency by a substantial amount, to avoid its high inflationary consequence, it has also imposed a variety of quantitative restrictions on the trade and exchange rate market.

As can be seen from Table 7.5, the nominal devaluation in 1993, in spite of its inflationary effects, has resulted in a remarkable real depreciation. However, this result indicates that how effective has been that devaluation policy to realign the real exchange rate, the final judgement depends on two important elements: a) Nominal devaluation as a part of stabilisation packages is a short-run instrument and therefore its effect on the relevant variables including the real exchange rate is expected to be temporary. On the other hand, changing the structure of an economy to reduce imbalances in the internal and external sectors needs a medium to long-term effects. Such results can be achieved by consistent relationship between nominal devaluation and the other parts of stabilisation packages. In the absence of this consistency, a nominal devaluation may generate a higher inflationary situation without improving the country's external deficit or internal imbalances. b) As mentioned before, although long-lived depreciated real exchange rate is an important indicator of the effectiveness of a nominal devaluation, it in itself is not the main purpose of such policies. The final target is to eliminate macroeconomic imbalances. Whether this ultimate target will actually be obtained will also depend on accompanying policies.

In sum, generating a real devaluation as well as seeking to provide an improvement in the country's macroeconomic imbalances via this real devaluation requires sustainable macroeconomic policies. The following sub-section will investigate the behaviour of these factors during the years after the devaluation.

7.3.4 Nominal devaluation and macroeconomic policy

Before the devaluation crisis the nominal exchange rate was predetermined by the government. On the other hand, the domestic credit was expanded to finance fiscal deficit and to increase lending to the private sector. These policies with some external shocks (as pointed out in the previous chapters) resulted in an inflationary situation and hence to a low and variable real exchange rate with their grave aftermath.

In response to this problem the 1993 devaluation has taken place. On the basis of this fact that unsustainable macroeconomic policies have been one of the ultimate causes of the crisis that led to the devaluation, the government should undoubtedly undertake an appropriate strategy to put a check on those key factors which play a significant role on the determination of the effectiveness of a devaluation. Without such strategies, the initial positive impact of the nominal devaluation will be lasting for a very short time.

Table 7.6 present data on the difference between the rate of growth of money stock and the rate of growth of real gross domestic product (real growth rate of money) as a proxy for the monetary policy, and the ratio of the government spending on the gross domestic product as an indicator of the fiscal policy. The data in this table are very revealing and provide some useful information to capture the cause of difficulties associated with the government unsuccessful exchange rate policy.

Table 7.6

Macroeconomic policies in the period preceding and following the devaluation

Year	Before devaluation	After devaluation	
	1992	1993	1994
The real growth rate of money stock	18.3	28.2	31.5
G/GDP	.19	.27	.29

Source; The central bank of Iran, Economic Reports, (1994) and the International Financial Statistics, Yearbook (August 1995).

As may be seen, both indicators show that the Iranian government has not imposed a tightening fiscal and monetary policy. The real growth rate of money supply and the ratio of the government spending on GDP are higher than their value before the devaluation. Such a tendency to maintain the loose macroeconomic policies will erode the real effect of nominal devaluation. When it happened, it may have doubted the ultimate success of reform and brought the whole stabilisation policy under accusation and causes the government to be unable to persuade the structural adjustment policy.

The government, however, in an attempt tried to reduce the budget deficit, increased the rate of growth of domestic credit to the private sector from 49 percent of the total credit in 1992 to 52 percent in 1993 and 74 percent in 1994. This has indeed demolished the positive effect of budget deficit reduction. That is because, as part of the general objectives of the stabilisation policy, the

government has been undertaking to protect the nation's purchasing power against the inflationary effect of devaluation. The extent of government preparedness to relieve this negative effect ensured the pursuit of an expansionary policy. Therefore, in spite of a low budget deficit, the economy has experienced a rapid increase in the rate of inflation. In this case, however, inflation has not been caused by an inflationary financing of a massive budget deficit. The increase in inflation and hence rapid downward trend of real exchange rate both have been caused by the fiscal and monetary expansion. This illustrates the fact that most of the real effect of devaluation has been eroded by the increasing real rate of money supply.

7.3.5 Prominent causes of the ineffective devaluation

It is not so easy to find exactly what has caused the nominal devaluation to translate into the real devaluation. Many possible criteria exist to evaluate such a programme and the fact that the devaluation is only one part of many components of the stabilisation package provide some intrinsic problems to analyse this issue. Despite these problems, the current sub-section will briefly investigate what elements made that undesirable result possible.

7.3.5.1 The rate of nominal devaluation

The rate of devaluation is one of the most important factors and must be further considered. Theoretically, the "right" value of a currency is determined by the fundamental realities about overall current productivity and expectations about the future condition of the economy. This brings us to a crucial question as to whether the chosen new exchange rate is appropriate. The government indirectly accepted that the right value of the domestic currency is reflected in its black market rate that is freely determined by the demand and supply mechanism, Farzin (1995). As Farzin argues, if this rate is appropriate in the sense of reflecting the right value of the domestic currency, it had to, at least, eliminate the gap between new official and black market exchange rates and exhibit a stable behaviour of those two rates over a reasonable period of time. From Table 7.4, it is seen that after two years, the devaluation neither eliminated the huge gap between black market and official exchange rates nor prohibited the wild fluctuation of these two rates. In consequence, the chosen rate is unlikely to be the appropriate one.

Moreover, in an economy that has encountered many economic and non-economic disturbances, such as revolution, war, sanction, and so on, the black market rate may be too far from the official rate. Adopting the existing black market rate as an indicator may lead to an overdepreciated domestic currency that even under

sustainable accompanying policies will result in an inflationary situation through tradable commodities.

7.3.5.2 The fiscal and monetary policy stance

Another component of the government's stabilisation policy has been to reduce the public budget deficit. Ever since 1990, the budget deficit has partly been financed by the sale of foreign currency in the black market and reduced subsidies to money-losing private and public enterprises.⁸ This figure has been accelerated after the devaluation. During this period the budget deficit has been relieved from exchange rate depreciation rather than a significant cut in non-essential current expenditure, or a substantial increase in tax revenues. On the other hand, the only available alternative way for those money-losing enterprises to finance their investment has been borrowing from the banking system. Not unexpectedly, the correlation between the money supply and private liquidity gave rise to a renewed burst of inflation which in turn made the devaluation unsuccessful.

Moreover, the stabilisation of exchange rate and its inflationary consequences brought about an increase in the money balances that the individuals wanted to hold. To satisfy this higher demand for money, the government has increased the share of domestic credit to the private sector. As mentioned before, the economy in question is highly dependent on the imported inputs for which there are no domestic substitutes. Trade restriction policy in the years preceding devaluation had substantially eliminated less essential imports and all those for which home production was possible. Therefore, imports have remained on their basic essential level. If the massive devaluation had been allowed to reduce imports further, it would cause lower growth rate of real output, higher rate of unemployment, and hence lower social welfare.

However, these negative effects have more or less emerged, and the government in response to such difficulties has undertaken a policy to finance essential imports. Following this policy, the government has earmarked about \$ 4 billion in foreign currency for imports of essential commodities at the official rate of before devaluation.⁹ For the rest of imports, public or private importers had to buy foreign currency at a new rate through the central bank system.¹⁰ Thus, the monetary authorities had to increase the share of private credit in order to provide the

⁸ The Central Bank of Iran, Economic Reports (1989-93).

⁹ Bill of National Budget for 1993.

¹⁰ That is because, the government is the owner of more than 90 percent of the country's foreign exchange incomes.

required domestic money. When the central bank decumulates foreign exchange reserves, it is initially expected that the domestic money supply has to decline. But, in the case of Iran, the domestic money, which has been accumulated by the central bank, has been returned to circulation through the increase in the government spending. Such policies then brought about a rise in the domestic money supply and allowed prices to increase sharply in line with the money supply.

7.3.5.3 An increasing reliance on the oil revenues

In spite of the strong early commitment to cut the economy's dependence on the international markets, and to construct a more self-sufficient economy without oil, this primary commodity has still remained as a major foreign exchange earner and continues to be the mainstay of the Iranian economy. There is actually no reason why the government with this information that the probability of a substantial increase in the oil earnings in the near future is inaccessible, it still relies heavily on the expansion of oil incomes. As a result of such unrealistic programmes, the economy has become more volatile in the short-run as oil revenues have fluctuated beyond the country's control in the international markets.

7.3.5.4 Political stance

The previous sub-sections covered some of the structural problems that limit the effectiveness of the exchange rate policy. We now return to some of the non-economic issues that play a significant role in the practical planning of the stabilisation programme. Any economic adjustment inevitably needs policy reforms that involve political risks and may confront the government with a serious problem. The economy under consideration, particularly after the revolution, in its all sectors have faced several fundamental, powerful, and conflicting objectives. Obtaining any progress in stabilisation policy has needed to satisfy all of the various factions. In practice, it was impossible and therefore the government in its new policy had to choose his own fundamental objective. Consequently, some of the radical factions have been criticising the government and arguing that the government's new policy is part of capitalist style and ignores the Islamic values. Such an inconsistency has taken a heavy toll on the economy which in turn has impeded timely considering of the problem affecting the economy and thus has delayed needed actions.

7.4 Conclusion

It has been recognised that policy-induced shocks along with external events have contributed to the real exchange rate crisis experienced by the Iranian economy. Since the external events are obviously outside the control of the government, the role of policy shocks in determining the real exchange rate variability thus can be held as an alternative way for stabilising the real exchange rate. To examine the overall effects that certain types of policy induced shocks (temporary component) can have on real exchange rate, we first specified that how important is the role played by such factors in determining the Iranian real exchange rate behaviour.

To do so, we used the Cochrane's (1988) methodology. The results show that temporary shocks have played an important role in the explaining of the behaviour of the real exchange rate. On the basis of this result, some alternative adjustment policies have been critically investigated. The roles of automatic adjustment, nominal devaluation, commercial policy, exchange rate regime, and macroeconomic policy have been examined. The following is a summary of the main results:

(i) Due to the relatively slow speed of adjustment and also because of continual domestic and external negative shocks on real exchange rate, the system on its own is not able to eliminate the gap between actual and equilibrium real exchange rate.

(ii) The "pass through" effect of a nominal devaluation does not allow the nominal devaluation to translate substantially into the real devaluation. If nominal exchange rate policy is not accompanied by a consistent monetary and fiscal policy, such a policy may create further difficulties so that the real exchange rate goes back to a level lower than its pre-devaluation value.

(iii) Gradual and continual removal of quantitative trade restriction could be a possible alternative policy to reduced the real exchange rate variability.

(iv) Due to some structural problems in the Iranian economy, a flexible or predetermined exchange rate regime can not help to stabilise the exchange rate market. Under the situation where the domestic price level is highly responsive to movements in the nominal exchange rate and control the capital flight is nearly impossible, a dual exchange rate system which has a fixed rate for some transactions and a free rate at which capital flows and the rest of transaction take place would be an appropriate one to bring stability in the real exchange rate market.

(v) Consistent macroeconomic (fiscal and monetary) policy is a necessary element in restoring real exchange rate equilibrium. If such a policy is not followed, the real exchange rate crisis will not end.

Finally to provide some evidence for our earlier analysis, we briefly considered the short-run macroeconomic consequences of the 1993 exchange rate reform pursued by the Iranian government. With this in mind the nominal exchange rate reform as one component of a broader stabilisation package which has initially been made with the aim of stabilising some variables rather than with the objective of imposing all undesirable movements in the economy. Therefore, the first step in attempting to assess the efficiency of the exchange rate reform was concentrated on the impact of this policy on the movements of domestic inflation rate, the gap between official and black market exchange rate, and the real exchange rate. The overall performance of these variables during the two years after the exchange rate reform were not as was hoped. This result supports our view that nominal exchange rate policy without consistent accompanying policies is not able to bring stability in the Iranian exchange rate market.

8

Conclusions

This research set out to analyse the dynamics of real exchange rate (RER) and its implications for the Iranian economy. The theoretical discussion in Chapter 2 focused on the basic concept of the RER in order to provide a basic frame of reference for subsequent analyses. From a theoretical prospective, it was argued that traditional analysis in which the RER is primarily regarded as a monetary phenomenon and so became a reflection of the rate of domestic inflation relative to the rest of the world, cannot shed much light on the problems of resource misallocation across the different sectors of the economy which plays an important role in creating imbalances in the country's internal and external sectors. Therefore, following modern macroeconomic analysis, the other aspect of RER was emphasised. That is, the link between relative price of two goods, tradables and nontradables. From this standpoint, real exchange rate policy is an important determinant of the allocation of resources in the economy. The impact of any attempt to rationalise the RER can be seen as raising the overall productivity in the use of resources by removing the distortions of incentives across the economic sectors.

Chapter 3 theoretically re-examined the question of how RER responds to the exogenous and policy-induced shocks in a small open economy. This issue has been considered in an intertemporal setting in which individuals' decisions are driven from the maximisation of an intertemporal utility function subject to lifetime budget constraints. However, this analysis has concentrated on a few types of disturbances, it has shown that: (i) The real exchange rate responds differently to the different shocks. (ii) In many cases it is difficult to find a clear relationship between RER and its determinants. (iii) In an primary-exporting country where most of the exports earnings occur to the government, increases in the price or volume of exports may not result in a real appreciation of domestic currency if the government fails to spend its share of new funds from the outset. (iv) The short-run responses are not necessarily the same as

the long-run responses. Long-run equilibrium RERs are affected by real variables only, while the prevailing RER at any time responds to both real and nominal variables. An important implication of this finding is that, understanding the complete transition path followed by the real exchange rate after a particular shock needs to integrate short-run dynamics with long-run equilibrium.

The empirical analyses have been started from Chapter 4. The first purpose of this part of thesis was to address the trends and variability of the Iranian real exchange rate over the 1961-92 period. Analysing the evolution of various indices of RER indicates a massive increase in the real value of the official exchange rate during this period. Statistical analysis of these indices has also shown that, particularly after the revolution, they moved together with a significant long-run downward trends. It is also found that the degree of variability has increased through time, being much larger in recent years than during the pre-revolutionary period.

An alternative measure of the real exchange rate constructed by using the black market exchange rate, also shows the same result during this period. This real appreciation in the black market exchange rate has taken place during the period where the increasing rate of the premium in the black market called for a real depreciation of the domestic currency. There are several interesting facts to take from this analysis. First, the role of domestic price level (and obviously its determinants) appears to be more significant compared to any of the other factors. Secondly, without a consistent accompanying policy to keep the rate of inflation differential under the rate of change in the nominal exchange rate, the RER volatility cannot be ended by a freely determined exchange rate system. Finally, under a predetermined nominal exchange rate, nominal devaluation cannot positively translate into a real devaluation. The whole (or more) of nominal devaluation may be eroded by increasing the rate of domestic inflation.

The long-run behaviour of real exchange rate indices and whether they revert toward a trend following a particular shock have also been examined. The results indicate that the level of RERs did not usually return to the trend. This is an important result, because it reveals that the long-run movements in real exchange rates follow a random walk process rather than the purchasing power parity rule. As a result of this fact, some of variation in the Iranian real exchange rate can be attributed to movements of the real variables. Moreover, it is possible to identify the underlying real shocks which explained long-run movements of the real exchange rate and to determine their relative importance with respect to nominal disturbances in a general model.

For this reason, this study has employed cointegration methods which has been specifically designed to address long-run issues and their relationship with short-run dynamic movements.

The analysis of the process of the real exchange rate determination in Chapter 5 confirms that the RER movements have responded to both real and nominal shocks. There are several interesting findings. First, there is a long-run relationship between real exchange rate and its fundamental determinants. Therefore, any deviation of actual real exchange rate from its equilibrium value is expected to eliminate by an autonomous tendency of the system. Secondly, error correction model tests have revealed that, however, such an tendency existed for the system during the period under study, the magnitude of this force which is on operation to move the actual real exchange rate back to equilibrium is quite low, keeping the economy out of equilibrium for a long time. Estimating the adjustment path of real exchange rate following temporary and permanent changes in its determinants also confirmed the slow operation of the adjustment process.

This study has also attempted to present further evidence to support the view that real exchange rate behaviour and economic performance are highly correlated, and thus massive real appreciation of the Iranian rial has been a major source of slow (or negative) growth in the economy. To examine this hypothesis, within a partial equilibrium approach several equations were run with exports, imports and output gap as the explained variables. The results suggest that there has been a strong negative correlation between the real exchange rate and performance indicators mentioned above.

Exports have been affected positively by real exchange rate movements, while imports have responded negatively to RER movements. This is a well-known result, however, but the important issue raised is that the absolute effect of the real exchange rate on the imports is lower than its effects on exports. In the case of Iran as a major oil-exporting country where the main exported commodity (oil) is not substantially affected by RER movements, real exchange rate targeting policy can provide little help in restoring the country's external balance.

Faced with chronic real exchange rate volatility that is not self-correcting, some policy action to deal with this problem is required. Chapter 7 concentrated on this issue. Empirical results in the previous chapter indicated that the RER volatility in the Iranian economy has been resulted from a complex combination of several elements that some of them were external and thus beyond the control of the government, while others were the direct result of internal policy-induced shocks. Stabilising the RER volatility

in situations where the economy has serious difficulty with respect to the external shocks, depends highly on the domestic policy action.

The size of the random walk and stationary components of the real exchange rate measured from the variance of its long run differences indicate that the relative importance of fundamental and monetary factors in determining the RER movements are the same. Therefore, in order to keep the RER close to its sustainable level, it is necessary to establish a policy package that can resolve the fundamental causes of the real exchange rate volatility and correct some of the domestically induced disturbances.

The final empirical discussion has tackled this subject and investigated some alternative stabilisation policies for reducing the RER volatility. There is a remarkable amount of evidence suggesting that the Iranian economy faces a crucial structural problem in this regard. Since early 1993, there have been some signs of more far-reaching structural and systematic changes in this economy. These have included the beginnings of an effort to increase the use of market forces in order to adjust the exchange rate automatically. The most significant move in this regard has been the unification of the multiple nominal exchange rates and to let the economy perform on the basis of its current institutional and economic structure. This was expected to reduce the government activity in the foreign exchange market and therefore to open up another way for the state to resolve its foreign exchange problems. Unfortunately, this policy formation process has done little to restore exchange rate equilibrium. This implies that the existing combination of the government intervention policy and the free market forces has not been efficient in bringing stability to the foreign exchange market. Therefore, further effort is required to determine the optimal combination of market forces and intervention policy on the basis of the structural features of the Iranian economy.

Bibliography

Agarwala, R., (1983), "Price distortions and growth in developing countries," *World Bank Staff Working Papers*, Vo. 575, World Bank, Washington, DC.

Amana, R. and S. Norden, (1995), "Terms of trade and real exchange rates: the Canadian evidence," *Journal of International Money and Finance*, Vol. 14, No. 1, pp. 83-104.

Amirahamadi, H., (1990), *Revolution and Economic Transition: The Iranian Experience*, Albany: SUNY Press.

Amuzegar, J., (1993), *Iran's Economy Under the Islamic Republic*, I. B. Tauris and Co. Ltd.

Artus, J. and A. McGuirk, (1981), "A Revised Version of the Multilateral Exchange Rate Model," *IMF Staff Papers*, (June), pp. 275-309.

Artus, J. and M. Night, (1984), *Issues in the Assessment of the Exchange Rate in Industrial Countries*, IMF Occasional Papers, No. 29.

Artus, J., (1988), "Methods of Assessing the Long-Run Equilibrium Value of an Exchange Rate," *Journal of International Economics*, (May), pp. 277-299.

Bahmani-Oskooee, M., (1993), "Black market exchange rates versus official exchange rates in testing Purchasing Power Parity: an examination of the Iranian rial," *Applied Economics*, vol. 25, pp. 465-472.

Balassa, B., (1964), "The Purchasing Power Parity Doctrine: A Reappraisal," *Journal of Political Economy*, (December), pp. 584-596.

Barro, R., (1977), "Unanticipated Money Growth and Employment in the United States," *American Economic Review*, (March), pp. 101-115.

Behdad, S., (1988), "Foreign Exchange Gap, Structural Constraints and the Political Economy of Exchange-Rate Determination in Iran," *International Journal of Middle East Studies*, (February), pp. 1-21.

Belanger, G., (1976), "An Indicator of Effective Exchange Rate for Primary Producing Countries," *IMF Staff Papers*, (March), pp. 113-131.

Bhagwati, J., (1984), "Why Are Services Cheaper in the Poor Countries?" *Economic Journal*, Vol. 94, (June), pp. 279-286.

Black, S., (1976), "Exchange Rate Policies for Less Developed Countries in a World of Floating Rate," *Princeton Essay in International Finance*, No. 119, (December).

Bleaney, M. and P. Mizen, (1994), "Do Real Exchange Rate Really Follow a Random Walk?" *Discussion Papers in Economics*, University of Nottingham.

Calvo, A., C. Reinhart and C. Ve'gh, (1995), "Targeting the real exchange rate: Theory and evidence," *Journal of Development Economics*, Vol. 47, pp. 97-133.

Cochrane, J., (1988), "How big is the random walk in GNP?", *Journal of Political Economy*, vol. 96, pp. 893-920.

Connolly, M. and D. Taylor, (1984), "The Exact Timing of the Collapse of an Exchange Rate Regime and Its Impact on Relative Price of Traded Goods," *Journal of Money, Credit and Banking*, Vol. 16, (May), pp. 194-207.

Connolly, M. and D. Taylor, (1976), "Adjustment to Devaluation with Money and Nontraded Goods," *Journal of International Economics*, (August), pp. 289-298.

Corden, W., (1981), "The Exchange Rate, Monetary Policy and North Sea Oil," *Oxford Economic Papers*, (July), pp. 23-46.

Corden, W., (1982), "Exchange Rate Policy and the Resources Boom," *Economic Record*, Vol. 58, (March), pp. 18-31.

Corden, W., (1984), "Booming Sector and Dutch Disease Economics: A Survey," *Oxford Economic Papers*, (November), pp. 359-380.

Corden, W., (1985), *Inflation, Exchange Rates and the World Economy*, (Third Edition), Clarendon Press.

Corden, W., (1989), "Macroeconomic Adjustment in Developing Countries," *Research Observer*, Vol. 4, No. 1, (January), pp. 51-64.

Cotani, J., D. Cavallo and M. Khan, (1990), "Real Exchange Rate Behaviour and Economic Performance in Developing Countries," *Economic Development and Cultural Change*, Vol. 39, (October), pp. 61-76.

Cuddington, J., (1989), "Commodity Export Booms in Developing Countries," *Research Observer* 4, No.2, (July), pp. 141-165.

Davis, J., (1983), "The Economic Effect of Windfall Gains in Export Earnings, 1975-1978," *World Development*, Vol. 11, No. 2, pp. 119-139.

Dollar, D., (1992), "Outward-oriented developing countries really do grow more rapidly: Evidence from 95 LDCs, 1976-1985," *Economic Development and Cultural Change*, Vol. 40, pp. 523-544.

Dornbusch, R., (1986a), "Special Exchange Rates for Commercial Transaction," In S. Edwards and L. Ahamed, eds., *Economic Adjustment and Exchange Rates in Developing Countries*, Chicago, University of Chicago Press.

Dornbusch, R., (1986b), "Special Exchange Rates for Capital Account Transaction," *World Bank Economic Review*, (September), pp. 3-33.

Dornbusch, R., (1974), "Tariffs and Nontraded Goods," *Journal of International Economics*, (May), pp. 117-185.

Dornbusch, R., (1980), *Open Economy Macroeconomics*, New York, Basic Books.

Dornbusch, R., D. Dantas, C. Pechman, R. Rocha and D. Simoes, (1983), "The Black Market for Dollars in Brazil," *Quarterly Journal of Economics*, No. 1, pp. 25-40.

Dornbusch, R., (1988), *Exchange Rate and Inflation*, The MIT Press.

Edwards, S. and L. Ahamed, (1986), *Economic Adjustment and Real Exchange Rates in Developing Countries*, Chicago, University of Chicago Press.

Edwards, S. and P. Montiel, (1989), "Devaluation Crises and the Macroeconomic Consequences of Postponed Adjustment in Developing Countries," *IMF Staff Papers*, (December), pp. 875-903.

Edwards, S. and Van Wijnbergen, (1987), "Tariffs, The Real Exchange Rate and the Terms of Trade: On Two Popular Propositions in International Economics," *Oxford Economic Papers*, Vol. 39, pp. 458-494.

Edwards, S., (1985), *Exchange Rate Misalignment in Developing Countries*, World Bank Occasional Paper, The World Bank.

Edwards, S., (1986), "Commodity Export Prices and the Real Exchange Rate in Developing Countries: Coffee in Colombia," In S. Edwards and L. Ahamed, eds., *Economic Adjustment and Exchange Rates in Developing Countries*, Chicago, University of Chicago Press.

Edwards, S., (1987), "Real Exchange Rate Variability: An Empirical Analysis of the Developing Countries Case," *International Economic Journal*, (Spring), pp. 91-106.

Edwards, S., (1988), *Exchange Rate Misalignment in Developing Countries*, Johns Hopkins University.

Edwards, S., (1989a), *Real Exchange Rates, Devaluation and Adjustment*, Cambridge, Mass: MIT Press.

Edwards, S., (1989b), "Exchange Rate Misalignment in Developing Countries," *Research Observer*, Vol. 4, No. 1, (January), pp. 3-12.

Engle, R. and C. Granger, (1987), " Cointegration and error correction: representation, estimating and testing," *Econometrica*, Vol. 55, pp. 251-276.

Farzin, Y., (1995), "Foreign Exchange Reform in Iran: Badly Designed, Badly Managed," *World Development*, Vol. 23, No. 6, pp. 987-1001.

Fisher, S., (1977), "Stability and Exchange Rate System in a Monetarist Model of the Payment," In R. Aliber, ed., *The Political Economy of Monetary Reform*, Macmillan Press.

Fuller, W., (1979), *Introduction to Statistical Time Series*, John Wiley and Sons, New York.

Genbery, H., (1978), "Purchasing Power Parity Under Fixed and Flexible Exchange Rates," *Journal of International Economics*, (May), pp. 247-276.

Ghose, D. and H. Kharas, (1993), "International competitiveness, the demand for exports and real exchange rates in developing countries," *Journal of Development Economics*, Vol. 41, pp. 377-398.

Ghura, D. and T. Grennes, (1993), "The real exchange rate and macroeconomic performance in Sub-Saharan Africa," *Journal of Development Economics*, Vol. 42, pp. 155-174.

Goldstein, M. and M. Khan, (1985), "Income and Price Effects in Foreign Trade," In R. Jones and P. Kenen, eds., *Handbook of International Economics*, Vol.11, Amsterdam: North Holland.

Grabor, L., (1993), "The effect of real exchange rate uncertainty on LDC manufactured exports," *Journal of Development Economics*, Vol. 41, pp. 367-376.

Granger, C., (1986), "Developments in the study of cointegrated variables," *Oxford Bulletin of Economics and Statistics*, Vol. 48, pp. 213-228.

Greider, W., (1987), *Secrets of the Tempel: How the Federal Reserve Runs the Country*, New York, Simon and Schuster.

Gross, R., (1992), "Colombia's Black Market in Foreign Exchange," *World Development*, Vol. 20, No. 8, pp. 1193-1207.

Gruen, D. and J. Wilkinson, (1994), "Australia's Real Exchange Rate- Is it Explained by the Terms of Trade or by Real Interest Differentials?" *The Economic Record*, Vol. 209, (June), pp. 204-219.

Gulde, A. and H. Wolf, (1992), "The Causes of Real Exchange Rate Variability: A Heretic View from the Interwar Period," *IMF Staff Papers*, (September),

Hall, R. and J. Taylor, (1988), *Macroeconomic, Theory, Performance, and Policy*, W.W. Norton and Company.

Harberger, A., (1983), "Dutch disease: How much sickness, how much boon?" *Resource and Energy*, Vol. 5, No. 1, pp. 1-20.

Harberger, A., (1986), "Economic Adjustment and Real Exchange Rate," In S. Edwards and L. Ahamed, eds., *Economic Adjustment and Exchange Rates in Developing Countries*, Chicago, University of Chicago Press.

Haynes, S. and J. Stone, (1994), "The relationship between bilateral and multilateral models of exchange rates," *Journal of International Money and Finance*, Vol. 13, pp. 71-82.

Holden, K. and J. Thompson, (1992), "Co-Integration: An Introductory Survey," *British Review of Economic Issues*, Vol. 14, No. 33, (June), pp. 1-54.

Johansen, S. and K. Juelius, (1990), "The Full Information Maximum Likelihood Procedure for Inference on Cointegration," *Oxford Bulletin of Economics and Statistics*, Vol. 52, (May), pp. 169-210.

Johansen, S., (1988), "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control*, Vol. 12, (June), pp. 231-254.

Kamin, S., (1993), "Devaluation, Exchange Controls, and Black Market for Foreign Exchange in Developing Countries," *Journal of Development Economics*, Vol. 40, pp. 151-169.

Khan, M. and J. Ostry, (1992), "Response of the Equilibrium Real Exchange Rate to Real Disturbances in Developing Countries," *World Development*, Vol. 20, No. 9, pp. 1325-1334.

Khan, M. and M. Knight, (1988), "Imports compression and export performance in developing countries," *Review of Economics and Statistics*, Vol. 70, (May), pp. 315-321.

Khan, M. and P. Montiel, (1987), "Real exchange rate dynamics in a small, primary-exporting country," *IMF Staff Papers*, (December), pp. 681-710.

Khan, M. and S. Lizondo, (1987), "Devaluation, Fiscal Deficit, and The Real Exchange Rate," *World Bank Economic Review*, (January), pp. 357-374.

Khan, M., (1974), "Import and Export Demand in Developing Countries," *IMF Staff Papers*, (November), pp. 678-693.

Khan, M., (1986), "Developing country exchange rate policy responses to exogenous shocks," *American Economic Review*, Vol. 76, No. 2, (May), pp. 84-87.

Krueger, A., (1978), *Foreign Trade Regimes and Economic Development: Liberalization Attempt and Consequences*, Cambridge, Mass: Ballinger.

Krugman, P. and M. Obstfeld, (1991), *International Economics; Theory and Policy*, Harper Collins Publishers.

Lautenschlager, W., (1986), "The Effect of an Over Valued Exchange Rate on the Iranian Economy, 1979-1984," *International Journal of Middle East Studies*, (February), pp. 31-52.

Layard, R., S. Nichell and R. Jackman, (1991), *Unemployment (Macroeconomic Performance and the Labour Market)*, Oxford University Press.

Lizondo, J., (1993), "Real exchange rate targeting under imperfect asset substitutability," *IMF Staff Papers*, Vol. 40, (December), pp. 829-851.

Lizondo, S., (1987), "Unification of Dual Exchange Markets," *Journal of International Economics*, Vol. 22, pp. 57-77.

Maciejewski, P., (1983), "Real Effective Exchange Rate Indices: A Re-Examination of the Major Conceptual and Methodological Issues," *IMF Staff Papers*, (September), pp. 491-541.

Milner, C., J. Presley and T. Westaway, (1995), "True protection and the real exchange rate in a capital-rich developing country: some evidence for Saudi Arabia," *Applied Economics*, Vol. 27, pp. 623-630.

Montiel, P. and J. Ostry, (1991), "Macroeconomic Implications of Real Exchange Rate Targeting in Developing Countries," *IMF Staff Papers*, (December), pp. 877-900.

Montiel, P. and J. Ostry, (1992), "Real exchange rate targeting under capital control: Can money provide a nominal Anchor?" *IMF Staff Papers*, No. 39, (March), pp. 58-78.

Montiel, P. and J. Ostry, (1994), "The Parallel Market Premium, Is It a Reliable Indicator of Real Exchange Rate Misalignment in Developing Countries?" *IMF Staff Papers*, (March), pp. 55-76.

Mussa, M., (1984), "The Theory of Exchange Rate Determination," In J. Bilson and R. Marston, eds., *Exchange Rate Theory and Practice*, University of Chicago Press.

Mussa, M., (1986), "The Effects of Commercial, Fiscal, Monetary and Exchange Rate Policies on the Real Exchange Rate," In S. Edwards and L. Ahamed, *Economic Adjustment and Exchange Rate in Developing Countries*, University of Chicago Press.

Neary, P., (1984), "Real and monetary aspects of the Dutch Disease," In K. Jangefeld and D. Hague, eds., *Structural Adjustment in Developed Open Economies*, London, Macmillan.

Neary, P., (1988), "Determination of the Equilibrium Real Exchange Rate," *American Economic Review*, Vol. 78, (March), pp. 210-215.

- Osterwald M. and Lenum, (1992), "A note with quantiles of the asymptotic distribution of ML cointegration rank test statistics" *Oxford Bulletin of Economics and Statistics*, Vol. 54, pp. 461-72.
- Ostry, J., (1988), "The Balance of Trade, Terms of Trade, and Real Exchange Rate: An Intertemporal Optimizing Framework," *IMF Staff Papers*, Vol. 35, (December).
- Ostry, J., (1994), "Government Purchases and Relative Price in a Two-Country World," *The Economic Record*, Vol. 70, No. 209, (June), pp. 506-524.
- Pentecost, E., (1993), *Exchange Rate Dynamics: A Modern Analysis of Exchange Rate Theory and Evidence*, Edwards Elgar Publishing Limited.
- Pessaran, M. H., (1992), "The Iranian Foreign Exchange Policy and the Black Market for Dollars," *International Journal of Middle East Studies*, (February).
- Phylaktis, k., (1992), "The black market for dollars in Chile," *Journal of Development Economics*, Vol. 37, pp. 155-172.
- Reinhart, C., (1991), "Fiscal Policy, the Real Exchange Rate, and Commodity Prices," *IMF Staff Papers*, Vol. 38, (September), pp. 509-524.
- Rodriguez, C., (1978), "A Stylized Model of the Devaluation-Inflation Spiral," *IMF Staff Papers*, Vol. 25, (March), pp. 76-89.
- Salter, E., (1959), Internal and External Balance: The Role of Price and Expenditure Effects," *Economic Record*, Vol. 35, pp. 226-238.
- Samuelson, p., (1964), "Theoretical Notes on Trade Problem," *Review of Economics and Statistics*, Vol. 46, pp. 145-147.
- Savvides, A., (1990), "Real exchange rate variability and the choice of exchange rate regime by developing countries," *Journal of International Money and Finance*, Vol. 9, pp. 440-454.
- Suches, J. and F. Larrain, (1993), *Macroeconomics In The Global Economy*, Harvester Wheatsheaf.
- Swan, T., (1960), "Economic Control in a Developed Economy," *Economic Record*, Vol. 36, pp. 51-66.
- Van Wijnbergen, S., (1983), "Interest Rate Management in LDCs," *Journal of Monetary Economics*, Vol. 12, (September), pp. 433-452.
- Van Wijnbergen, S., (1984), "The Dutch Disease: A Disease After All?" *Economic Journal*, (March), pp. 41-55.
- Van Wijnbergen, S., (1986), "Exchange Rate Management and Stabilization Policies in Developing Countries," In S. Edwards and L. Ahamed, eds., *Economic*

Adjustment and Exchange Rates in Developing Countries, Chicago, University of Chicago Press.

Williamson, J., (1981), *Exchange Rate Rules*, St. Martins

Williamson, J., (1982), "A Survey of the Literature on the Optimal Peg," *Journal of Development Economics*, Vol. 11, pp. 39-61.

Williamson, J., (1983), *The Exchange Rate System*, MIT Press for the Institute of International Economics, Revised in 1985.

Wright, S., (1993), "Measures of real effective exchange rates," DAE Working Paper, No. 9316, University of Cambridge.

