Title: A time series analysis of structural breaks, and export-GDP nexus in Iran

Author: Mosayeb Pahlavani

Year: 2005

A time series analysis of structural breaks, and export-GDP nexus in Iran

Mosayeb Pahlavani
University of Wollongong

A TIME SERIES ANALYSIS OF STRUCTURAL BREAKS, AND EXPORT-GDP NEXUS IN IRAN

A thesis submitted in fulfillment of the requirements for the award of the degree

Doctor of Philosophy

From

University of Wollongong
School of Economics and Information Systems
Faculty of Commerce
New South Wales, Australia

By

Mosayeb Pahlavani
Master of Arts in Economics (University of Tehran, Iran)

CERTIFICATION

I hereby certify that this dissertation has not been submitted previously as part of the requirements of another degree and that it is the result of my own independent research, unless otherwise referenced or acknowledged.

Mosayeb Pahlavani
December 2005

ACKNOWLEDGEMENTS

Praise be to God, Who taught man what he knew not (The Holy Quran: 96-5).

The completion of this research has been possible through the help of many individuals who supported me in the different stages of this study. First of all, I would like to express my deepest appreciation to my major supervisor Associate Professor Ed Wilson, Head of the Economics Discipline for his insightful comments and unfailing support. His invaluable suggestions and advice and contagious enthusiasm have been inspirational. Next I wish also to thank my Co-supervisors Dr Abbas Valadkhani and Dr Khorshed Chowdhury for their equally important assistance and in particular for their encouragement and 'networking' help.

I have also benefited from the help of the many other individuals during my studies at UOW, especially Professor Robert Castle (Deputy Vice-Chancellor (academic), Professor John Glynn former Dean of the Faculty of Commerce and Professor John Patterson, current Acting Dean of the Faculty of Commerce, Professor Michael Gaffikin (Associate Dean of Research).

I also wish to extend my appreciation to Associate Professor Ann Hodgkinson, Head of the School of Economics and Information Systems for providing both encouragement as well as the facilities for my research and to Professor Simon Ville, former Head of the School, and Dr.Nelson Perera, Head of Postgraduate Studies.

In addition to my supervisors, many colleagues encouraged me to apply these research methods to the cases of other economies, including Australia. The following academics collaborated on a number of joint research papers which are either forthcoming or have already been published. I am very grateful to my supervisors Dr. Abbas Valadkhani, Associate Professor Ed Wilson and Dr. Khorshed Chowdhury, to Professor Andrew Worthington, Head of the Finance Discipline (UOW), Professor Allan P. Layton, Head of the School of Economics and Finance (QUT), Charles Harvie, Associate Professor of Economics (UOW), Professor G. Sivalingam (Monash University Malaysia), Dr Kankesu Jayanthakumaran (UOW) and Professor Andre Jordaan (University of Pretoria).

I wish to thank Mr. David Aylward, Faculty of Commerce Research Manager for his kind and efficient administrative help to present my work at several international conferences. Thanks also to Ms. Carol Borgatti and Ms. Hazel Jones for their assistance and kindness.

I would like also to thank the directors of the scholarship office at the Ministry of Science, Research and Technology for providing me a PhD scholarship. Special thanks to the former and current directors of the Iranian students in Australia: Dr. Farhoudi and Dr. Kohian for their support and guidance.

I must also offer my sincerest gratitude to Dr. Madeleine Strong Cincotta for her untiring editing and patient language help and to her family and the families of so many Australian colleagues and friends who have made me and my family welcome over these past, sometimes difficult years.

I have also enjoyed considerable friendship at my work place at the research wing of the faculty of commerce, especially my colleagues and friends Akshyim Afandi, Hazem Mershedeh, Reetu Verma, Dr Min Sheeresta and Dr Ali Salman Saleh.

Finally, I would like to give my special thanks to my wife Arezou, and my children Ghazal and Parsa. Without their understanding, patience and moral support, this dissertation could not have been completed. Last but definitely not least, I am indebted to my parents, brothers and sisters for their blessing, spiritual support and patience during my absence from their company. They have sacrificed much for the sake of my future career. To this dear extended family I dedicate this thesis.

ABSTRACT

This dissertation examines the major determinants of GDP growth in Iran using annual time series data spanning the years from 1960 through 2003. The Iranian economy has been subject to a multitude of structural changes and regime shifts during the sample period. Thus after applying conventional unit root tests like Augmented Dickey–Fuller (ADF) and Phillips-Perron (PP) procedures, time series properties of the data are analysed by applying the Zivot-Andrews (ZA, 1992) model, Perron's (1997) Innovational Outlier (IO) and Additive Outlier (AO) models and finally the Lumsdaine and Papell (LP, 1997) approach to determine endogenously the more likely time of major structural breaks in various macroeconomic variables of the Iranian economy. Based on the above models, the presence of one and two unknown structural breaks in the data are considered. After accounting for the single most significant structural break, the results from the ZA, IO and AO models clearly indicate that for all series under examination, the null hypothesis of at least one unit root cannot be rejected, a result consistent with those of conventional unit root tests. In other words, the empirical results based on both the conventional unit root tests as well as on all the above new models of unit root tests which take into account the presence of potential structural breaks, indicate that there is not enough evidence to reject the null hypothesis of unit root for any of the variables under investigation. However, when two structural breaks are incorporated into the testing procedure within the framework proposed by LP, the test results indicate that the unit root hypothesis is indeed rejected for some of the variables under investigation at the 10 per cent level or better.

It should be noted that the critical values reported by LP (1997) cannot be used to make a decision about the stationarity of the series under investigation in this research. The empirical literature shows that the critical values are heavily dependent on the sample size and as the sample size in the present study differs markedly from LP's, applying this testing procedure, only the existence of two significant potential structural breaks in the data can be determined and it is not possible to adequately examine the stationarity of the data under investigation.

Empirical results indicate that for a majority of the variables under investigation the endogenously determined break dates based on the above mentioned methodologies closely correspond to some important phenomena in the economy such as (a) the oil

boom in the 1974-75; (b) the effects of the Islamic Revolution (regime change) in 1979 and finally (c) the outbreaks of the Iraqi war in the1980s.

In order to address the role of exports in economic growth, i.e. to examine the export-led growth hypothesis (ELG) in an oil based economy, an extended Feder-type aggregate production function model is proposed, which considers the broad range of externality effects of exports (both oil and non-oil) on the economy. In this model, by following the endogenous growth theory as well as recent empirical findings on the trade-GDP nexus, factors such as: physical capital (R&D effects), human capital (representing knowledge spillover effects), export expansion (proxying positive externality effects), and total imports (capturing learning-by-doing effects) are considered in order to determine their effects on economic growth.

A production function approach which includes all of the above-mentioned factors is then used in the cointegration analyses: both conventional cointegration approaches such as the Johansen-Juselius (1990) technique as well as newer cointegration approaches (e.g. Gregory-Hansen (1996) and Saikkonen and Lütkepohl (2000)) are employed to determine the long-run drivers of economic growth in the presence of structural breaks in Iran. This latter cointegration technique accommodates potential structural breaks which could potentially undermine the existence of a long-run relationship between GDP growth and its main determinants.

As both traditional cointegration tests (like Johansen-Juselius), as well as tests for cointegration in the presence of structural breaks (i.e., GH (1996) and SL (2000)) have all shown that there exists only one cointegrating vector, therefore applying the autoregressive distributed lag (ARDL) procedure is the best way of determining long-run and short-run relationships. The ARDL procedure is more appropriate with mixed order I (0) and I (1) processes. For this reason, the error correction version of the ARDL procedure is then employed to specify the short- and long-term determinants of economic growth in the presence of structural breaks. The estimated model tracks the historical data very well and satisfies various specification and stability tests. Empirical estimates indicate that, in the long-term, policies aimed at promoting various types of physical investment, human capital, trade openness and technological innovations will improve economic growth.

More specifically, empirical results show that while the effects of gross capital formation and oil exports are highly significant and important, as expected, for the expansion of the Iranian GDP over the sample period, non-oil exports and human

capital are generally less pivotal and have an even smaller effect than had been anticipated. However, whilst the long run non-oil exports are small, they are statistically significant. It is also found that the speed of adjustment in the estimated models is relatively high with 40-60 percent of disequilibrium eliminated within one year. The empirical findings of this research indicate that in order to achieve high and stable economic growth and to protect the economy from the negative effects of oil price fluctuations, the Iranian government should continue its quest for more efficient and effective non-oil export promotion policies as well as its diversification strategies aimed at weaning the economy from its dependence on the oil sector.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1
INTRODUCTION

1.1. Background of the Study

The literature on international economics suggests that there are a number of ways in which the expansion of exports promotes economic growth. Increased export earnings help reduce the foreign exchange gap and thus facilitate the importation of capital goods and technical knowledge, and these would lead to economic growth. According to Bhagwati (1978) and Krueger (1978), the expansion of exports leads to specialization, economy of scale and the efficient allocation of resources. This, in turn results in an increase in the real income, economic growth and productivity of a country, a sequence of events which they call the Export-Led Growth Hypothesis (ELG). Despite the expected positive effect of exports on GDP, however, developing countries, depending on their economic requirements and their structure, have not only relied on such export promotion policies but also pursued import substitution strategies or, indeed, a combination of these two.

Governments deciding on which economic policy to follow, are immediately faced with the following questions:

- Do the economic benefits accrued from the adoption of outward looking strategies exceed those of inward looking strategies?
- Does attaining a given level of economic development constitute the pre-requisite for benefiting from the expansion of exports?
- Is there any relationship between the degree of effectiveness of outward looking strategies for a developing country and the level of economic growth in its major trading partners?

Although there has been much progress in determining the relationship between export expansion and economic growth, a number of theories as well as empirical studies have set forth differing answers to these questions. Some economists are of the view that an export expansion policy leads to improvements in the productivity of individual sectors and in the concentration of capital in the production sector but can we now assume that this export expansion is the sole reason behind the production growth? Perhaps the direction of causality functions in the opposite manner: could growth in GDP, indeed, lead to the expansion of exports?

Although empirical studies show that by adopting export promotion policies, newly industrialized countries (for example those in South East Asia) have constantly demonstrated higher rates of growth compared to other countries, it remains to be seen whether these higher growth rates are due, in fact, to these policies. In addition, a strategy to quantify the potential effectiveness of export expansion on economic growth would be of great help to governments evaluating appropriate economic policies. Leaving aside those developing countries which are wholly oil-dependent and therefore at the mercy of the huge fluctuations of the international oil market, this study turns its attention to the case of Iran, which in addition to policies regarding its huge oil reserves and exports, has attempted to implement policies aimed at increasing non-oil exports. Using data from 1960 to 2003, this study examines the relationship between the expansion of exports and economic growth in Iran, to evaluate the effectiveness of both oil and non-oil export promotion policies.

1.2. Objectives of the Study

The primary objective of this study is to investigate the nature of economic growth in Iran and to identify its major determinants. To do this, we use an augmented production function model that includes human capital accumulation and trade flow between the oil and non-oil sectors of the economy. In particular, the study proposes to investigate the relationship between trade (exports and imports) and economic growth in order to test the degree of meaningful effects of export promotion policies on the country's economic growth through empirical investigation of the Export-Led Growth hypothesis (ELG) for an oil-based economy. In other words, the study attempts to find out whether the export sector (oil and non-oil) has promoted economic growth in Iran or not? Therefore both total exports, as well as exports disaggregated into oil and non-oil exports, were used to test the hypothesis of ELG in Iran. We proceeded in the following manner:

- Theoretical and recent empirical works on the topic of the trade-GDP nexus were reviewed.
- A model was developed for an oil-based economy to examine the export-led growth theory (ELG) based on the prevailing literature regarding the trade-GDP nexus, and in particular on the export ratio and the export multiplier derived by Feder (1982) and extended by Salehi-Esfahani (1991).

- Recent cointegration techniques were applied to examine and identify the relationship between the expansion of exports and economic growth.
- The effectiveness of the oil and non-oil exports promotion policies on overall economic growth (GDP performance) was examined.
- The impact of structural breaks on the time series property of Iran's macroeconomic data was evaluated.
- A dynamic error correction model (ECM) was established in order to determine any long-run relationship as well as any short-term equilibrium model between trade and GDP.

In fact, the major contribution of this study is the application of the new cointegration techniques in the presence of structural breaks to determine the trade-GDP nexus in Iran. This study will examine the possible effects of transferring the resources from the non-export to the export sector first investigated by the Feder (1982) model as well as the extended Feder type model for an oil-based economy. The relative growth of the export sector appears to affect the rate of growth of the non-export sector and the rest of the economy as well. This study will find out the policy implications relating to non-oil export promotion in the Iranian economy.

Hypotheses:

1. GDP growth leads to growth in total exports.
2. The growth of non-oil exports in Iran does not demonstrate a significant effect on the growth of GDP.
3. Iranian oil exports demonstrate a sizeable effect on the growth of GDP.
4. The expansion of international trade will have a positive effect on the Iranian economy.
5. The Iranian economy has been subjected to numerous structural breaks, which have significant effects on the time series properties of the data, e.g. unit root tests and cointegration results.

1.3. Econometrics Methodology

This study uses separate production function models and comprehensive econometric methodologies which investigate non-stationarity and cointegration in time series data between 1960 and 2003. In particular, in order to test for non-stationarity of the data employed in this research, both conventional unit roots tests and new testing procedures like the Innovational Outlier (IO) and Additive Outlier (AO) models are applied. In order to determine any long-term relationship between trade and economic growth based on an extended Feder-type model, this study applies Johansen cointegration tests and some new cointegration techniques (Gregory-Hansen (1996) and Saikkonen-Lutkephol (2000). Finally, in order to identify the long-run as well short-term determinants of economic growth in Iran, an error correction model (ECM) version of the ARDL was applied. Applying several different econometric techniques, this research can achieve more robust results and in addition, using these new cointegration techniques in the presence of the structural breaks provides more efficient short-run and long-run coefficient estimates and avoids the problems of a potential 'spurious regression'.

1.4. Organization of the Thesis

The study is divided into eight chapters. Chapter 2 of this research explores Iran's economic performance during the period under analysis (1960-2003) and provides a historical background to the Iranian economy from pre-revolutionary times to the post-revolutionary period. While providing a general picture of the main features of the Iranian economy, the sectoral composition of the Iranian GDP is also highlighted. The review reveals that the country has undergone a number of structural changes, e.g. the Islamic revolution, the eight-year war with Iraq, and a number of huge fluctuations in the price of oil. Quantitative analysis shows that Iran's dependency on oil has continued to affect the economy very significantly. In terms of GDP, we find that GDP performance closely follows the performance of the value added in the oil sector. This dependency becomes even worse during the first decade after the 1979 revolution because it coincides with eight years of war with Iraq, and the continuing US trade embargo. The enormous cost of the devastating war with Iraq deprived the country of many opportunities for development. However, after the war as part of the reconstruction effort, three comprehensive Five-Year Development Plans (FYDP) were implemented and the fourth one is still in progress. Through offering shares in the Tehran stock market and establishing free trade zones in order to attract foreign direct investment (FDI), these FYDPs are aimed at privatization and trade liberalization.

Chapter 3 provide an analysis of the Iranian foreign trade sector, looking at the share of trade represented by disaggregated exports and imports, as well as the importance of both the oil and the non-oil sectors in Iran's GDP performance. What we observe in Chapter 3 is essentially the role played by the oil sector over all other sectors in the Iranian economy. Indeed, oil continues to act as the leading driver of the Iranian economy.

Chapter 4 reviews the pertinent theoretical literature, including recent debate concerning the relationship between trade and growth. In fact this chapter includes both the theoretical basis of the trade-GDP nexus as well as empirical econometric studies which measure the macroeconomic impact of trade (especially export) on GDP. We explain earlier models of the trade-GDP relationship and then re-examine this relationship in the light of new endogenous growth models. Following this examination of the theoretical background, attention is directed to the empirical issues, examining them in the light of a comprehensive literature review in the area of the export-led growth hypothesis.

Chapter 5 derives and explains the model to be employed in this research. Based on theoretical considerations and on the empirical review presented in the previous chapter, Chapter 5 specifies a Feder-type model for an oil-based economy. In this model, the positive effects of the export sector on the rest of the economy are highlighted. In the same manner, the second model (the extended Feder model) is used to examine the effects on GDP growth performance of disaggregating exports into the oil and non-oil sectors in the presence of other variables like physical and human capital as well as imports.

In order to overcome several potential problems of previous studies on the trade-GDP nexus, we adopt both cointegration techniques as well as the error correction model (ECM) version of the ARDL approach, applying them to a special form of the production function, which treats exports as a kind of production factor. Trade is assumed to exert externalities through international knowledge spillover, etc as suggested by endogenous growth theories. Until now, most empirical research concerning the trade-GDP nexus had been done using conventional econometric tests. Because the Iranian economy has been faced with significant structural breaks, applying only conventional tests would most likely result in misleading empirical findings (so-called "spurious regression"). For this reason, therefore, in Chapter 6 more recent methodologies like IO and AO unit root tests for investigating the non-stationarity of the Iranian macroeconomic data are applied.

In Chapter 7, the nature of economic growth in Iran is investigated using recent cointegration techniques. This chapter applies a multivariate cointegration analysis to determine the long-run relation between exports and other components of the GDP. In order to explore the sources of economic growth in Iran, we apply the ARDL approach and finally, in order to check for the direction of causality between exports and economic growth, we applied the ECM version of the ARDL model as well. The final chapter outlines the major findings of the study and looks at the policy implications of these findings.

CHAPTER 2
AN OVERVIEW OF THE IRANIAN ECONOMY (1960-2003)

2.1. Introduction

Before starting the empirical work in this study, we must take a closer look at the main characteristics of the Iranian economy during the period under study (1960 to 2003). This period has been divided into two sub-periods, namely the pre-revolutionary period (1960-78) and the post-revolutionary period (1979-2003). Before the 1979 revolution, the most salient feature of the Iranian economy was the oil boom in 1973-74, which led the economy to sharp economic growth. However, after the Islamic revolution in Iran in 1979, the Iranian economy was subject to a number of major problems, disruptions and shocks. The after-effects of the revolution itself, the Iran-Iraq war and continuing U.S. sanctions shackled the economy, preventing it from fully realizing its potential (Pesaran, 2000). The country was unable to take full advantage of its strategic geopolitical situation, its rich resources and the opportunities which were made possible by rapid technological advances, the increasing globalization of the world economy and the "opening up of new markets in Eastern Europe and in central Asia" (Pesaran, 2000: 28).

This chapter is divided into several sections. Section 2.2 discusses the geographical position and climate of Iran followed by an analysis of the population and the Iranian labour force, both active and unemployed in Section 2.3. Section 2.4 reviews the growth of the Iranian GDP and its sectoral composition. In Sections 2.5 to 2.8, the individual domestic sectors of the economy, which make up GDP, i.e. agriculture, oil and gas, industries and mining, and services are then analysed. Finally, a summary and some concluding remarks are offered concerning Iran's macroeconomic performance and policy during the period of the study (1960-2003).

2.2. Geographical Position of Iran

Iran means the 'land of the Aryans', and it refers to those who settled some four thousands years ago in the Middle East region. Iran is situated in southwestern Asia and its area is 1.648 million square kilometers. Its geographical location has been important to its politics and history. Iran is bounded on the north by the Caspian Sea (740km), the Azerbaijan Republic (611 km), Armenia (35 km) and Turkmenistan (992km). To the west it shares borders with Turkey (497km) and Iraq (1,458km). To the south-west lie the Persian Gulf and the Sea of Oman and to the south-east Afghanistan shares a 936 km border and Pakistan a 909 km border with Iran (Razzaghi, 1992).

Due to its vast area, the country is subject to differening climate systems. The Caspian Sea area is humid and has heavy rainfall. The mountain areas of the north have huge amounts of snow. An extremely dry climate is found in the desert area in the central plateau of Iran, which contains extensive deposits of minerals, including chlorides, sulfates and carbonates. In the remaining areas of the country the climate is less extreme with moderate temperatures and rainfall (Salehkhou, 1999).

2.3. Population and Employment

The Iranian population has increased very significantly. Indeed it more than doubled due to the baby boom in the early years after the revolution, and rose from approximately 30 million in 1977 to 62.8 million in 2000 (Central Bank of Iran 'CBI', 2001a). According to the Management and Planning Organization of Iran (hereafter, 'MPOI', 2002), the population growth rate increased from an average 2.7 percent between 1966 and 1976 to 3.9 percent between 1978 and 1987. According to Azimi (1992), there were 3 million unemployed in 1988. He noted that in this year the active proportion of the population constituted 26.4 percent of the total population, which means each employed person had to support at least 4 people. After 1989, however, due to the effects of family planning and population controls programs as well as health and contraception education, the population growth rate decreased very significantly and the annual average rate of population growth between 1986 and 1991 was 2.4 percent. This trend continued during the period between 1991 and 1996, decreasing to 1.4 percent and finally for the period between 1996 and 1998 the population growth decreased to as low as 0.9 percent. It should be noted that due, on the one hand, to the significant increase in the population growth rate during the 1980s, the first decade after the revolution, and on the other, to the government's inability to provide growing job opportunity, during the past twenty years the Iranian economy has been faced with a serious problem of unemployment. In fact, between 1966 and 1976 unemployment increased from 9.2 percent to 10.1 percent. This increasing trend continued and by 1986 unemployment had reached as high as 14.2 percent.

However, after the ceasefire in 1988, which led to a massive reconstruction effort with the implementation of the first Five Year Development Plan (1989-1994), resulting in sound economic growth, many new job opportunities were created and consequently the unemployment rate decreased sharply. The unemployment rate between 1991 and 1996 decreased from 11.1 percent to 9.8 percent. Unfortunately, after 1996, because of a serious economic recession in the country and low economic performance, the unemployment rate grew instead and increased to 16.1 percent by 2000 and 15.7 percent by 2001 (MPOI, 2002). Official data indicate that due to this post-revolution population explosion, by 2000, people less than twenty years of age constituted more than 48 percent of the total population (CBI, 2001a). The total number of employed in this year reached 15,576 thousand. The unemployment rate was about 15 percent in 2000 and the unemployed population reached 2.7 million in that year (CBI, 2001a). Some economists believe, however, that the real unemployment rate is higher than that of the official data and with this young population a high unemployment rate will be one of the feature of the Iranian economy at least for the next decade. According to Valadkhani (2004), there has been a marked disequilibrium between supply and demand in the labour market. Between 1996 and 2000 an average 692,750 new job seekers entered the labor market competing for the 296,250 new jobs created each year. According to the third Five Year Development Plan (FYDP) (cited in Valadkhani, 2004: 457) between 750,000 and 800,000 job seekers would look for job opportunities each year during the third FYDP. During this same period of time, because of this serious disequilibrium between labour supply and demand, approximately half a million people are expected to join the ranks of the unemployed each year. Given this picture, one can claim that the problem of a high unemployment rate remains a serious issue for the government over at least the next ten years.

It is interesting to note that between 1960 and 2003, the relative percentages of employment by sector also changed. For example, in 1966 around 10 percent of the labour force was employed in the agricultural sector, 18.5 in industry and mining and 71.5 percent in construction, services and energy. By 1986, these figures had changed completely. Employment in the agricultural sector increased to 16.5 percent while employment in the industrial and mining sector decreased to 13.5 percent. In 1996, the ratio of the labour force employed in the agricultural sector again decreased to as low as 9.9 percent and the ratio of the labour force employed in the industrial sector reached 17.5 percent. This means that the percentage of the workforce represented by construction, services and energy remained relatively constant at over 70 percent (MPOI, 2002). It should be noted that the majority of unemployed workers in Iran are unskilled simple workers from rural areas who move to cities and towns in order to find a job in the service sector. For this reason, a considerable number of these unskilled workers in the cities are engaged in 'unproductive activities' (Valadkhani, 1996).

Another interesting issue is the share of the labour force employed by the private and by the public sectors of the economy. In 1976, the labour force employed in the private sector comprised more than 80 percent of the total labour force and the share of the public sector was around 19 percent. In 1986, ten years later, due to an economic recession and the movement towards greater government intervention in the economy, the share of the labour force in the private sector decreased to 64 percent while the share of the labour force in the public sector increased to around 32 percent. Finally, in 1996, due to the implementation of adjustment policies and the privatisation of the economy based on the second FYDP (1995-1999), this picture changed again and the private sector increased to 68 percent of the total employed labour force and the government share fell to around 29.2 percent (MPOI, 2002).

2.4. Gross Domestic Product (GDP) and its Sectoral Composition

One of the most important steps in analyzing the Iranian economy is to review the structure of GDP and its sectoral composition. The statistical data used in this chapter are expressed in 1997 constant prices and have been collected from the Central Bank of Iran 'CBI' (2001b; 2004), unless otherwise indicated. Figure 2.1 show that the Iranian GDP growth performance between 1960-2003 was quite volatile. The pattern of GDP growth during the past four decades indicates that before the revolution there was a significant rising trend in GDP due to the oil price boom and rising exports. After the revolution, however, this upward trend did not continue. The revolution, the Iran-Iraq war as well as unfavorable conditions on the world oil market had severe negative effects on GDP growth (Haerian, 1996).

Figure 2.1 shows clear breaks in the Iranian GDP growth rate trend that coincide with the effects of the 1974 oil shock, the Islamic Revolution in 1979 and the Iraqi war beginning in 1980. In other words, the most notable feature of this figure is that the Iranian GDP growth is unstable and subject to wild and periodic fluctuations: in fact, clear upward and/or downward movement is evident and they coincide with the oil boom in 1974-75, the Islamic revolution in 1979, the war with Iraq beginning in 1980 and the oil price collapse in 1986.

Figure 2.1

Annual Growth Rate of GDP at Constant 1997 Price

(1960-2003)

Please see print copy for Figure 2.1

Pre-revolution (1960-78): The rate of GDP growth in the 1970s was very high compared with the 1960s due to the high annual rate of oil production and huge oil export revenues. In 1975, for example, the oil price increased by four-fold, and this led to the sharpest growth in GDP in 1976 (17.6 percent). The Iranian government's policies have always seen the oil industry as the leading sector, and the source of foreign exchange for development projects. According to Jalali-Naini (2003), already by the Third Development Plan (1963-1967), before the revolution, import substitutions had become the official policy. The same general patterns were followed in the Fourth Development Plan (1968-1972). Because of the huge oil windfall during the Fifth Development Plan (1973-1977), however, the government began to let domestic protection slip and tried to implement open-door policies.

The National Account of Iran, (CBI, 2001b) showed that in fact, during the entire period before the revolution (1960-1978), GDP enjoyed an annual growth rate of about 9 percent. Jalali-Naini (2003), noted that significant share of the oil revenues in GDP, the low inflation rate, the stable exchange rate and the channeling of resources to the industrial sector through the Five-Year Development Plans all constituted an environment very favorable for a high rate of economic growth in Iran in this period. He argued that even the growth rate of non-oil GDP followed suit during the pre-revolutionary period (1960-1977). According to Hakimian (1999:1), "favorable GDP growth rate during this period made Iran one of the few developing countries which succeeded in reducing their relative income gaps with the industrial countries. The situation, however, changed radically after the late 1970s as Iran experienced a retraction in GDP per capita standards throughout the 1980s followed by a generally lack–luster performance in more recent years."

2.4.1. First Decade after the Revolution (1979-88)

The beginning of the Islamic revolution in 1979 brought about significant changes in economic policies. There was greater state control on prices and extensive nationalization was undertaken. This policy was implemented in regard to large-scale modern industries, the entire banking system, the insurance system as well as foreign trade (Jalali-Naini, 2003). In addition to nationalization, the government's continuing inward orientation and its expansion of social subsidy programs were other basic features of the new economic policy. Moreover, during the first decade after the revolution, Iran was faced with an eight-year war with Iraq and this assured that these policies would continue (Jalali-Naini, 2003). The average real growth rate of GDP for this post-revolutionary period declined significantly between 1978 and 1981. The flight of capital and skilled workers and the commencement of the eight-year war were the major factors relevant to the dramatic decline in GDP in the early post-revolution years (Pesaran, 1995). The Iran-Iraq war, of course, was devastating to the Iranian economy. There was a serious decline in GDP because of lost oil revenues due to war damage on the oil infrastructure and hence oil exports. The direct expenditures of the war comprised on average 16.9 percent of total expenditures of the Iranian government between 1981 and 1986 (Mazarei, 1996). The physical damage of the war is estimated by the Iranian government at about 30,811 billion Rials (Mazarei, 1996), not to mention the toll in human suffering, the direct effects on the labour force and the loss of human capital due to emigration.

The oil crisis and a sharp drop in foreign exchange from oil revenue in 1986 led to a recession during the 1986-88 period. According to Mazarei (1996), the difficulty in importing intermediate and capital goods due to lack of foreign exchange was one of the causes of serious problems in the supply side of the Iranian economy at this time. Table 2.1 indicates the real growth rate of GDP between 1979 and 1987. Real GDP, measured in constant 1997 prices, decreased from 209 919 billion Rials in 1979 to 191,312 billion Rials in 1987. During the war period (1980 - 88) the real GDP growth rate declined to –1.5 percent and the per capita GDP growth rate declined by -3.7 percent (Hakimian, 1999). The two main reasons for unsatisfactory GDP growth performance in this period were, according to Jalali-Naini (2003), the war's destruction of valuable productive assets and the negative terms of trade because of the oil price collapse of the mid-1980s. He also noted that the high level of uncertainty and adverse incentive/price signals were caused by the nationalization process, economic mismanagement and institutional and public sector inefficiency. In fact, Jalali-Naini argues that credit, loans, foreign exchange rates and imports were all controlled by the government and that situation led to low rates of private sector investment in the economy. Obviously, low investment rates, lack of efficiency and low productivity caused the per capita GDP growth rate to be negative during this period.

It should be mentioned that the drastic decline in the GDP per capita growth rate during the first decade after the revolution resulted from rapidly expanding population on the one hand and severe decline in the real GDP on the other. It should be noted however, that during two years of this period, that is, 1982 and 1983, the Iranian economy experienced instead, a very strong GDP growth, due to the boom in oil prices on the international market (see Table 2.1).

Table 2.1: GDP During the First Decade after the Revolution

Please see print copy for Table 2.1

In summary, the two most important reasons for the low growth performance of the economy during the first decade after the revolution were: first, the cost of the physical damage inflicted by the war and second, the negative effects of the war on the economy because of massive war-related expenditure.

The total damage of the eight years of war was estimated by Amirahmadi (1990) to be about $US 592 billion of which $US 369 billion related to damage inflicted on the infrastructure of the country's machinery, buildings, equipment, materials, oil refineries, factories and other national wealth. This estimate, however, excludes the loss of oil export revenues (Amirahmadi, 1990). The war damage is estimated to have ranged between 12.4 to 47.94 percent of the GDP in every year from 1980 to 1988. Moreover, the huge military expenditure is estimated to be between $US105 billion to $US110 billion (Iran Chamber of Commerce, Industrial and Mining (ICCIM), cited in Haerian, 1996: 60). In addition, $US3 billion extra charges went for shipping oil exports beyond the war zone and a further $US3.5 billion for the cost of re-orienting imports to ports unaffected by the war (Amirahmadi cited in Haerian 1996: 60).

2.4.2. GDP Growth During the First Five Year Development Plan (1989-93)

With the end of the war in late 1988, a new period of post-war reconstruction efforts and economic adjustment policies were implemented under the First Five-Year Development Plan (FYDP). According to Pesaran (2000), the first FYDP (1989-93) aimed to regenerate the economy, reconstruct the war-damaged regions, and promote foreign investment, to reform foreign exchange and implement trade liberalization policies. With the beginning of this FYDP real GDP increased by 5.9 percent in 1990. Moreover, re-building of the war damaged areas and infrastructure contributed to an economic growth rate of 14.1 percent in the second year (1991) of the plan. As can also be seen from Table 2.2, during the first FYDP, real GDP increased at an average annual rate of 7.5 percent, which was slightly below the plan's target (8.1 percent). Liberalization of trade and foreign exchange markets together with the utilization of previously unused capacities in the economy were the main drivers of the high economic growth achieved from 1989 until 1993 (Pesaran, 2000). Moreover, according to Jalali-Naini (2003: 32), the upturn in economic growth in this period " partly reflects the unwinding of some of the government controls and partial correction of the prices system" imposed in the period of the post-war reconstruction.

Table 2.2: GDP Growth Rate During the First Five-Year Development Plan

Please see print copy for Table 2.2

Iran's post-revolution Five-Year Development Plans (FYDP) followed IMF policy recommendations for all developing countries. Jalali-Naini (2003) (among others) has called such reforms "structural adjustment policies" and has noted that they contain a privatization strategy which leads to more reliance on the market mechanism, price reforms and the removal of restrictions on foreign-trade. According to Salehkhou (1999), the main objectives of the first FYDP are:

- **Privatization**: The economy would gradually be privatized by reducing the size of the government and selling shares of state controlled industries and nationalized companies to the private sector. For this reason, the Tehran Stock Market (TSM) was re-opened.
- **Price liberalization**: Commodity price control would be eliminated by gradually decreasing subsidies.
- **Trade liberalization**: By eliminating tariffs and superfluous customs regulations and formalities, as well as reducing restrictions on imports and exports, trade was to be liberalized and reformed.
- **Post-war re-construction**: Reconstruction of the regions affected by the massive damage of the war would be fostered through major new investment projects in infrastructure.
- **Non-oil export promotion policy**: Applying an export promotion policy would increase the quantity and value of non-oil exports.

2.4.3. GDP Growth During the Second Five Year Development Plan (1995-1999)

With the achievements and failures of the first FYDP in mind, the government was especially keen to be sure that the second FYDP would be efficient and effective. The completion of infrastructure and development projects initiated under the first FYDP were the main priorities of the second FYDP (Salehkhou, 1999). The target growth rate of the second FYDP was 5.1 percent, which was less than the first FYDP target. However, as a result of the oil price collapse during the second FYDP period, the projected GDP growth rate slowed down. The average GDP growth rate remained at 3.3 percent, against the 5.1 percent projection for the second FYDP (see Table 2.3).

Table 2.3: GDP Growth Rate During the Second FYDP (1994-98)

Please see print copy for Table 2.3

In a similar way, the second FYDP drew up targets for economic sectors as well as identifying key areas needing reform. According to Salehkhou (1999), some of the most important strategies to be introduced included:

- **Establishing the Export Guarantee Fund (EGF) and the Export Development Bank (EDB):** In order to achieve and enhance the policies of the non-oil export promotion strategy, the EGP and the EDB were established together with a comprehensive export insurance system.
- **Environmental Concerns:** Consistent with worldwide efforts, threats to the environment, especially air and soil pollution, were to be addressed.
- **Long-range policies:** Long-term solutions in the areas of infrastructure, communication and transportation were sought.
- **Privatization**: Like the first FYDP, the second FYDP continued to gradually decrease the role of government in the economy through privatization.

At the end of the second FYDP in 1999, the Management and Planning Organization of Iran (MPOI) introduced the third FYDP for the period of 2000 to 2004. According to the CBI (2002a) the policy framework of the third FYDP mandated:

1. The establishment of the “High Administrative Council” to reform the administrative system;
2. The assessment of the financial position of national companies with the aim of privatization;
3. The creation of the “Oil Stabilization Fund” (OSF) in order to protect the national economy from the negative effects of potential collapses in the oil price;
4. The introduction of appropriate conditions for private banks and private non-bank credit institutions and,
5. The removal of non-tariff barriers in order to promote foreign trade.

With overall improvement in general economic conditions, GDP exceeded the projected target and grew by 5.1 percent during the first year of the third FYDP. This growth was due to a positive upturn in the oil market with crude oil prices increasing by 36 percent to US$25.3 per barrel, an increase in Iran’s OPEC quota, a consequent rise in the production of crude oil and the implementation of new foreign trade regulations which improved the export of non-oil production as well (CBI, 2002b).

Table 2.4: A Comparison of GDP Growth Rate in Different Periods

Please see print copy for Table 2.4

Table 2.4 clearly shows that before the revolution the average GDP growth rate was around 9 percent. In fact this growth peaked in 1974-1975 due to the continuing oil boom and reached approximately 17.6 percent in 1976. After the revolution however, the average growth rate was 2.5 percent and declined to as low as -15 percent in 1980 due to the effect of the flight of capital (due to the revolution) and the extensive damage of the Iran/Iraq war. Table 2.4 shows clearly, however, the rise in GDP growth after the ceasefire, with rebuilding and reconstruction efforts and then the implementation of FYDPs 1, 2 and 3.

Per capita GDP also shows a negative trend during the post revolutionary era, which is partly due to the decline in GDP growth rate. According to Dadkhah and Zangeneh (2001), the economic shock of the 1979 revolution followed by the process of nationalization through the confiscation of properties, the resultant flight of both physical and human capital as well as mismanagement, the destruction of the war with Iraq, and finally the U.S. trade embargo have left the Iranian real per capita GDP income below its 1978 level.

The following section will examine the individual domestic sectors which make up GDP, i.e. agriculture, oil and gas, industries and mining, and services.

2.5. Agricultural Sector

The sectoral composition of the Iranian GDP after the revolution has changed significantly. For example, official data show that the contribution of the agricultural sector to the GDP increased from an average of 11.2 percent before the revolution (1960-1978) to a peak of 15.8 percent in 1988 (CBI, 2001b). This was due mostly to increases in the acreage under cultivation as well as increased yields. Following the ceasefire, in the period between 1989 and 2000, the average share of GDP represented by the agricultural sector stood at approximately 15 percent (CBI, 2001b).

Overall, according to Salehkhou (1999), the Iranian government's agricultural policy has two basic aims: to achieve self-sufficiency in strategic agricultural products, and to raise the quantity and the value of these products for export by increasing the productivity and efficiency of this sector. He noted that, in order to do this, the Iranian government used subsidies, preferential rate loans and guaranteed support prices for strategic products. More investment will most probably continue in agricultural mechanization, processing industries and storage facilities. Further investment in this sector is required nevertheless. Of the 51 million hectares of land capable of cultivation, only 18.5 million hectares are in fact presently being farmed (Salehkhou, 1999).

The agricultural growth rates are presented in Figure 2.2. During the pre-revolution period (1960-1978), the agricultural sector had an average growth rate of approximately

4.4 percent per annum. During the ten years following the revolution, the agricultural sector grew by approximately 4.3 percent annually. This shows that although the Iranian economy as a whole was affected very negatively by the war, the agricultural sector was less seriously affected than other sectors of the economy.

Following the cease-fire, the agricultural sector had an annual growth rate of 6.4 percent over the length of the first FYDP (1989–1993). During the second FYDP (1995-1999), however, a serious and dramatic reduction in the amount of rainfall caused the average growth rate in the agricultural sector to fall to 2.2 percent, far below its target of 4.3 percent growth (CBI, 2001a). The agricultural sector enjoyed an average annual growth rate of 4.3 percent during the whole period after the revolution, reaching a peak of 11 percent in 1990. The lowest rate of –7.3 percent occurred in 1999 due to a drought (See Figure 2.2).

Figure 2.2

Annual Growth Rate of the Agriculture Sector at Constant 1997 Price

(1960-2003)

Please see print copy for Figure 2.2

2.6. Oil Sector

Iran, with about 10 percent of the world's oil reserves--approximately more than 110,000 million barrels-- is one of the largest oil producing countries in the world (Salehkhou, 1999). It could produce some 4 million barrels per day for 60 years. Oil fields in the Caspian Sea could raise that figure to 160,000 million barrels of oil (Organization of the Petroleum Exporting Countries, 'OPEC', 2000). After Saudi Arabia, Iran is the second largest OPEC oil producer. Apart from these enormous oil reserves, Iran also has around twenty three trillion cubic meters of natural gas, or some 14.7 percent of the world's total gas reserves. This means that after Russia, Iran has the second largest reserve of natural gas (Economic Intelligence Unit (EIU), 2000; Salehkhou, 1999).

The Iranian government is attempting to decrease dependence on oil resources, but the oil sector still continues to play a significant role in the process of economic development in Iran. Official data indicate that the average contribution of the oil sector to GDP, however, has indeed dropped dramatically from approximately 40 percent in the pre-revolutionary period to about 12.9 percent in the war period due to the extensive damage to the oil infrastructure (EIU, 2000; CBI, 2001b). Prior to the revolution, Iran's daily crude oil production had been as high as 6 million barrels per day (Salehkhou, 1999).

Following the Iran-Iraq war, this figure dropped to 2.9 million barrels per day in 1988 (the ceasefire year). In 1987/8, nominal oil revenues stood at about 40 percent of their 1978/79 level (Mazarei, 1996). Following the cease-fire and the implementation of the first FYDP (1989-1993), the National Iranian Oil Company (NIOC) implemented an intensive reconstruction plan to restore fields damaged by the war (EIU, 2000). Oil production capacity rose to 3.3 million barrels daily in 1991 and reached 3.7 million barrels daily by 1999/00 (see Table 2.5).

Table 2.5: Production and Export of the Crude Oil During (1989/90-1999/00)

Please see Table 2.5

The growth rate of the oil sector during the period 1960-2000 is shown in Figure 2.3. The average growth rate of the oil and gas sector was 7.6 percent during the post-revolutionary period. This rate decreased very significantly to -28.9 percent due to the effect of a series strikes in 1978 followed by subsequent revolutionary upheavals (Amirahmadi, 1990). This trend decreased even further with the beginning of the Iran-Iraq war. The largest drop in the sector's value added was in 1980 (-67 percent). The output of the sector did not change significantly during the next year, but sharply increased in 1982 by 128 percent (highest recorded rate of increase in the oil sector after the revolution).

Figure 2.3

Annual Growth Rate of the Oil & Gas Sector at Constant 1997 Price

(1960-2003)

Please see print copy for Figure 2.3

The average annual growth rate of the oil sector, from the beginning of the revolution until the ceasefire (1979-88) was 6.7 percent. During the first FYDP (1989-93), the performance of the oil sector improved and its average annual growth reached 9.1 percent. But this high growth rate dropped to -1.3 percent during the second FYDP (1995-99) due to oil price collapses during this time. The level of oil production in Iran has always been affected by three factors: the need for foreign exchange to finance development plans, Iran's OPEC oil production quota and the price of oil on the international market.

Three FYDPs were implemented after the ceasefire with Iraq in 1988 and oil revenue was the major source of financing of these development plans (Haerian-Ardakani, 1996). In fact, the fourth FYDP is now underway and oil revenue continues its pre-eminent role.

More specifically, the Iranian government has used petrodollars in order to invest in the development and the expansion of the petrochemical industry. Indeed, its first and second post-revolution development plans allocated huge amounts of money for investment for these purposes. For this reason Iran's petrochemical production increased sharply from 0.8 million tons / year in 1989 to approximately 13.2 million tons per year in 1999 (Salehkhou, 1999). It should be noted that due to the huge oil reserves and comparative advantage of this sector, further investment in the petrochemical industry in Iran has obviously been a good place for government investment.

2.7. The Industrial Sector

The components of the industrial sector in Iran are: manufacturing, mining, construction, water, gas and electricity. National data (CBI, 2001b) indicate, however, that the largest part of this sector (in 2000 for example some 67.3 percent of its value added) has been related to manufacturing, despite the fact that most of the manufacturing industries have been dependent on imports from more advanced countries. In fact, between 65 and 85 percent of intermediate and capital input has been imported from industrialized countries (Haerian, 1996). This figure clearly shows that a major part of the manufacturing sector is comprised of imported intermediate inputs and as Pesaran (2000) argues, the heavy dependence of this sector on the importation of intermediate and raw materials has not been reduced efficiently. According to Mazarei (1996: 302) "the intensive reliance of Iranian industry on imported intermediate and primary goods is due largely to pursuit of import-substitution policies prior to the revolution." In fact, as Hakimian and Karshenas (2000) added, the undesirable result of this strategy was to make the economy more and more dependent on oil-export revenues to pay for the importation of intermediate and capital goods.

According to Iran's National Accounts (CBI, 2001b) the average annual share of industrial sector in GDP was about 10 percent before the revolution (1960-1978) compared with 15.8 percent during the first decade after the revolution. During the period of post-war reconstruction (first FYDP, 1989-1993), the average annual contribution of the industrial sector to GDP increased to 18.6 percent. This share steadily increased to 19 percent for the period of the second FYDP (1995-1999).

Figure 2.4

Annual Growth Rate of Industrial & Mining Sector at Constant 1997 Price

(1960-2003)

Please see print copy for Figure 2.4

The growth performance of the Industrial sector is presented in Figure 2.4. As is clear from this figure, the sector enjoyed a growth rate of 13.7 percent per annum during the period before the revolution (1960-78). The oil boom in the 1970s enabled high investment in the industrial sector. The Figure shows the maximum growth rate (46 percent) of this sector in 1976, due to the effects of oil boom. The annual growth rate of the industrial and mining sectors took a downward trend after the revolution and especially with the beginning of the war with Iraq in 1980. During the war period (1980-88) the average growth rate of the sector was -0.7 percent. Between 1990 and

2000, with reconstruction and the implementation of the first and second FYDPs, this sector enjoyed a growth rate of 8 percent per annum. In fact, during the first FYDP (1989-93), the annual growth rate of the industrial and mining sectors trended upward and reached an average of 10.2 percent --See Figure2.4.

It should be noted that during the first FYDP, the manufacturing sector, which represents the highest share of the industrial sector, did not meet its 15 percent targeted growth rate, growing only by 9.1 percent (Valadkhani, 1996). Between 1995 and 1999 (second FYDP) the performance of industry and mining continued to be favorable and the value added of this sector increased by an average of 5 percent, though of course this was far less than the 10 percent growth rate of the first FYDP.

2.8. Services Sector

The Iranian National Accounts (CBI, 2001b) show that the average share of the services sector to GDP was around 41 percent during the post-revolutionary period (1960-78). During the decade after the revolution this share increased very significantly and reached as high as 59.6 percent and finally after the war (between 1989 and 2000) this share stood at approximately 52 percent. According to Haerian (1996), the surprising expansion of the services sector in Iran, rather than reflecting stable economic development, actually represented the ballooning of bureaucracy and the armed forces because of the war during the 1980s, and this instability created uncertainty in long-term planning. Moreover, domestic trade, one of the most important activities within the services sector, increased significantly but only because of the sharp decline in profitability in other sectors of the economy (Tayebi, 1996). Government intervention in the economy brought about distorted prices and inhibited the market mechanism and this caused further economic uncertainty and encouraged rent-seeking activities, which, in turn, caused further expansion of the service and the informal sectors (Mazarei, 1996). Finally, the relative simplicity of entry into small business activities and domestic trade led to a large amount of money from the private sector being diverted to domestic business activities and the service sector (Haerian, 1996). The average annual growth of the services sector in constant prices is shown in Figure 2.5.

A close look at Figure 2.5 shows that, while the growth rate of the services sector shows an upward trend during the period before the revolution, the annual growth rate of the sector fell sharply after the revolution and especially during the war with

Iraq. The service sector showed its largest negative growth rate in 1986 (-13.7 percent). The average growth rate of the service sector during the war period was approximately -3 percent per annum. However, after the ceasefire with Iraq, this rate increased to an average of 7.2 percent during the first FYDP. During the second FYDP this growth rate averaged 4.9 percent.

Figure 2.5

Annual Growth Rate of the Services Sector at Constant 1997 Price

(1960-2003)

Please see print copy for Figure 2.5

2.9. Summary and Concluding Remarks

This chapter has presented an overview of the Iranian economy between 1960 and 2003. The salient feature of the Iranian economy before the revolution was the 1973-74 oil boom, which fostered a sharp upward trend in economic growth. During the first decade after the revolution in 1979, the Iranian economy was subjected to a number of major problems, disruptions and shocks. The after-effects of the revolution itself, the destructive Iran-Iraq war, the oil price collapse of 1986 and continuing U.S. sanctions shackled the economy, preventing it from fully realizing its potential. Moreover, the high level of uncertainty and lack of price incentives were the main reasons for low rates of private sector investment in the economy. Due to low investment rates and low productivity, the per capita GDP growth rate was negative in this period.

During the second decade after the revolution, which was characterized by the post-war reconstruction and the implementation of the First and Second FYDP, the economy began an upward trend again. This was also due to a number of effective economic policies: trade liberalization, privatization, foreign exchange reform, and the promotion of foreign investment on the one hand and of exports on the other. Despite government policies aimed at the diversification non-oil export, Iran's dependence on oil revenue continued and the country's GDP growth rate remained tied to fluctuations in the price of oil in the international market.

The composition of the GDP shifted dramatically after the revolution. While the agricultural and the industrial shares in GDP had a modest increase, the share of the oil and gas sector of the GDP decreased significantly due to war damage and lack of investment in the sector and finally the services sector share in GDP increased markedly. The increase in the services sector was due, however, more to the expansion of bureaucracy and the armed forces and to the unstable economic situation and the government's interventionist economic policies rather than to solid economic growth and development.

CHAPTER 3
THE STRUCTURE OF THE IRANIAN FOREIGN TRADE SECTOR

3.1. Introduction

In Iran, particularly after the 1979 Islamic revolution, there was an imbalance in the external sector and in the balance of payments. This resulted from a number of factors: the eight-year war with Iraq (1980-88), the collapse in the international price of oil, and capital outflow due to the political uncertainty. According to Tayebi (1996), in order to solve the balance of payments problem, the government made an attempt to control imports through various restrictions, compression policies and by limiting the importation of consumer goods in particular. Other policies introduced by the Iranian government included an export promotion policy and control of the foreign exchange market.

The purpose of this chapter is to shed some light on the structure of the Iranian foreign trade sector. In fact, this chapter analyses the structure of Iran's foreign trade sector and assesses the performance of the oil and non-oil export sectors in the pre-and post-revolution eras. The export and import sectors, the composition of imports and non-oil exports, the balance of payments and the geographical distribution of imposts and exports are in turn analysed.

3.2. The Export Sector

In Iran, crude oil export revenues have always dominated the structure of the export sector. In fact, petrodollars have been the mainstay of the Iranian economy since the late 1960s, especially after the 1973-74 oil boom which saw its price tripled, the oil sector has functioned as the leading sector in the Iranian economy. This happy situation continued until 1979 when the political uncertainty immediately preceding the Islamic revolution caused massive strikes in the oil industry and these reduced both production and export in this sector. During the 1980s, the period of the eight-year Iran-Iraq war, oil revenue made up about 80 percent of total export revenue and about 40-50 percent of the government budget (EIU, 2000; CBI, 2001b). Figure 3.1 shows the annual growth rate of oil export revenue and real GDP over the period between 1960 and 2003.

Figure 3.1

Cycle of Economic growth and Oil Exports Growth (1960-2003)

At constant 1997 Price

Please see print copy for Figure 3.1

A close look at Figure 3.1 shows that the fluctuations in oil exports have continued to affect Iran's economic growth due to what Hakimian (1999:15) refers to as the "remarkably-interlinked nature of the two cycles".

According to Karshenas and Pesaran, 1995, "Oil export earnings can play three vital roles in the Iranian economy: provision of foreign exchange, addition to national savings, and contribution to government revenues". Funds provided by the oil and gas sector should be used for investment not only in this sector but in other sectors of the economy in order to built a platform for strengthening the whole economy in the long term (Valadkhani, 1996:50). Unfortunately, however, this has not been the case. Instead, such oil revenues have been used to support inefficient manufacturing industries which were protected by high tariffs. The result, of course, was that instead of diversification and rapid growth of non-oil exports, which would have enabled the economy to rely less on imported intermediate goods, the oil sector actually aggravated the country's reliance on imports (Valadkhani, 1996).

According to Dadkhah and Zangeneh (2001) the Iranian government appears to have two choices. It can either allow the economy to remain dependent on oil income and stagnate or it can allow it to open and grow as a part of the global economy.

Official statistical data indicate that Iran's share in world exports declined from a high of around 1.5 percent in 1975-78 to 0.2 percent in 2000. At a time of world-wide growth in exports, Iran's economy has been constricted by overwhelming and inefficient state intervention with such practices as artificially low foreign exchange rate deals granted to government owned companies, rife. Privatization is taking place but not quickly or efficiently enough (Dadkhah and Zangeneh ,2001).

The data in Figure 3.2 indicate that the share of total exports (valued at 1997 constant prices) as a proportion of the GDP increased from 33 percent in 1960 to about 50 percent in 1974, following the 1973-74 oil boom. This share declined to about 26 percent at the beginning of the revolution (1978) and decreased dramatically to approximately 8 percent in 1981, due to the destructive war which had began in 1980. According to Amuzegar (1993), the main reasons for the low performance of the oil sector between 1978 and 1981 were first of all, the 1978 three-month general strike, the reduction of oil production (and hence export) in early 1979 as a result of the revolution and of course the heavy damage to the oil refineries inflicted in the course of the Iran-Iraq war.

The total export share in GDP however, increased again and reached 15 percent in 1983. This ratio dropped to 10 percent in 1986 when oil prices fell sharply**.** The average share of total exports (both oil and non-oil) in GDP during the first decade after the revolution was about 15 percent. With the end of the war in 1989 and subsequent export promotion policies, this share increased steadily during the first Five-Year Development Plan (FYDP) (1989-93) to an average of 20 percent of GDP. Moreover, this share increased significantly to reach its peak of 25 percent in 1994. After that, the share decreased gradually to an average of 18 percent of GDP during the period of the second FYDP (1995-99).

Figure 3.2 clearly indicates that almost all of the change in the increasing share of exports in GDP --particularly during the 1973-74 periods and the first decade after the revolution (1979-1989)-- has been caused by increasing both the volume as well as the value of oil exports. Official data indicate that during the 1980s, oil exports represented over 90 percent of total commodity exports. This share began to decrease, however, because of the implementation of the Five-Year Development Plans and the government's non-oil export promotion policies. Figure 3.2 clearly illustrates this and shows the dramatic differences between total export and oil-export share of GDP during the post-war period. By 1994, the year after the completion of the first FYDP, the contribution of total exports to the GDP was 23 percent while the shares of oil export to GDP was less than 10 percent.

Figure 3.2

Share of the Total exports and Oil Exports in GDP (1960-2003)

At constant 1997 Price

Please see print copy for Figure 3.2

Figure 3.3 shows the revenues resulting from crude oil compared with non-oil export revenues during the period under analysis. As can be seen from this graph, while there is a substantial increase in the level of non-oil exports, there are very large fluctuations in the levels of crude oil export revenues. Fluctuations in the level of crude oil prices on the international market are regarded as the main cause for the unsustainable trend in the revenue of oil export in this period.

As is clear from Figure 3.3 above, several oil shocks (booms and collapses) can be identified during the period of this study. According to Yavari (1996), the first, a boom, occurred in 1973 as a result of the Arab-Israeli conflict, the second occurred in 1979 when the Islamic government in Iran cut oil production. This later shock was followed by an after-shock in 1980 (the beginning of the destructive war between Iran and Iraq). The third shock, a collapse, occurred in 1986 and the fourth, also a collapse, in 1998.

Figure 3.3

Oil and Non-Oil Exports Revenues ($US million)

(1960-2003)

Please see print copy for Figure 3.3

The first oil shock in 1973-74 brought about a huge windfall in oil revenues to all oil-exporting countries and speeded up the process of economic growth in Iran as well (Yavari, 1996). Iran's oil exports increased from $US 2185 million in 1970 to $US 21,014 million in 1974--See Figure 3.3.

The 1979-80 oil boom again had positive effects on all major oil-producing countries, but it had negative effects on the Iranian economy because of the revolution and the Iran-Iraq war. While total exports increased very rapidly in all oil-exporting countries, it led to a sharp decline in Iran's oil production and this resulted in a crash in total exports (Yavari, 1996). In 1979 Iran's oil exports were $US 24,158 million and decreased by 1980 to $US11, 639 million--See Figure 3.3.

The third and fourth oil shocks, both collapses in the oil price, had a negative effect on the Iranian economy as they did to other oil-exporting nations. (In 1986 Iran's oil exports decreased very significantly to less than $US 6,235 million and in 1998, it was around $US 9,932 million--See Figure 3.3.

Official data shows that during the first decade after the revolution (1979-88) oil prices fluctuated between $US 34 and $ US 12 per barrel. The Iran-Iraq war (1980-88) caused a significant decrease in crude oil production in Iran, from 3,126 million barrels per day in 1979 to 1,315 million barrels per day in 1981 and then stabilised at approximately 2 million barrel daily until the cease-fire in 1988. By 1990 due to the post-war reconstruction of production capacity, oil production increased to 3.5 million barrels daily. In this year the average price of crude oil reached $US 20 per barrel due to the Persian Gulf War and the Iraqi invasion of Kuwait.

The oil price was approximately $US17 per barrel, during the time of the first FYDP (1989-93), and for Iran, this represented annual revenues of about $US 15 billion. During the second FYDP (1995-99), the oil price hit a period of serious instability. In fact, while the 1996 average price of crude oil (OPEC basket) was a little over US$ 20 per barrel, by 1998 the price had reached as low as $US 12 (CBI, 2001a). Reasons for this sharp decline include on the one hand, the financial crisis in Asia in 1997 which resulted in diminished demand and on the other, a noticeable increase in OPEC production. This downward trend of oil prices, however, was reversed again at the beginning of 1999 and reached as high as $US 17.23 per barrel (CBI, 2001a). In this year Iran's crude oil exports amounted to $US 17.089 billion. This increasing trend continued and Iran's crude oil export reached about $US 24.280 billion in 2000 --See Figure 3.3.

3.2.1. Non-Oil Export Trends (1960-2003)

Over the past twenty years, the Iranian government has been attempting to promote non-oil exports. It should be noted, however, that the idea of specific policies aimed at non-oil export expansion was first put forward well before the revolution. In the early post-revolution years, mainly because of the war with Iraq, these policies were dropped (Iran Exports Magazine, 2002). The huge fall in oil prices and fluctuations in oil export revenue, meant that the government was forced to re-introduce non-oil export promotion policies (Amirahmadi, 1990). It should also be borne in mind that the non-oil export sector not only gives access to foreign exchange which can finance the importation of capital, intermediate and other goods, but it is also necessary for the transfer of technology as well as the development of manufacturing potential.

The three development plans after the Iran-Iraq war attempted to increase non-oil exports. In Iran, as in many other developing countries, export promotion is introduced in order to deal with foreign currency shortages as well as to reduce dependency on crude oil exports and to stimulate diversification.

According to Shafaeddin (2001) there are three main reasons why the economy needs to be weaned from its dependence on oil: the present oil resources are limited and cannot be exported indefinitely, the economy's dependence on oil exports and revenues involves high risks, and the capital intensive oil sector does not provide the jobs required for the young and growing labour force in Iran. Moreover, he noted that in 2000 the proven reserves of crude oil in Iran were estimated to be about 96.4 to 100 billion barrels and even if the present level of oil exports (2.5 mb/d) were able to be maintained, since domestic consumption is also rapidly increasing, the present export situation could not last for more than 30 years.

In addition to all of this, new sources of energy may be found to replace oil, the OPEC agreement is unstable and there still remains the general political risk of international trade embargos or sanctions. In fact, diversification of oil exports is urgently needed, not only for Iran but for all oil-exporting countries (Shafaeddin, 2001).

Figure 3.4 shows that before the revolution the value of Iran's non-oil exports never reached $US 1 billion. In fact, the 1973-74 oil boom caused the share of non-oil exports over total foreign exchange revenues to fall from 12 percent in 1960 to less than 5 percent in 1974-- See Figure 3.5. At the beginning of the revolution in 1979, non-oil exports brought in $US 542.8 million, falling to $US 339.5 million in 1982 as a result of the war. As can be seen from Figure 3.4, between 1979 and 1984, non-oil exports fell, but this trend began to improve after 1985. The value of the country's non-oil exports jumped from $US 464 million in 1985 to $US 1161 million and 1035 million in1987 and 1988, respectively. The upturn continued over the following years with the value of Iran's non-oil exports increasing from $US 1044 million in the beginning of the first FYDP (1989-1993) to $US 3747 million at the end of the plan.

Figure 3.4

Non-Oil Exports Trend ($US million)

(1960-2003)

Please see print copy for Figure 3.4

In 1994 total exports amounted to $US 19.4 billion, $US 4.8 billion of which (25 percent of the total exports) was comprised of non-oil exports. This positive trend was due to the government using the first FYDP policy recommendations to provide exporters with incentives, including a reduction in the surrender requirement for non-oil exports. By 1994 exporters were no longer required to exchange their foreign currency at the official rate and within the national banking system as they had been prior to this time (Zangeneh, 1997). The removal of many trade restrictions and the liberalization of the exchange rate system led to a surge of non-oil exports which placed Iran among the best performing economies in the region (IMF, 2002).

The highlights of the first FYDP (1989-99) with respect to the export sector (http://www.irvl.net/Firan5.HTM; Salehkhou, 1999) were:

- the reform of import/export laws and regulations,
- policies aimed at making production more competitive,
- the introduction of more efficient foreign exchange and tariff policies,

- the establishment of an export guarantee fund (EGF) to provide suitable insurance coverage for exports,
- supporting the Export Promotion Bank (EPB),
- the elimination of bureaucratic customs regulation and formalities through trade liberalization policies, and
- an increase in manufactured and agricultural exports through allocating a certain portion of production to exports.

Other policies introduced in the FYDP to promote non-oil exports included: adopting suitable tax and credit policies for export promotion; fighting against non-official commodity export smuggling through border controls; and effectively operating free trade zones to promote exports.

In the beginning years of the second FYDP (1995-99) and especially between 1995 and 1997, however, a series of policy reversals occurred due to a tight debt repayment schedule. In this period, according to the IMF (2002), the non-oil export sector was particularly constrained by (a) import restrictions of up to 50 percent in some years which were needed to make room for external debt repayment, (b) the extension of the US embargo on trade and investment which restricted market-access to Iran's exports, and (c) the tightening of exchange rate controls, including the re-imposition of export surrender requirements. As a result, non-oil exports decreased sharply and fell to 1990s levels --See Figure 3.4.

A review of the second FYDP (1995-99) reveals that in 1995, non-oil exports amounted to $US 3.257 billion, amounting to 17.7 percent of total exchange earnings. In 1996 this fell to $US 3.12 billion, around 14 percent of total export earnings. It further declined to $ US 2.9 billion in 1997, equal to 15.8 percent of total export earning (see Figures 3.4 and 3.5). Based on the IMF (2002) report, at the end of 1997 and early 1998 Iran initiated a series of reforms again in the context of the non-oil export sector: the various exchange rates were unified, exporters were granted easier access to inputs at international prices, most export barriers were removed and as a result, non-oil exports were once more on the increase--See Figurer 3.4.

In fact, by the end of 1997 all the non-oil export earnings could be used for imports or they could have an 'import certificate' that would be tradable on the Tehran Stock Exchange (TSE) market. In other words, after 1997 it became possible for foreign exchange transactions to take place outside of the banking system (Pesaran, 2000). In 1998, foreign exchange earnings from non-oil exports rose to $US 3.040 billion, or 24 percent of total exports --See Figures 3.4 and 3.5.

Figure 3.5

Share of the Non-Oil Exports in Total exports

(1960-2003)

Please see print copy for Figure 3.5

In summary, the implementation of export promotion policies has resulted in an increase in the level of non-oil export revenues and while these are encouraging results, they are less than optimal due to several factors. First of all, not all the government's policies were consistent, especially in regard to the exchange rate system. Due to the veto power of the U.S.A, Iran remained unable to join World Trade Organization (WTO). The lack of foreign direct investment (FDI) in export infrastructure, illegal trade such as the smuggling of some commodities, as well as the export of low quality goods were other reasons for the smaller than expected increase in the level of non-oil exports (ICCIM, 1999).

During the third FYDP (2000-2004), the government introduced more realistic foreign exchange policies for non-oil export earnings and set levels which were very close to the market rate. In fact, this policy made non-oil exports more profitable.

Furthermore, permission was no longer required for exports (except for a small number of goods such as antiques and cultural heritage items) (Export Promotion Center of Iran (EPCI, 2002); CBI, 2001a). Consequently, the third FYDP policies, which led to the exemption of exports from surrender requirements, resulted in the improvement in both quality and quantity of non-oil export products during the third FYDP (see Figures 3.4 and 3.5). According to the (CBI, 2002a), in order to promote non-oil exports, during the third FYDP the government:

- removed all taxes and levies from exported goods and services,
- lifted non-tariff barriers in order to promote foreign trade, and
- refunded all taxes and charges laid against both raw material and intermediate imports for exportable goods, as soon as these had been, in fact, exported.

3.2.2. Composition of Non-Oil Exports by Sector

Iran's non-oil exports fall into four major categories, namely: agricultural products, mining and mineral products, industrial products and carpets and handicrafts. However, the nature of non-oil goods which have been exported, has been heavily weighted in favour of traditional and agricultural products. For instance, industrial goods accounted for only 8.7 percent of total non-oil exports in 1985, whereas the shares of agricultural and traditional goods was 82.8 percent of total non-oil exports in this year (Amirahmadi, 1990). Following the implementation of the first and second FYDP, exports of manufactured and industrial products such as steel, petrochemical products, textiles and other industrial goods increased significantly. Official data show that while in 1989 the export of industrial products stood at 11.7 percent of total non-oil exports, this share had increased to 32.1 percent by the end of second FYDP in 1999.

Table 3.1: Share of Different Groups in the total Value of Non-Oil Exports

Please see print copy for Table 3.1

In contrast, the share of agricultural products and traditional goods (such as carpets, pistachio nuts, caviar, and saffron) over total non-oil exports decreased very significantly from 68 percent in 1979 to around 38 percent in 2000 (EPCI, 2001; CBI, 2001b). The top ten non-oil export items in this year were: hand-woven carpets, chemical products, pistachios and other nuts, ironware and steel, other industrial commodities, textiles, copperware, animal hides, as well as benzene and its derivatives (ICCIM, 2000).

Table 3.1 shows that In 2001, Iran exported $US 3.7 billion non-oil goods of which 18.6 percent consisted of agricultural products, 45.8 percent industrial and petrochemical products and about 15 percent mineral materials. Hand-made Persian carpets, which had an almost exclusive hold on the world market before the revolution, were badly affected by the Iran-Iraq war, and this allowed other nations like India, Turkey and China to enter the market. Nevertheless, carpets remain Iran's most popular export product. Total exports of carpets amounted to $US 619 million in 2001, equal to 16 percent of total non-oil exports. The next largest non-oil exports were pistachio nuts worth $US 318 million and comprising 8.4 percent of total non-oil exports (Iran exports Magazine, 2002).

3.3. Import Sector

The import capacity of the Iranian economy heavily depends on oil exports. The 1973-74 oil boom greatly increased Iran's total imports and these had reached as high as $US25 billion by 1977. The value of total imports declined to around $US 10.89 billion in 1980 at the beginning of the war with Iraq, but it increased to as high as 18.02 billion in 1983 (its peak during the first decade after the revolution, when the oil revenue and the GDP were also at their peak) (Tayebi, 1996). It should be noted that a substantial portion of imports during this period (1980-83) was used to support the war effort. However, due to the U.S. freeze on Iran's foreign assets, the urgent situation brought about by the war with Iraq and a shortage in foreign exchange due to the universal drop in oil prices, the Iranian government was forced to adopt import restriction policies. The year 1986 saw the lowest level of imports since the revolution, while at the same time revenues from oil as well as from other exports declined to their lowest level **--**See Figure 3.6. In this year some $US 8.5 billion were paid for imports. After the ceasefire in 1988, the country's First Five-Year Development Plan reflected a shift towards trade liberalization policies. The relaxation of import restrictions during this plan caused an increase in the importation of commodities such as consumer goods. Such steps resulted in a record $US 25 billion peak in the level of imports in 1991 (see Figure 3.6). Given Iran's limited export capacity, these high levels of imports were unsustainable and led to a deterioration of the country's external current account.

The high levels of external debt were also another problems which exerted pressure on the economy due to the high level of imports in this period. In fact, according to Dadkhah (1996), by 1993 Iran's $23.4 billion external debt led to the government's adoption of an import 'compression' policy which led to a very significant decline in the value of imports during the second FYDP (1995-99). The average value of imports was around $US 13.92 billion per annum during the second FYDP --See Figure 3.6.

According to Dadkhah and Zangeneh (2001), there are many tools used to restrict imports in Iran. Almost all items require a licence in order to be imported into Iran. There are quotas, restrictions, customs regulations as well as outright bans and these are applied not only to imported goods but to the sale of foreign exchange earned from export of goods and services as well.

The data in Figure 3.6 indicate that for all years between 1960 and 1990 (except for the year 1986) Iranian exports were roughly equal to or exceeded Iranian imports. In addition a close look at this graph shows that the two variables (exports and imports) follow each other very closely during the decade 1980-90 (except in 1986 because of the sharp decline in the price of oil in that year). It is worth noting that oil exports, in fact, had been major sources of the financing of investment projects as well as major source of capital and intermediate imports in the Iranian economy.

Figure 3.6 also shows that there was a sharp rise in the level of imports after 1990. As a result of the liberalization of imports during the first FYDP (1989-1993), the import trend changed. In particular the value of commodity imports in 1991,1992 and 1993, were more than that of exports, which resulted in a negative trend in the external accounts of the country during these years.

Figure 3.6

Total Exports and Imports Trend ($ US million)

(1960-2003)

Please see print copy for Figure 3.6

During the second FYDP (1995-99), the implementation of import restriction policies caused the value of commodity imports to exceed the value of exports. In sum, due to the liberalization of imports during the first plan (1989-93) and a cap on imports during the second plan (1995-99), exports and imports no longer moved in tandem (see Figure 3.6).

3.3.1. Composition of the Commodity Imports

Official statistical data show that from 1960 to 1978, the share of raw material and intermediate goods was never less than 50% of total imports, indicating the high dependence of the Iranian industrial sector on foreign exchange. During the first decade after the revolution, the share of capital imports over total imports declined as well. According to Amirahmadi (1990), by 1980 it fell to about 16 percent from a high of 37.5 percent in 1977, two years before the revolution. As Amirahmadi (1990) states, this together with the war damage to national infrastructure as well as the low level of capital formation during the first decade after the revolution, all had a seriously negative impact on the Iranian economy. During the war period (1980-88), the government gave the highest priority to the importation of essential consumer goods like wheat, sugar and rice, as well as intermediate and capital inputs for the industrial sector and the military needs of the war (Tayebi, 1996). The Iranian government attempted a two-pronged strategy: to gradually increase the level of the importation of capital goods while at the same time decreasing the level of consumer-imported goods. By 1983, only four years after the revolution, capital imports reached as high as 26 percent of total imports. In that year the share of intermediate inputs out of total imports was about 58 percent and the share of consumer goods was only 16 percent (Amirahmadi, 1990).

Turning to more recent data, Table 3.2 shows the composition of imports in 1998 and 1999 (the final year of the second FYDP). By 1999 official data showed that the share of raw materials and intermediate goods over total imports had increased over the previous year from 44.1 percent to 49.1 percent. During the same time, the share of capital imported goods in total imports dropped from 41.9 to 35.5 percent. Finally, the share of consumer goods in total imports declined slightly, from 15.4 percent to 14.6 percent (CBI, 2001a).

Table 3.2: Compositions of the Iran's Imports in 1998 and 1999

Please see print copy for Table 3.2

In sum, Table 3.2 shows that in 1999 approximately 50 percent of total imports were comprised of raw materials and intermediate goods. As mentioned earlier, this is simply because the structure of Iran's imports was dominated by the needs of the industrial sector. For example, the value of manufacturing and mining inputs registered about 45 percent of Iran's total imports in 1999 (CBI, 2001b). Even now, manufacturing inputs continue to be the largest component of Iran's imports due to the nature of Iran's manufacturing which consists primarily of the assembly of parts sourced from industrialized countries.

3.4. Balance of Payments

Iran's balance of payments has shown a widening gap between imports and non-oil exports. In the mid-1970s, oil revenue brought Iran a foreign exchange surplus, but when this fell sharply in 1978 due to the effects of a strike, the result was a serious current account deficit. It is obvious that Iran's current account is significantly affected by the value and amount of oil exports. After the Iran-Iraq ceasefire and the implementation of the non-oil export promotion policy however, non-oil exports began to have a more significant role in the balance of payments. The share of non-oil exports in total exports increased from 10 percent during the first decade to around 20-25 percent during the second decade after the revolution. Despite this growth, however, non-oil exports still failed to have a strong impact on the trade balance surplus, as they remained too small to compensate for the large value of Iran's imports.

As Tayebi (1996) indicates and Table 3.3 shows, during the war period (1980-88), the trade balance was in surplus, the current account was not positive. Moreover, for most years of the first decade after the revolution (1979-89) the current account showed a deficit ranging between $ US 1-5 billion. The main reasons for this large deficit during these years were the sharp decline in oil prices, war damage to oil fields and refineries and the high level of military imports related to the war. Table 3.3 shows that during the war period, current accounts had an annual average deficit of about $US 1,131 million. Then, the post-war period of reconstruction caused an almost two-fold increase in the value of imports between 1989 and 1991 (up from $US 13.5 billion to $US 25 billion) (Hakimian and Karshenas, 2000). By 1991, the current account was in deficit by $US 9.5 billion and by 1992 this reached $US 6.5 billion (see Table 3.3).

During the first FYDP (1989-93) the average current account deficit was around $US 4 billion per annum. This created major repayment difficulties for the government as the country's foreign debts are estimated to have been around $US 23.2 billion by the end of the first plan in 1993/94. It was a particularly difficult problem because as much as three-quarters of this amount were in the form of up to one year (short-term) debts (Pesaran, 1995; 2000). The external debt forced the Iranian government to reverse its open door policy and according to Hakimian and Karshenas (2000: 50) to solve this problem: "in the short term, the government embarked on urgent debt rescheduling negotiations to avoid default and to manage its arrears. In the medium term, however, it came to rely mainly on import controls to meet its new priority of paying back foreign dues". During the second FYDP (1995-99), the high degree of import restrictions and better than predicted oil revenues as well as the expansion of the non-petroleum commodity exports, allowed Iran to pay off some of the debt arrears and so the position of the country's current account improved very significantly (Pesaran, 2000). The import restriction policy introduced by the FYDP resulted in a significant decrease in total imports and a surplus in the current account. Table 3.3 shows a decrease in imports from an annual average of $US 19.9 billion between 1989 and 1993 to $US 13.6 billions between 1995-1999. The trade surplus averaged about $US 4,687 million, and the current account surplus averaged around $US 2,772 million during the second FYDP (see Table 3.3).

It should be noted that although the policies implemented during the second FYDP were partially successful in reducing the current account deficit and the country's foreign debts, these measures were not without costs. The re-introduction of import restriction policies negated the liberalization policy, which had been introduced at the beginning of the first FYDP, and this caused a large drop in the growth rate of the GDP during the second FYDP (Hakimian and Karshenas, 2000).

Table 3.3: Foreign Trade\ Current Account Balance ($ US Million)

Please see print copy for Table 3.3

Improvement in the external sector of the Iranian economy, which started during the second FYDP, continued during the third FYDP (2000-2004). For instance, in 2000, the growth of total exports (oil and non-oil) led to a remarkable positive upturn in the trade surplus $US 13,138 million and current accounts surplus $US 12,634 million (CBI, 2001a). In fact, this positive situation enabled the establishment of the Oil Stabilization Fund (OSF), which was proposed by the Management and Planning Organization of Iran in order to insulate the government budget from fluctuation in the oil price (IMF, 2002). Moreover, in the case of a collapse in oil prices, OSF foreign exchange reserves would provide a reserve of funds, which could be allocated to investment projects. In recent times, however, the allocation of OSF reserves appears to have strayed quite considerably from the original intent.

3.5. Iran’s Major Trading Partners

Although since the revolution Iran has attempted to widen the circle of its trading partners, its primary trading partners still remain the advanced industrialized countries. Official data show that imports from developed countries such as the USA, Western Europe, Canada and Australia fell to as low as 62.7 percent of Iran’s total imports in 1982 compared to the 85 percent share it had in 1976. This dramatic decline reflected the impact of the American trade embargo after the revolution (Tayebi, 1996).

In fact, as Table 3.4 indicates, imports from European markets have comprised around 50 percent of Iran’s total imports in recent years, followed by approximately 30 percent from Asian countries. This table indicates that imports from the American continent declined from about 15 percent in 1995 to around 13 percent of total imports in 1999. Imports from Australia and New Zealand also declined from 4 percent in 1995 to about 2.6 percent of total imports in 1999. Finally, imports from African countries registered 0.9 percent and 1.6 percent of total imports in 1995 and 1999, respectively.

Non-oil exports to developed countries also increased. From a low of 46 percent in 1976, it rose to about 53 percent of total non-oil exports in 1985 and 57 percent in 1986 (Amirahmadi, 1990). Despite the seemingly high level of Iran’s exports to European countries, it is only Iran’s traditional goods such as carpets, pistachios and caviar which are traded, while the country’s manufacturing exports have not been able to compete in the international market.

Table 3.4: Iran’s Non-Oil Exports \ Imports by Continent

Please see print copy for Table 3.4

Table 3.4 shows the geographical distribution of Iran’s non-oil exports and indicates that 49.6 percent of Iran’s non-oil exports went to Asian countries in 1995, increasing to 56.8 percent in 1999. European countries were the second most important destination for non-oil exports from Iran with a 46.4 percent share in 1995 and 37 percent in 1999. In 1999, only 4 percent of Iran’s non-oil exports went to America, due to the American trade embargo, followed by 1.6 percent to Africa and finally 0.4 percent to Australia and New Zealand.

As can be seen from Table 3.5, Germany, Italy, the United Arab Emirates (UAE), South Korea and France together accounted for about 35 percent of Iran‘s total imports in 1999. Germany with a share of 10.9 percent was the largest followed by Italy with 7.1 percent. The third largest share of Iran’s imports was from the UAE (CBI, 2001a). It should be noted, however, that the main reason for the high amount of imports (6.1 percent) from the UAE is the use of the Dubai Free Trade Zone in order to circumvent American trade sanctions. Most of the commodities in the Dubai Free Trade Zone are originally imported from developed countries, especially the USA, and these are then re-exported to Iran and other countries in the Persian Gulf region. Finally South Korea and France represent 5.6 and 5.4 of Iran’s total imports in 1999, respectively (see Table 3.5).

Table 3.5: Iran’s Five Major Trading Partners in 1999

Please see print copy for Table 3.5

The five major countries, to which Iran exports its goods, are also shown in Table 3.5 and they are the UAE, Germany, Turkey, Italy and India. These countries represent approximately a 45 percent share of Iran’s total non-oil exports. In 1999, the U.A.E share was 17.8 percent, to Germany 12.6 percent, to Turkey 5.5 percent, to Italy 5.4

percent and to India 3.8 percent (CBI, 2001a). Again, the reason for the UAE's first place among these countries is its role as intermediary "source" of Iranian goods to the American market. In fact, many Iranian expatriates living and doing business in the USA have established "branches" of their companies in the UAE so as to legally both import as well as export goods which are forbidden from direct trade by American sanctions.

3.6. Summary and Concluding Remarks

In this chapter, an attempt has been made to explain the structure of the Iranian foreign trade sector over the period between 1960 and 2003 with a special focus on the post-revolutionary period and recent years. Oil dependency is the most important characteristic of both the pre-and the post-revolutionary period in the Iranian economy. Oil has always been the main source of foreign exchange for the economy. The 1973-74 oil boom brought a huge windfall to oil revenues and significantly intensified the role of the government in the economic development process. Over the pre-revolutionary period, as the result of rapid growth in the price of oil, the economy grew at an average annual rate of 8.2 percent.

Between 1960 and 1977 major shifts in the Iranian economy occurred due to the 1973-74 oil boom and the 1986 oil bust, the 1979 regime change, the prolonged devastating 1980-88 war with Iraq, and the American trade embargo. Oil export booms had the biggest positive impact on the Iranian economy but an exogenous capital outflow due to the Islamic revolution in 1979 and the devastation of the Iran/Iraq war, caused a huge negative shift in the economy during the 1980s. Because oil revenues will not, in any case, earn enough foreign exchange beyond the next generation, the Iranian government especially since 1990 tried to achieve export diversification by discouraging over-dependence on oil exports and encouraging non-oil exports. In fact, oil is an exhaustible resource and is subject to extreme price fluctuations on the international market. The non-oil export promotion policies were, in fact, partially successful. The performance of these exports, however, has been less than optimal due to both a chronic instability in government trade policies as well as to the U.S. embargo on trade and investment which restricted the access of Iranian exports to international markets.

CHAPTER 4
TRADE AND ECONOMIC GROWTH (SURVEY)

4.1. Introduction

Competing viewpoints are held on the possible relationships between trade and economic growth. The lack of consensus on this issue pertains to the fact that expanded trade opportunities can accelerate economic growth through exports but at the same time it may impede the growth of infant industries and impact adversely on the balance of payments (Jayme, 2001). The literature reflects these two divergent perspectives in both conventional ‘welfare gain’ models and the newer ‘endogenous growth’ models. The most important distinction is the alternative focus on the effect of trade on economic growth in general and the export sector of the economy and its externality effects in particular. It is the second approach, which forms the basis of the present study.

The aim of this chapter is to review the existing literature on the relationship between foreign trade and economic growth. We begin by earlier models of welfare gains of trade followed by trade and new endogenous growth models and finally we present a comprehensive empirical literature review about the relationship between trade and economic growth. In particular, we summarize the empirical studies of the relationship between the two major components of trade (i.e. exports and imports) and economic growth.

4. 2. Earlier Models of the Trade/Economic Growth Relationship

The literature shows two different perspectives on the relationship between foreign trade and economic growth. As Jayme (2001) explains, some economists argue that open economies lead to growth while others believe that such economic growth could be prevented by openness because of the negative effects of trade liberalization on infant industries. In fact, as Jayme noted, in the case of developing countries in particular, there is empirical evidence to support both of these points of view.

The traditional theory of comparative advantage argues that trade leads to the more efficient use of resources because cheaper goods and services can be imported rather than produced domestically at a higher cost. Thus, an open economy can be assured of greater welfare gains (Jayme, 2001).

Jayme (2001) notes that, according to the Riccardian model of comparative advantage, if each country specializes in producing the commodities it can produce efficiently, that is at less comparative cost to other countries, and then sells these on the international market, there will be benefits not only to that country but to the world marketplace as well. In addition, Jayme stresses that Hecksher-Ohlin's two-country trade model shows welfare gains only when each country specializes 'based on its factor endowments'. In other words, international trade leads to greater efficiency and productivity and this leads to greater economic growth. The Ricardian and Hecksher-Ohlin models, however, as Jayme notes, do not explain clearly what, if any, long term effect international trade might have on economic growth, nor how such a relationship might function.

Krugman (1986) saw that increasing bi-lateral trade in similar products between developed countries and the low levels of exports from many poor countries cannot simply be the result of differences in factor endowments or insufficient technological progress. According to the Bhagwati (1958) model cited in Jayme (2001: 12), when technological progress leads to economic growth, this may have a negative effect on national welfare. In fact, following economic growth, the terms of trade may deteriorate and such conditions can reduce consumption, thus contributing to a negative effect on welfare of the economy as well as on economic growth.

According to traditional comparative-statics methodologies, changes in trade policy lead only to one-time changes in the levels of production, whether there are economic distortions or not. In the same way, according to the standard neoclassical model of exogenous growth, trade-policy changes are thought to bring about changes in "the pattern of product specialization but not in the steady-state rate of growth." (Baldwin 2003:16).

Recently economic theory has stressed the importance of market structure and product diversification in explaining the direction, the volume, and the composition of world trade because a country's trade performance is also affected by its geography, size and access to information. In particular, economists like Krugman (1986) see trade as more likely to grow between countries of comparable economic size, especially among countries with high GDPs. Despite the fact that these theories do not address the issue of the relative importance of the various factors contributing to international trade, they are nevertheless important because they identify more clearly the factors which will be important in later empirical and theoretical studies.

4. 3. Trade and New Endogenous Growth Models

By the late 1980s, 'dynamic endogenous growth' theories had emerged (e.g. Lucas, 1988; Grossman and Helpman, 1990a, 1991; Romer, 1990). According to Romer (1990) the primary difference between new endogenous growth models and the traditional neoclassical growth model is inherent in its very name. The newer theories insist that growth is an endogenous outcome of an economic system and not the result of factors which are external to the system. In the new endogenous growth model the relationship between trade and growth became, in fact, a focal point. The newly emerging endogenous growth theories began to emphasize the role of exports in economic growth (Sengupta, 1993). Pack (1994) noted that exports must also be incorporated in the model because trade plays an important role in explaining international productivity differences.

Endogenous growth theories emphasize the fact that exports work as a conduit of knowledge spillover from advanced economies and encourage technological change. This knowledge spillover also works as a factor that enables the economy to realize increasing returns. According to Sengupta (1993), this new endogenous growth model, however, have inherited a great deal from the traditional neoclassical model of the exports-growth relationship: they treat exports as a kind of production input, which raises national output through externalities. An increase in exports is supposed to bring about more externalities, and so raise output.

On the other hand, in this new endogenous growth model, it is argued that an importing country gains knowledge, especially through learning by doing, and technology embedded in the products traded, which is then adopted by local manufacturers to increase their competitiveness in domestic and global markets. This positive externality continues to emerge as long as there is a local R&D sector capable of exploiting this opportunity. This is an important insight. According to endogenous growth theories, knowledge spillovers between countries are important in increasing returns through the economy of scale and thereby spreading growth among trading partners (Jones and Monuelli, 1990; Rebelo, 1991).

Long and Wong (1997) noted that along with other exponents of endogenous growth models, Lucas (1988), saw 'learning by doing' as one of the most important feature of these endogenous growth models. They saw it as a channel through which human capital and knowledge (of an individual or an economy) accumulates. While in previous static models, countries were seen to specialize in producing specific goods and services according to their comparative advantages, the Lucas dynamic model highlights the increasing role of human capital in the process of economic growth. According to this model, a country will accumulate only the type of human capital that is specific to the goods produced. This means that free trade will cause different countries producing different goods to have different growth patterns.

In a similar vein to Lucas, Van and Wan (1997), cited in Long and Wong (1997: 48), applied the concept of 'learning by doing' to the issue of technological transfer through international trade, arguing that technological progress and foreign trade work together to promote economic growth. Thus, foreign trade provides an opportunity for an economy to learn from other economies, and physical capital accumulation, rather than being a source of growth, is, instead, the consequence of economic growth.

Weinhold and Rauch (1997) found that increasing trade liberalization in developing countries can lead to higher productivity as well as increased specialization through 'learning by doing' and the economies of scale due to the larger market.

Based on the new endogenous growth model, Grossman and Helpman (1990a) introduced a model of the relationship between openness and trade. They look at several mechanisms that show the effect of openness on growth. First, because of the economy of scale on the global market, firms have a great deal of incentive to exploit their research successes and invest in new technology. Second, modern communication permits such innovation to easily and rapidly spread worldwide. In this way, countries can take advantage of the knowledge spillover of their trading partners. Third, participation in international capital markets can provide more opportunities for financing investments in all forms of capital.

According to Grossman and Helpman (1990a), one of the most important features of the endogenous growth model is the idea that trade conveys knowledge to the importing country, especially through the technology embedded in intermediate and capital imports. Local manufacturers can make use of such knowledge to increase their competitiveness on local and world markets. Grossman and Helpman (1990a) warn, however, that this functions only if local industry has a domestic R & D sector capable of exploiting the conveyed knowledge.

Grossman and Helpman (1990b) stress the importance of the growth effects of the economy of scale and technological progress in their dynamic two-country model of trade and growth with endogenous technological progress. They also identify the importance of knowledge accumulation, which enables innovation in the production of new intermediate products and makes further research less expensive. They contend that the diffusion of technology and knowledge leads to the creation of links between trade and growth.

Jayme (2001) highlights some further aspects of the trade/growth relationship in the Grossman and Helpman model as follows:

- First, stronger relative demand for the country's final good, with comparative advantage in R & D, lowers the country's long-term share of the number of middle products; and this slows long-term growth in the world economy.
- Second, a country's steady state share in middle products and R & D is lessened by a small export subsidy or import tariff on final goods. If the policy-active country has a comparative disadvantage in R & D, then the rate of long-term growth in the world economy will be increased.
- Third, national R & D subsidies can increase long-term growth in a country if the level of trade between it and its trading partner remain stable. Otherwise, the long-term growth rate may rise, but it may also fall.

In a later study, Grossman and Helpman (1991) suggest a different theoretical analysis. Their new theoretical argument relates productivity with trade volume. According to this model, if the residents of a country interact with those of their foreign trading partner, they may obtain opportunities to acquire technical information that might contribute to their country's general knowledge. Such opportunities might not arise if the country remains under autarchy.

Grossman and Helpman (1991) go on to suggest that international trade can lead to knowledge transfer in a number of ways: (a) the foreign knowledge embedded in the imported capital and intermediate inputs increases the productivity of domestic resources; (b) the resultant improved communication can lead to the learning of new production techniques and product design; and (c) finally, a country's productivity is also improved through being exposed to new technologies.

According to Romer (1994), through the importation of new technology and knowledge spillover from more advanced economies, developing countries can improve their economic performance. Chuang (1998) introduces a two-country model of trade and economic growth and concludes that trade, however, is not always beneficial: it is only trade with advanced economies, which leads to technology spillover effects and economic growth for developing economies.

Barro and Sala-i-Martin (1995) introduce a model in which the diffusion of technology between advanced industrialized countries and those still in the process of development is explained in terms of what they call the "catch up effect". The model implies a kind of convergence because a developing economy may grow faster than an advanced economy in cases where the technology gap between the two countries is large.

Grossman and Helpman (1994) introduced 'capital accumulation' into the endogenous growth model as well. They noted that capital could be used to produce intermediate as well as final goods. Technological innovation, however, occurs in the production of these intermediate goods and with the resultant improvement in their quality, the productivity of physical capital is enhanced. These researchers look at international growth in terms of comparative advantage in the research sector as well.

The role played by research and development (R & D) is one of the other important distinctions between new endogenous growth models and the traditional models. In endogenous growth models, however, the effect of the quality of R & D is more important than the effect of its quantity on productivity growth (Braconier and Sjoholm, 1999). Coe and Helpman (1995) investigate the R & D effects in one country on its own productivity as well as on that of its trading partners. Their findings show that domestic productivity is related to domestic spending on R & D as well as trading partners' R & D expenditure. Foreign spillovers can be achieved directly through technology transfer or indirectly through the importation of hi-tech products. They concluded that the larger the level of international trade, the greater such spillovers will be. Coe and Helpman show that the benefits of foreign R & D are larger for a small open economy's total factor productivity (TFP) than their domestic R & D. They conclude that the difference between small and large economies in this regard is due to the volume of international trade.

More recent studies by Engelbrecht (1997) and Keller (1998) on international knowledge spillover reconfirm the earlier finding of Coe and Helpman. These studies show that international trade has significant spillover effects on the productivity of trading nations because, as we have seen, the R & D of trading partners has a greater spillovers effect than domestic R & D. In another study Coe, Helpman, and Hoffmaister (1997) report that developed economies also benefit from international R & D because ideas tend to move between countries and the flow of technology which is promoted by international trade in fact helps facilitate the flow of technology.

In a recent study, Baldwin (2003) noted that developers of the endogenous growth models accepted the idea of increasing returns as a 'driving force for endogenous growth' but also introduced concepts like 'knowledge spillovers' as well as foreign product 'imitation' as sources of such growth. In addition, Baldwin argued that these theorists saw that growth rates were generally slowed, instead, under import protection and restriction policies.

Baldwin (2003) concluded, however, that some doubts still remain among economists about the beneficial effects of trade on economic growth. He argued that despite several wide-ranging research studies on the trade/GDP nexus using comparable analytical frameworks, economists nevertheless continue to disagree about the essential nature of the trade/economic growth relationship.

In sum, although earlier 'welfare gain of trade' models discuss the benefits or harmful effects of trade on economic growth, 'endogenous growth' models question the accuracy of the various competing models. Jayme (2001) noted that McCombie and Thirlwall (1999), for example, were critical of the Grossman and Helpman (1990, 1991) models for having neglected balance of payments constraints.

Frankel and Romer (1999) point out that one of the most important problem in testing the trade-GDP nexus, is that it is necessary to be aware that the trade share may be an endogenous variable. They build a model analysing the important effects on the trade performance of a country's geographical location and the size of its economy. Their aim was to propose an alternative instrument for measuring trade in order to overcome this problem and they proposed the use of geographical features as instrumental variables to estimate trade impact on income and growth. However, several studies challenged Frankel and Romer's findings by suggesting that geography may affect income through channels other than trade (Rodriguez and Roderick, 1999).

4. 4. Review of the Empirical Studies on the Trade/GDP Nexus

When export promotion policies in Asian Newly Industrialized Countries (NICs) in the 1980s led to remarkable economic growth, attention drawn to the linkage between exports and economic growth in other developing countries. Some Latin American countries that followed import substitution strategies and continued to perform poorly also became interested in export-oriented strategies. Bhagwati (1978), Balassa (1985) and Ghatak *et al*. (1997) suggested that export expansion might generate positive externality through more efficient allocation of resources, efficient management, improved production techniques, specialization, competition and the economy of scale. Hence various development theories have emerged in the literature suggesting that export expansion further accelerates economic growth due to the above-mentioned factors and this is referred to as the Export-Led Growth (ELG) hypothesis in the literature.

4.4.1. Export-Led Growth Hypothesis (ELG)

In order to study the relationship between export and economic growth, researchers began applying a number of different empirical methodologies to the available data. Earlier studies such as Michaely (1977), Krueger (1978; 1986), Balassa (1978), and Tyler (1981) examined the correlation between export expansion and economic growth. They concluded that there is a positive correlation between export expansion and economic growth. Michaely (1977), in particular, argued that GDP in a country would be affected by the expansion of its exports only once it achieves a minimum level of development and growth.

Krueger (1978) regressed export growth for each of 10 countries against the rate of GNP growth. He found a strong positive correlation between the two variables. Again Krueger (1986) argues that a trade regime with export–led growth tends to produce more quality products for international markets. He concluded that there is a positive association between openness and GDP growth. Analysing a group of semi-industrialised countries, Balassa (1978) found a significant and positive correlation between growth in real exports and average growth in real GDP. His sample consisted of eleven countries with an established industrial base consisting of both import substitution and export promotion policies. He argues that export-oriented policies lead to better growth performance than policies favouring import substitution. The results of his study indicate that export growth favourably affects the rate of economic growth.

Tyler (1981) examined a cross-section of 55 countries during the period from 1960 to 1977. He found that GDP growth depended on both export performance as well as capital formation and that there is a significant positive correlation between economic growth and total exports. He also found that using the growth rate of manufacturing exports as a proxy of total exports yielded consistently similar results. Finally, he identified a lower economic growth rate in countries that did not utilize export promotion policies. It should be noted that some researchers state that the results might involve spurious correlations due to the fact that exports are a part of GDP. This issue led some researchers to use GDP excluding exports or other alternative variables as more appropriate measures.

A second group of studies like Feder (1982) tried to establish a kind of production function and they included exports like other explanatory variables such as labour, human capital, investment, etc in their analysis. Feder takes into account the re-allocation of existing resources from less efficient non-export sectors to higher productivity export sectors. He differentiated between the productivity of export and non-export sectors and concluded that there are substantial differences in marginal factor productivity between the export sector and the non-export sector. He shows that productivity is significantly higher in the export sector; and economies that shift resources into the export sector will gain more than that of inwards-oriented economies. Moreover, he mentioned that export-oriented policies led to an optimal allocation of resources and increased productivity in the countries that pursued these policies. His results indicate that there is a positive relationship between the expansion of exports and economic growth.

Following Feder, a number of researchers made an attempt to expand his production function approach by including exports in the production function and considered the broad range of externality effects through exports. For instance, Balassa (1985) examined the export and economic growth nexus for a group of developing countries after the 1973-1974 oil shock, and showed that the rate of growth in exports, in addition to the domestic investment share of GDP and average labour force growth, affected the growth of GDP. Similar to Balassa (1985), Ram (1987) also analysed the role of exports in economic growth. He estimated the average real GNP growth as a function of labour force growth, and the share of investment in GDP and export growth as explanatory variables. He found that the impact of export performance on growth was small in the Less Developed Countries (LDCs) during the first period of his research (1960-1970), while in a later period, (1970-1977), this impact rose substantially. A few years later, Fosu (1990) regressed GDP growth on labour, capital formation and export growth. He found that exports had a significant effect on economic growth in several African countries, but the magnitude of effect in these countries was relatively smaller, on average, than that of other LDCs.

Sengupta (1993) has considered the role of exports in a production function framework for a group of NICs. He treats exports as a kind of production input, which raises national output through externalities. He noted that endogenous growth theories emphasize the fact that exports work as a conduit of knowledge spillover from advanced economies that encourages technological change. He argued that by international knowledge spillover or through trade externalities, human capital also could increase. His empirical finding supports the hypothesis of export-led growth in NICs.

Amirkhalkhali and Dar (1995) investigated the role of export growth in a production function framework for a group of 23 developing countries. Their results indicate that there is a significant positive relationship between export expansion and economic growth for all of the developing countries in his sample which followed outward-looking policies whereas data for those countries that applied strongly inward-looking strategies did not support this relationship and in fact, the level of economic growth was higher in the former countries than in the latter ones.

In an attempt to avoid the problem of bias in estimation using single equation models, Sprout and Weaver (1993), Khan and Saqib (1993), Van den Berg and Schmidt (1994) and Lee and Cole (1994) all applied simultaneous-equation models to investigate the relationship between export and economic growth. However, in a comprehensive study of the literature on the relationship between export and economic growth Giles and Williams (2000) argued that the estimation of simultaneous equations models does not typically change the main conclusions of previous studies of the export-GDP nexus.

Sprout and Weaver estimated a two-stage least square (2SLS) model. Their findings showed that the effect of export expansion varies widely among different LDCs, and those countries with more "processed exports" benefit more from foreign trade. Moreover, they concluded that the performance of the export sector influences the way in which the economy operates. They argued that primary exporting countries experience meager economic growth compared with more diversified-export-base economies.

By using both single and simultaneous equation models, Khan and Saqib (1993) investigated the relationship between export expansion and economic growth for Pakistan between 1972-88. They disaggregated total exports into primary goods and industrial goods and found that the effect on GDP growth of the export of primary goods was higher than the effect of the export of industrial goods. Lee and Cole (1994), by applying a simultaneous-equation system, introduced export as an endogenous variable as it plays a more significant role in economic growth. Van den Berg and Schmidt (1994) investigated the relationship between foreign trade and economic growth and showed a positive long-term relationship between export expansion and economic growth in twelve out of seventeen countries of their sample. Overall they did not refute the interplay between international trade and economic growth.

In 1994, Yaghmaian challenged the results of the neoclassical theory of export-led growth. Although the theory of export-led growth has been promoted as a more efficient strategy than import substitution, according to Yaghmaian this has been challenged by a number of empirical works. He indicates that in most countries the process of development, although initiated with some sort of import substitution policy, was most often continued with export promotion policy and in fact, in some cases when this did not occur, the process of development stalled.

Vohra (2001) specified two forms of production functions and showed that the significance of the export variable is stronger in the middle-income countries than in the low-income economies. As a result, he argued that the positive and meaningful effect of export expansion on economic growth is greater when a country has reached a certain level of development.

Ibrahim and MacPhee (2003) presented an updated and new economic estimate of the relationship between exports and GDP growth based on the Feder (1982) model. They used a system of simultaneous-equation models to determine the relationship between exports and economic growth. Their findings support the view that "higher productivity in the export sector is associated with the size and trade orientation of a country as well as the extent of manufacturing" (2003: 281). They further reiterated that if the export sector heavily relies on primary products rather than manufactured products, then the positive externality effect of the export sector would be weaker and vice-versa.

4.4.2. Exports, Imports and Economic Growth

While the above-mentioned researchers concentrated on the role of exports in economic growth, a number of other researchers like Salehi-Esfahani (1991), Metwally (1993), Chaudhri and Wilson (1995), and Van den Berg (1997) incorporated, along with the role of the export sector, the importance of the import sector in the process of economic growth. In order to avoid the problem of bias involved in the estimation of single-equation models, Salehi-Esfahani (1991) developed a simultaneous-equation model in which there were three equations in the system. In other words, in addition to the equation for GDP growth, two other equations were specified to model the growth rates of exports and imports. He found that the expansion of exports is an integral part of the economic growth process. Moreover, he concluded that the contribution of exports to economic growth was mainly attributable to the provision of foreign exchange for the importation of intermediate and capital goods.

Using a simultaneous equation model, Metwally (1993) examined these factors for 10 Asian countries. He included real GDP, real exports and imports as endogenous variables for each economy as well as real GDP growth of the major trading partners of each country and was able to show the interdependence between each of the sample economies and the rest of the world.

Chaudhri and Wilson (1995) introduced the concept of 'Meta-production Function' in order to determine the drivers of economic growth in Australia and in some Asian countries. Along with international trade, they introduce investment, government consumption and human capital as the major drivers of productivity growth. Their empirical results show that the role of government consumption, international trade and investment is positive and significant in influencing the level of labour productivity of their sample countries.

By using a single equation model, Van den Berg (1997) assumed that the growth rate of GDP is a function of the growth rate of capital, labour, export and import. Then, he specified a simultaneous equation system by using the three-stage least square estimation method and found a positive relationship between international trade and economic growth. Van Den Berg argued that R & D activity in a country involved in foreign trade will lead to more growth than profit–motivated R & D activity in a country under autarchy.

In sum, the empirical literature shows that there is a production function model for the study of the relationship between exports and economic growth which includes both exports as well as imports as additional inputs. Studies applying this model found evidence in favour of the export-led growth hypothesis (ELG). Even the use of a simultaneous-equation model supports this conclusion. Table 4.1 at the end of this chapter summarizes the empirical studies which used correlation and production function approaches to analyse the relationship between exports, imports and economic growth.

4.4.3. Causality: Exports, Imports and Economic Growth

It should be noted, however, that Yaghmaian (1994) argued that the neoclassical theory of export-led growth has also been challenged for its causality between GDP and exports. Consequently, some economists believe that export expansion is a consequence rather than the cause of economic growth. For this reason, they questioned the validity of the empirical results that assumed that the direction of causality runs from exports to economic growth. Instead they were interested in conducting causality tests to examine the relationship between exports, imports and economic growth. Some of these studies include: Jung and Marshal (1985), Chow (1987) Kugler (1991), Ahmad and Kwan (1991), Bahmani-Oskooee *et.al.* (1991), Chowdhury (1992), Giles and McCann (1992), Bahmani-Oskooee and Alse (1993), Dodaro (1993), Sharma and Dhakal (1994), Riezman *et.al.*(1996), Ghatak *et.al.*(1997), Paul (1998), Karunaratne (1998), and Ribeiro-Ramos (2001)

Jung and Marshal (1985) used the Granger causality method to explore the direction of causality between exports and economic growth for 37 developing countries. Their results were surprising as they could establish a causal link from export growth to output growth (ELG) only in four of these countries. Despite arguing that the evidence in favour of export expansion to accelerate GDP growth was weaker than previous empirical findings, they did not recommend that a policy of export expansion should be abandoned solely based on their findings.

Chow (1987) tested the causality relationship between growth of total exports and the development of manufacturing output in eight newly industrialized countries (NICs). This study indicated a positive relation between export growth and industrial development. In addition, in almost all the cases, causality analysis indicated that the positive relation indicated that the causality was bi-directional, that is, growth in total exports caused development of manufacturing industries and vice-versa. He concluded that export expansion in these countries has led to economic growth.

Using Johansen's methodology as well as the Granger causality test, Kugler (1991) conducted his research in order to identify the relationship between GDP, consumption and investment on the one hand, and exports on the other hand. His results showed little evidence supporting the export led growth hypothesis.

Ahmad and Kwan (1991) utilize Granger causality tests to investigate the relationship between exports and economic growth for 47 African countries. The causality inferences indicate no causal relationship between exports and economic growth in these countries. A few of their sample countries nevertheless provide some evidence for uni-directional causality running from economic growth to export expansion.

Based on the empirical analysis of Bahmani-Oskooee *et al*. (1991), one can conclude that previous studies which mainly used the Granger causality test suffered from several shortcomings. Bahmani-Oskooee *et al*. (1991) have addressed these issues by applying more appropriate techniques. Nevertheless, their new approach lends some empirical support for the export-led-growth (ELG) hypothesis for only 5 out of 20 countries. Two countries showed exactly the opposite result consistent with the growth-led export expansion hypothesis, while 5 showed a bi-directional causality between exports and economic growth. Finally, the remaining 8 countries showed no evidence of causality at all in the growth-export nexus.

Chowdhury (1992) investigated the relationship between trade and economic growth for a sample of 12 countries in the Asia-Pacific region. In his study, he utilized the Granger causality method as well as the Finite Prediction Error (FPE) and Hocking's Sp criteria. In his empirical work he included trade (exports plus imports) and tried to identify the relationship between trade and GNP. He argued that failure to include import variables might cause a biased conclusion. He found that there was substantial support in favour of the hypothesis that trade acted as a growth engine in these countries. Using the FPE criterion, he concluded that in approximately 75 percent of the sample countries there was uni-directional causality from trade to economic growth and using the Sp criterion, he found that the causality was bi-directional.

Giles and McCann (1992), using cointegration technique to examine the case of New Zealand, argue that the commodity composition of exports is also important in investigating the relationship between exports and economic growth. They used both disaggregated and aggregated export data in their study and found that the export of live animals and meat, minerals, chemicals, manufactured goods and metals contribute positively to that country's economic growth.

Bahmani-Oskooee and Alse (1993) also re-examined the question of causality between export growth and economic growth. They used cointegration techniques and an error correction model (ECM) so that they would not lose the long-run information in the data. They found evidence of cointegration between exports and GDP in the log level for the nine countries under the investigation, favoring the hypothesis of export-led growth.

In his study of 87 developing countries, Dodaro (1993) investigated the relationship between real export growth and real GDP growth. He employed individual country time series data and concluded that causality tests offer very weak support for the neoclassical theory of export led growth and his result approved the ELG hypothesis in only eight poor and low-income countries. However, he noted that he could rule out export promotion policy as the best way to promote growth. He also suggested that more detailed models and data are needed for the investigation of the export - growth casualty relationship.

Sharma and Dhakal (1994) carried out a study using the Granger causality test on 30 developing countries over the period 1960-88. The study revealed that although no causal relationship was found in the data for 11 of the sample countries, there was indeed a causal relationship in the case of the remaining 19. Of these 19, export growth caused economic growth (ELG) in 6 of the sample countries. In 8 countries, including Iran, the opposite was the case. In these 8, it was growth in real GDP which led to increases in the value of exports (GLE) and they found that there was bi-directional causality (BD) for the remaining 5 countries. Based on these findings, they recommended the adoption of export promotion policies.

Riezman *et al* (1996) also estimated the export-income relationship including import growth for nine Asian countries. They argue that ignoring the role of imports in the process of economic growth could result in both a spurious rejection of export-led growth as well as a spurious detection of it.

Karunaratne (1996), examined growth and trade dynamics for the Australian economy in the presence of regime shift. He applied Granger causality analysis, ECM and multicointegration analysis for the period 1979(2)-1994(2) to determine the relationship between trade and economic growth in Australia. He found that trade acted as an engine of growth. Because the Australian economy faced in the mid-1980s some radical policy shifts as it moved from a protectionist to a liberal trading regime, he applied a superexogeneity testing procedure in order to counter Lucas' critique that policy change itself might be the cause of structural breaks and thus invalidate the results of the Granger causality testing procedure. As Karunaratne (1996: 61) noted, superexogeneity testing had been applied previously 'to test the effect of regime shift on monetary, exchange rate, consumption and savings rate behaviour' but he applied this testing procedure for the first time in order to determine whether changes in trade policy caused structural changes in the 'underlying growth trade dynamics' of a country. The results of the superexogeneity testing procedure showed that the policy shift to trade liberalization 'did not cause a structural variance in Australia's trade growth dynamics' as the Lucas critique would have predicted and confirmed his findings that trade had indeed acted as an engine of economic growth in Australia.

Ghatak et.al, (1997) examined the export-led growth hypothesis by using cointegration techniques and causality testing for the period of 1955-99 for the Malaysian economy. Their results yield support for the ELG hypothesis in the Malaysian economy. In addition, by disaggregating total exports into traditional and manufacturing exports, they saw that in the case of Malaysia, (as has been seen in the majority of advanced developed countries) industrial exports have a stronger role in economic growth than traditional exports.

Paul (1998) investigated these issues in the Australian economy and found that both export and GDP variables in log levels had unit roots but they were not cointegrated, suggesting that both GDP and export series have grown independently. In his findings, however, there was evidence in favour of the causality running from exports to GDP growth and based on that he concluded that the export-led growth hypothesis is applicable in Australia but only in the short term.

As he had in his 1996 study, Karunaratne (1998) again applied Granger causality analysis, this time to 1971(1)-1991(4) data on the Australian economy in order to test the hypothesis that trade acts as an engine of growth. He applied the Johansen maximum likelihood approach to determine the number of cointegrating vectors in the trade-growth nexus in the presence of some other relevant variables. His results confirmed that there is at least one cointegrating vector, or long-run relationship, between trade and economic growth in the Australian economy. More specifically, by applying ECM, he again showed that trade has indeed acted as an engine of growth in

Australia. In addition, Karunaratne found that there is evidence of bi-directional causality (feedback effects) between trade and economic growth within the Australian economy. As in 1996, these findings were again confirmed using superexogeneity testing and he found that the growth-trade relationship is 'robust to provide credible policy insight' in the Australian economy. These findings support the view that export promotion policies should be encouraged.

Finally, Ribeiro-Ramos (2001) incorporated imports in the causality analysis of the export-growth relationship for Portugal. His empirical findings did not show a unidirectional causality between the variables, however he showed that there existed a feedback effect between export-GDP growth and import-GDP growth in Portugal.

By using Lucas' (1988) human capital model of endogenous growth theory, Dutta and Ahmed (2004) examined the relationship between trade liberalization and industrial growth in Pakistan. They applied both the Johansen cointegration technique as well as Error Correction Modelling (ECM). Their empirical findings indicate that there is a unique cointegration relationship among the aggregate production functions of the industrial sector and their major determinants, including physical and human capital, the labour force, exports and import tariff collection. In addition, by applying ECM they found that while the effects of real capital formation, the labour force and real exports are highly significant in the economy of Pakistan, human capital has an even smaller effect than had been anticipated.

Using similar theoretical frameworks and econometrics methodology for the economy of Turkey, Cihan and Dutta (2005) applied the human capital model of endogenous growth theory developed by Romer (1990). In addition, by incorporating an index of trade liberalisation, they augmented the Romer model in this study. Using cointegration techniques as well as error correction modeling (ECM), they found that there exists a unique cointegration relationship between GDP and its major determinants, i.e. real capital stock, the labour force, real net imports as a proxy of trade liberalization and finally, the secondary school enrolment ratio. The short-term dynamic behaviour of this relationship indicates that the above-mentioned factors have emerged as playing a significant role in the process of GDP growth in the Turkish economy. Their empirical findings, however, indicate that the estimated coefficient of real net imports signals a very weak relationship with GDP.

In sum, adopting the Granger causality and cointegration techniques shed some doubt as to whether economic growth was the result or the cause of export expansion.

It has been recommended that both the long- and the short-term relationships needed to be considered in order to identify the direction of causality between these variables. A selective summary of the causality and cointegration studies of the export-GDP nexus is presented in Table 4.2 at the end of this chapter.

4.4.4. Relevance for the Oil Exporting Countries and Iran

As one might expect, export performance in oil exporting countries is highly dependent on the export of oil. Approximately eighty to ninety percent of OPEC members' export earnings are from the export of crude oil. Consequently many studies attempt to examine the relationship between oil export and economic growth in these countries. However, there are not many studies on the relationship between 'non-oil' exports and economic growth in these countries.

Metwally and Tamaschke (1980) studied the effect of oil export growth on the economic development of six major oil-producing countries: Saudi Arabia, Iran, Kuwait, Iraq, Libya, and Algeria between 1960-75. To determine the time lag between export growth and economic growth, the researchers used a Koyck distributed lag scheme. They found a strong and positive relationship between exports and GDP growth in all of their sample countries. Their results showed that in these countries, the current period effects of oil exports on the rest of the economy is greater than the lagged period effects. Finally, in four of the sample countries (i.e. Saudi Arabia, Iran, Algeria and Iraq) capital formation and investment were found to be wholly dependent on the growth of oil exports.

In order to evaluate the impact of the oil sector on the economy of OPEC countries, Yusefi (1994) applied the Koyck distributed lag model. His empirical results show that oil revenue has a positive impact on the economy of OPEC countries in the current period except for Saudi Arabia and Kuwait. Moreover, the results show that, while current income from oil exports has a negative effect on the non-oil sector of these countries, the lagged oil export revenues provide more significant results.

Using time series data for the period between 1960-92, Haerian (1996) investigated the role of oil exports on Iranian economic development. He tested the hypothesis that oil exports act as a 'leading sector' in the Iranian economy. In his single equation model, he applied a Koyck type lag model to test the spread effects of the oil export sector. He notes that large oil revenues have financed the Iranian economy. His results also approve the hypothesis of the oil sector being a leading sector in Iran's economy. Moreover, the results of a simultaneous equation model were the same.

Using data from 4 major oil-producing countries, Al-Yousif (1997) applied both the production function method and cointegration techniques and investigated the relationship between exports and economic growth. In his Feder-type model, he estimated the real aggregate output as a function of domestic investment as a percentage of GDP, growth of government expenditure, labour force growth, and the share of exports in GDP. By applying cointegration techniques he found a significant relationship between export growth and real output growth in all of the countries in his sample. The summary of previous empirical studies of exports and economic growth relationship in oil-exporting countries is given in Table 4.3 (at the end of this chapter).

4. 5. Summary and Concluding Remarks

In this chapter on trade and economic growth, we first examined the earlier model of the welfare gain of trade, which was based on the theory of comparative advantage. The keystone of these earlier theories is that international trade is the way to achieve static productivity efficiency and international competitiveness. Economic growth is merely a result of this strategy.

Next attention was directed to trade as analysed using new endogenous growth models. These described how importing countries gain knowledge, especially through technology embedded in the product traded and how such countries can take advantage of knowledge spill-over as well as technology transfer through international trade. 'Learning by doing' is another feature of the endogenous growth model which is related to trade and this concept describes a channel through which human capital and the knowledge of individuals or an economy accumulates.

Having dealt with theoretical matters, a comprehensive review of the empirical literature concerning the relationship between trade and economic growth was presented. The earliest empirical research on this nexus used correlation and production function studies of export-led growth (ELG), while more recent studies make use of causality and cointegration techniques. Correlation studies have shown that there is a positive correlation between export expansion and economic growth. Other researchers applied Feder-type models by including exports in a production function framework and they showed the rate of growth in exports, added to labour force and investment growth resulted in GDP growth, i.e. ELG. Finally, there were other studies which included intermediate and capital imports into the analysis and some of them showed that there is a positive correlation between trade expansion and GDP growth.

Finally, a selective summary of causality and cointegration studies of the relationship between exports, imports and GDP growth was discussed. Some economists argued that export expansion is a consequence, rather than the cause, of economic growth and instead of using typical production function models, they preformed causality tests to examine the relationship. The results were mixed: some found ELG, some found GLE and some found bi-directional causality between exports and economic growth. Other empirical studies re-examined the question by using cointegration and error correction models. It is argued that by taking into account the long run information, the results from cointegration and error correction models are more statistically valid. Hence, the present study follows these more recent approaches in order to examine the relationship between exports and economic growth in Iran, by considering the recent empirical findings on the trade-GDP nexus in the context of endogenous growth models, showing that economic growth is determining by endogenous growth factors such as physical capital (R&D effects), human capital (representing knowledge spillover effects), export expansion (proxying positive externality effects), and capital and intermediate imports (capturing learning-by-doing effects). In this research all of these determinants of economic growth are considered by including physical and human capital, as well as imports and exports in the model.

Table 4.1: Summary of the Correlations and Production Function Studies on the Relationship Between Exports and Economic Growth

Please see print copy for Table 4.1

Table 4.2: Summary of Causality and Cointegration Studies Relating to the Exports and Economic Growth Relationship

Please see print copy for Table 4.2

Table 4.3: Summary Of The Empirical Studies Relating Exports and Economic Growth in Oil-Exporting Countries and Iran

Please see print copy for Table 4.3

CHAPTER 5

THEORETICAL FRAMEWORK AND ECONOMETRIC METHODOLOGY*

5.1. Introduction

As mentioned in the literature review, one of the most common approaches to the export-growth relationship is to use the neoclassical production function model. The growth theory demonstrates the importance of export expansion in promoting productivity growth (Sharma and Dhakal, 1994). It can even improve productivity in non-export sectors through its positive externality effects. Using a simple neo-classical model, Feder (1983) showed that there is a productivity differential in favour of the export sector.

Feder identified that export-lead growth (ELG) happens in two ways: through positive externalities from the export sector to the rest of the economy and through its greater efficiency leading to a factor productivity differential in favor of the export sector. Therefore a larger allocation of resources in the export sector contributes to higher GDP growth.

Following Feder, Salehi-Esfahani (1991) specified a model emphasizing the role of exports as a main source of the foreign exchange for the importation of intermediate and capital goods. In the following section a modified version of Feder/Salehi's framework is used to develop a model for identifying the relationship between trade (exports and imports) on the one hand, and the growth of the Iranian GDP on the other. Our approach differs, however, from Feder and Salehi-Esfahani's models because they examine semi-industrialized countries and cross-sectional data, but we are using this framework for an oil-based economy.

5.2. Model Specification in the Present Study

As mentioned in the literature review, recent empirical studies take a production function form in which exports enter into the model in addition to labour and capital inputs. It is argued that export expansion might generate positive externality to the rest

* A modified version of this chapter has already been published in the *International Journal of Applied Econometrics and Quantitative Studies*, (2005), 2 (4).

of the economy through more efficient allocation of resources, efficient management and improved production techniques, specialization, competition and the economy of scale (Balassa, 1985; Ghatak *et al*. 1997).

Moreover as Salehi-Esfahani (1991) noted that export expansion may also affect aggregate output by relaxing the foreign exchange constraint for importation of intermediate and capital goods. Most of the empirical studies conducted within the production function framework ignore the role of exports as the main source of foreign exchange for intermediate and capital imports.

Drawing upon the existing literature on the trade-growth nexus and following Feder (1983), Ram (1987), Lucas (1988), Salehi-Esfahani (1991), Sengupta (1993), Ghatak *et al.* (1997) and Van Den Berg (1997), we consider the following extended Feder type models in order to identify a long-run relationship between trade and economic growth in an oil-based economy. These models are basically a production function augmented by trade and human capital.

Feder develops a model to show exports exert their positive externalities on the rest of the economy. These externalities are incorporated in the two sector general equilibrium. Following Feder and Salehi-Esfahani models, it is assumed that the economy consists of two sectors:

$$Y = Y_D + Y_X \qquad 5.1$$

Equation 5.1 shows the total output of each economy is produced through both the production of goods for domestic use, Y_D , and production of goods for export, Y_X.
These two sub-sectors have different production functions:

$$Y_D = F[K_D, L_D, M_D, Y_X] \qquad 5.2$$

$$Y_x = G[K_x, L_x, M_x] \qquad 5.3$$

Where Y_d and Y_x are output of non-export sector and production of the export sector, respectively. F and G are their respective production functions. In equation 5.2 it is assumed that there is a positive externality from the export sector to the non-export sector.

As in the Feder model, output in both sectors is produced with the labour (*L*) and capital (*K*) factors allocated to each sector. In addition, adopting an endogenous growth model we include intermediate imports (M) as a new factor in equations 5.2 and 5.3. It is argued that intermediate and capital imports, are also important to carry on the production process in developing countries. As mentioned above, imports have been neglected in most studies of the relationship between exports and economic growth. However, endogenous growth models also address the role of imports in the model. Endogenous growth theories emphasize the fact that imports work as a conduit of knowledge spillover from advanced economies. In turn, this knowledge spillover enables the economy to achieve increasing returns (Sengupta, 1993).

Therefore in this study to capture the effects of capital and intermediate imports in the growth process of developing countries like Iran, the imports factor is also included in the production function.

Following Feder and others (above mentioned), we also assumed that the export sector of the economy generates an externality effect on the production sector for domestic use. According to Feder (1982), Salehi-Esfahani (1991), and Ghatak *et al.* (1997), the level of production for domestic use depends also on the volume of the exports, due to the positive external effects stemming from the export sector such as: competitive environment; improved production technique; better quality management and workers; and continuous flow of the imported inputs.

The externality effect of the export sector on production for domestic use is approximated by including exports as a factor in equation 5.2. This equation shows that output for domestic use Y_D is a function of capital K_D, labour forces L_D, intermediate and capital imports M_D (imported inputs allocated into the production of Y_D) and total exports Y_X. Equation 5.3 also indicates that the export sector Y_X is a function of capital K_X, labour force L_X and capital and intermediate imports M_X, which are necessary for the production in the export sector. A total differentiating of equations 5.1 to 5.3 yields:

$$\dot{Y} = \dot{Y}_D + \dot{Y}_X \tag{5.4}$$

$$\dot{Y}_D = F_K.\dot{K}_D + F_L.\dot{L}_D + F_M\dot{M}_D + F_X.\dot{Y}_X \tag{5.5}$$

$$\dot{Y}_X = G_K.\dot{K}_X + G_L.\dot{L}_X + G_M.\dot{M}_X \tag{5.6}$$

where the dot above each variable indicates the corresponding rate of change in that variable. The Fx term in equation 5.5 represents the marginal externality effect of the export sector on the output of the non-export sector (Y_D). By substituting 5.5 and 5.6 into 5.4 we obtain:

$$\dot{Y} = F_K.\dot{K}_D + F_L.\dot{L}_D + F_M.\dot{M}_D + F_X.\dot{X}_X + G_K.\dot{K}_X + G_L.\dot{L}_X + G_M.\dot{M}_X \qquad 5.7$$

It is also important to note that Feder assumes that the ratio of the marginal factor productivities presented below in equation 5.8 in the export and non-export sectors differs by the amount δ. It is argued that because the export sector is more efficient, a factor productivity differential exists in favor of the exports sector. In other words, the factor productivity in the export sector is higher (by a fraction of δ) due to the more competitive environment, induced innovation and better quality management of resources, more qualified workers in the export sector and so on. Following Feder/ Salehi-Esfahani the concept of productivity differential is formulized in the following equation*:*

$$\frac{G_K}{F_K} = \frac{G_L}{F_L} = \frac{G_M}{F_M} = 1 + \delta \qquad 5.8$$

In equation 5.8 capital letter subscripts denote partial derivatives and δ is a parameter that measures the difference in the marginal factor productivities of inputs in the two sectors. It is assumed that δ is positive and significantly different from zero. In this equation G_L and F_L are the marginal productivities of labour force in the two sectors. F_k and G_K are the corresponding marginal productivities of capital in these two sectors. It should be noted that if there is no limitation on the mobilization of input factors between the two sectors, δ will be equal to zero. Using equation 5.8 in equation 5.7 yields:

$$\dot{Y} = F_K.\dot{K}_D + F_L.\dot{L}_D + F_M.\dot{M}_D + F_X.\dot{X}_X + (1+\delta)F_K.\dot{K}_X + (1+\delta)F_L.\dot{L}_X + (1+\delta)F_M.\dot{M}_X \qquad 5.9$$

After rearranging we have:

$$\dot{Y} = F_K[\dot{K}_D + \dot{K}_X] + F_L[\dot{L}_D + \dot{L}_X] + F_M[\dot{M}_D + \dot{M}_X] + F_X.\dot{X}_X + \delta[F_K.\dot{K}_X + F_L.\dot{L}_X + F_M.\dot{M}_X] \qquad 5.10$$

After expressing equation 5.8 in terms of *Gs* and substituting them into $[F_K.\dot{K}_X + F_L.\dot{L}_X + F_M.\dot{M}_X]$ the result will be:

$$F_K.\dot{K}_X + F_L.\dot{L}_X + F_M.\dot{M}_X = \frac{G_K}{1+\delta}\dot{K}_X + \frac{G_L}{1+\delta}\dot{L}_X + \frac{G_M}{1+\delta}\dot{M}_X \qquad 5.11$$

Given $\dot{Y}_X = G_K.\dot{K}_X + G_L.\dot{L}_X + G_M.\dot{M}_X$ [from equation 5.6], one can write the following equation:

$$F_K.\dot{K}_X + F_L.\dot{L}_X + F_M.\dot{M}_X = \frac{1}{1+\delta}\dot{Y}_X \qquad 5.12$$

Let us now assume that all factors are fully employed and so total capital stock and change in total labour force can be written as: $\dot{K}_D + \dot{K}_X = \dot{K}, \dot{L}_D + \dot{L}_X = \dot{L}$, $\dot{M}_D + \dot{M}_X = \dot{M}$. Moreover, as it can be seen, the right hand side of the equation 5.12 is the last term in equation 5.10, therefore after substituting equation 5.12 into equation 5.10 one can obtain:

$$\dot{Y} = F_K.\dot{K} + F_L.\dot{L} + F_M.\dot{M} + [F_X + \frac{\delta}{1+\delta}]\dot{Y}_X \qquad 5.13$$

In the above equation, the inclusion of intermediate goods into the production function is not considered, also the marginal productivities are equalized across the sectors (δ=0) and finally if there are no inter-sectoral externalities (Fx=0), then equation 5.13 reduces to the familiar neoclassical sources of growth model.

In the above equation 5.13, let the marginal productivity of capital F_K be α; the growth rate of the labour force F_L be β; the growth rate of intermediate imports F_M be γ and the last term of the above equation $[F_X + \frac{\delta}{1+\delta}]$ be θ (representing the combination of the externality effects *(* F_X *)* and productivity differential *(* $\delta/1+\delta$ *),* then the following equation can be written:

$$\dot{Y} = \alpha.\dot{K} + \beta\dot{L} + \gamma\dot{M} + \theta\dot{Y}_X \qquad 5.14$$

This is similar to the neoclassical formulation of the sources of economic growth. In fact, this production function includes exports and imports as a kind of inputs exerting externality effects through international knowledge spillover etc.

In equation 5.14, the first three terms on the right–hand side show the sources of total output growth in the economy as a result of the growth of various inputs. Moreover, increasing the growth rate of exports leads to increases in the growth rate of the total real output. This means that the higher the ratio of exports to total output, the greater the productivity of the export sector as compared to the non-export sector of the economy. In fact, the fourth term, represents the sum of the marginal externality effect and inter-sectoral relative factor productivity differential effect of the export sector on the rate of total output growth. This can be interpreted as the gains brought about by shifting factors from a low productivity non-export sector to a high productivity export sector.

Equation 5.14 in the literature has been used to analyse the relationship between the growth of GDP, physical capital, labour, intermediate imports and exports. In fact, many empirical studies including Ram (1987), Salehi-Esfahani (1991), Sengupta (1993), Van den Berg (1996; 1997) and Ibrahim and MacPhee (2003) have directly adopted the Feder type model with some modifications. In order to analyse the broad externality effects of the trade on economic growth endogenous growth theories address the role of human capital as well. The inclusion of human capital (along with physical capital *et al.*) as one of the inputs for the production sector and a major source of innovation in the R & D sector is one of the most important characteristics of endogenous growth models (Lucas, 1988; Romer, 1990; Coe and Helpman, 1995).

As mentioned above, in Feder model, GDP is considered to be simply a function of ordinary labour force together with the other relevant factors. In the Iranian economy, however, due to the low productivity of the labour force and its surplus in the economy, we follow the human capital model of endogenous growth theory (Lucas, 1988; Romer, 1990) and consider instead, human capital (the number of employed workforce with a university degree) rather than the total labour force. Mankiw *et al*, (1992) argue that the empirical estimation of the model yields better results by including human capital in the model. Because it shows that by adding human capital the accumulation of physical capital has larger impact on per capita income. Therefore, by including human capital into the model, we use the following modified Feder model in logarithm form to examine the trade-growth nexus in Iran:

$$Ln(y_t) = \beta_0 + \beta_1 Ln(k_t) + \beta_2 Ln(hc_t) + \beta_3 Ln(xo_t) + \beta_4 Ln(xno_t) + \beta_5 Ln(m_t) + e_t \qquad 5.15$$

In equation (5.15), y denotes real GDP, k is gross capital formation, m is total real imports and hc is human capital, (as represented in this research by the number of employed persons with a tertiary education). In this equation, the possible effects of exports on economic growth have been disaggregated into oil (xo) and non-oil (xno) exports. As outlined in Chapter 3, the non-oil export promotion policy is one of the most important policies introduced in Iran, after it faced huge fluctuations in oil market prices. The role of non-oil exports in Iran's economy can be analysed within the framework of a straightforward production function that, like Feder type model treats exports as a production input. This model includes exports in the typical production function used in most empirical studies on the sources of growth. Several researchers including Ram (1987), Salehi-Esfahani (1991), Sengupta (1993), Greenaway and Spasford (1994), Van Den Berg (1996) and, Ibrahim and MacPhee (2003) have followed the Feder methodology with some modifications. The present research follows the same models and empirical methodologies, but with some modifications due to the nature of the Iranian economy.

Since this research is devoted to determining the relationship between exports (oil and non-oil) and economic growth within the context of a specific oil-based country over a given period of time (1960-2003), a time series framework will be applied. Several statistical tests and econometric methodologies are considered before estimating the above-specified model. The results of several pre-testing procedures are considered before the specification of models and the estimation of the parameters of the final model. In fact, this study applies a production function model as well as cointegration techniques. When working with time series, attention must be given to non-stationarity of data by applying unit root tests.

The econometric tools which will be used in this dissertation include: conventional unit root tests (ADF and PP) without considering the existence of potential structural breaks; the Perron (1997) Innovational Outlier (IO) and Additive Outlier (AO) models, the Zivot-Andrews (1992) approach and the Lumsdaine-Papell (1997) model (all unit root tests in the presence of potential structural breaks). Then, after determining endogenously the times of the breaks, we will examine the existence of the long-run relationship between GDP and its determinants by applying cointegration techniques, therefore the Johansen cointegration technique as well as newer versions like Gregory-Hansen's (1996) and Saikanon-Lutkephol's (2000) cointegration techniques (in the presence of endogenously determined structural breaks) are applied; and finally the error correction model (ECM) version of the autoregressive lag distributed model (ARDL) is applied in order to identify the long-term and short-term determinants of economic growth.

5.3. Summary and Concluding Remarks

Using a production function framework, the externality effects of exports on GDP were described. Based on the Feder model, exports exert their externalities on the non-export sectors as well as on the economy as a whole. It is argued that export expansion might generate positive externality through more efficient allocation of resources, efficient management, improved production techniques, greater specialization and competition and finally through the economy of scale.

By considering recent empirical findings on the trade-GDP nexus in the context of endogenous growth models, it can be seen that economic growth is determined by endogenous growth factors such as physical capital (R&D effects), human capital (representing knowledge spillover effects), export expansion (proxying positive externality effects), and capital and intermediate imports (capturing learning-by-doing effects). In this research all of these determinants of economic growth have been considered by including physical and human capital, imports and exports within a production function framework.

CHAPTER 6

AN EMPIRICAL INVESTIGATION OF THE STRUCTURAL BREAKS AND STATIONARITY IN IRANIAN MACROECONOMIC TIME SERIES*

6.1. Introduction

Before doing any cointegration or Granger causality analysis, it is necessary to check the stationarity of the data. In other words, because the majority of the macroeconomic variables are non-stationary, testing for unit root is needed as a first step. Therefore, it is prudent to begin any time–series work by first checking the variables for trends, and this is known as a unit root test. As mentioned in Chapters 2 and 3 of this research, the Iranian economy has been subjected to numerous shocks and regime shifts such as the 1974-75 oil shock, the upheavals following the 1979 Islamic Revolution, the destructive eight-year (1980-1988) war with Iraq, the freezing of the country's foreign assets, the volatile international oil market, as well as economic sanctions and international economic isolation. In other words, almost every year there has been some radical policy changes and/or external shocks to the economy resulting in the occurrence of a multitude of structural breaks in macroeconomic variables.

Leybourne and Newbold (2003) argue that if structural breaks are not dealt with appropriately, the empirical results obtained from the use of cointegration techniques could be spurious and misleading. In the context of Iran, only a few studies have considered the issue of structural breaks in the data. For example, Bahmani-Oskooee (1993) examined the presence of a structural break in the black market exchange rate and relative prices associated with the 1979 revolution. Bahmani-Oskooee (1993) assumed, quite logically, that the structural break occurred in 1979. In fact, however, the exact time of structural breaks cannot be deduced from logic as events may have both immediate as well as gradual effects and their timing is of paramount importance in any empirical analysis. More importantly, applying conventional unit root tests alone is insufficient and problematic since it is highly likely that there could be significant structural breaks in the time series data.

* Modified versions of this chapter have already been published in the *International Journal of Applied Econometrics and Quantitative Studies*, (2005) 2(3-4) and *Applied Financial Economics Letters*, (2005) 1 (3).

Therefore, in this research and as a matter of comparison, we use two different testing procedures. First we test for nonstationarity by applying conventional unit root tests (ADF and PP) without considering the existence of potential structural breaks. Then we test for unit root in the presence of potential structural breaks by applying different approaches in order to examine the stationarity of the data with unknown and data-determined structural breaks without imposing predetermined dates for these breaks.

The structure of the rest of this chapter is as follows: Section 6.2 briefly discusses conventional unit root tests (which do not take into consideration the potential existence of structural breaks) and presents empirical results based on the Augmented Dickey–Fuller (ADF) and Phillips-Perron (PP) tests. Section 6.3 explains new testing procedures which do take into account the presence of potential structural breaks. Section 6.3.1 applies one of these new procedures, the Zivot and Andrews (ZA, 1992) method, to test the unit root hypothesis assuming the existence of one major unknown structural break. Sections 6.3.2 briefly discuss the theoretical underpinnings of the Perron (1997) Innovational Outlier (IO) and Additive Outlier (AO) models, which are two other new testing procedures. The empirical findings based on these methodologies are then presented. Section 6.4 looks at the case of multiple potential structural breaks by applying Lumsdaine and Papell's (1997) recursive, rolling or sequential approach.. Section 6.5 presents some concluding remarks.

6.2. Unit Root Tests without Structural Breaks

According to the empirical literature, the standard and well accepted method of detecting nonstationary behavior is to examine the tests for the presence of unit roots using the Augmented Dickey–Fuller (ADF) test (Dickey and Fuller (1979, 1981). In order to investigate the stationary properties of the data based on the ADF test, an analysis of each variable is done using a unit root test based on the following equation:

$$\Delta y_t = \mu + \beta t + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t \tag{6.1}$$

Where y_t is the time series being tested, t is a time trend variable, Δ denotes the first difference operator, and k is the number of lags which are added to the model to ensure that residuals, ε_t, are white noise. The Schwartz Bayesian Criterion (SBC) and Akaike Information Criterion (AIC) are used to determine the optimal lag length or k.

The ADF test is principally concerned with the estimate of α in the above equation, i.e., we test the hypothesis $H_0: \alpha=0$. The rejection of the null hypothesis in favor of the alternative hypothesis implies that y_t is stationary and integrated of order zero, that is *I(0).* If the null hypothesis of unit root for the first difference is rejected, the first difference is stationary and the variable is integrated of order one.

In order to identify the stationarity of the variables under study in this research, we start by applying the ADF test. The null hypothesis of a unit root is rejected if the value of the t-statistic for α (in absolute value) is greater than the critical value. From the results in Table 6.1, we find that the null hypothesis of a unit root cannot be rejected for any of the series at the 5 or 10 percent level. Since the ADF test is known to be a low power test that is biased towards not rejecting the unit root (especially with short time spans of the data), we then run a Phillips-Perron (PP, 1988) test as well. However, from Table 6.1, the results of the PP test also display strong evidence of unit root for the all variables under study. Furthermore, using the standard ADF and PP tests, the null hypothesis of unit root is tested against the alternative hypothesis of stationarity for the first difference of the data as well. The empirical results in Table 6.1 show quite the opposite result after the first differentiating of the data where all of the variables under study become stationary and this means that all of these variables are *I(1)* in log level and I(0) after the first differencing.

In sum, as it can be seen from the Table 6.1, the results of conventional ADF and PP tests (with constant and trend) up to a maximum of 5 truncation lags are shown that, all variables under investigation in log level are non-stationary (containing one unit root) for the sample period. Without considering the break points, an informal inspection of the graphs of these variables may also support the view that the series are not stationary. However, and as discussed earlier, applying the ADF and PP unit root tests may be biased towards non-rejection of the unit root hypothesis.

Table 6.1: ADF and Phillips-Perron Unit Root Test Results

Please see print copy for Table 6.1

Since macroeconomic variables in Iran could be subject to several structural breaks or regime shifts, the ADF test is considered biased towards not rejecting the unit root (especially with short time spans of data). As we mentioned earlier, since 1970s, Iran has undergone important structural changes in its political and economic institutions and has been affected by significant internal and external economic and political shocks such as the 1979 revolution, war with Iraq, and oil price fluctuations.

Therefore, it is interesting to see how the unit root results can be affected if we allow for the existence of the structural breaks in the data. In the next section, we will investigate whether or not these results are reversed or robust when a structural change is included in the model. For this purpose we use both Zivot-Andrews (1992) and Perron (1997) Innovational and Additive outlier (IO, and AO) models to make robust conclusion about the time series property of the data for the series under investigation.

6.3. Unit Root Test in the Presence of Structural Change

The issue of structural change is of considerable importance in the analysis of macroeconomic time series. Structural changes occur in many time series for any number of reasons, including economic crises, changes in institutional arrangements, policy changes and regime shifts. An associated problem is that of testing the null hypothesis of structural stability against the alternative of a one or two-time structural break. Most importantly, if such structural changes are present in the data generating process, but not allowed for in the specification of an econometric model, results may be biased towards the erroneous non-rejection of the non-stationarity hypothesis (Perron, 1989; Perron, 1997; Leybourne and Newbold, 2003). The economic content of such a result is to incorrectly conclude that the series under investigation has a stochastic trend. This in turn implies that any shock – whether demand, supply, or policy-induced – to the variable will have effects on the variable into the very long run. It is therefore very important to allow for the presence of potential structural break in the data so as to more reliably conduct the test of non-stationarity.

Perron (1989) introduced a way to determine the existence of a structural break in a series, which appears to be non-stationary. Perron's procedure enables the use of the complete sample period at one time, rather than considering this period in two sub-samples. The null hypothesis in Perron's methodology is the presence of a unit root against the alternative, i.e. that the series is trending stationary. Perron showed theoretically that if the data generating process has "a kink or jump" in the deterministic trend, a unit root test which did not consider this as a possibility, tended towards a bias for accepting the null hypothesis of unit root. He presented evidence that most economic time-series are trend stationary if one allows a single change in the intercept. He found that many of the variables that had previously been judged as non-stationary were actually stationary. Perron (1989) showed that the standard test of the unit root hypothesis against trend stationary alternatives could not reject the null hypothesis of unit root. He derived the test statistics that enabled distinguishing the two hypotheses when a break is present. In sum, Perron developed three models allowing for one-time change either in the level or in the slope of the trend function, or a one-time change in both trend and slope, and then calculated critical values for unit root under each of the three different data-generating processes.

Based on Perron (1989), the following equations are estimated to test for a unit root, which takes into account the existence of three kinds of structural breaks: a “crash” model (6.2), which allows for a break in the level (or intercept) of the series; a “changing growth” model (6.3), that allows for a one-time break in the slope (or the rate of growth); and a combination of both, which allows for one time change in both the level and the slope of the series (6.4):

$$x_t = \alpha_0 + \alpha_1 DU_t + d(DTB)_t + \beta t + \rho x_{t-1} + \sum_{i=1}^{p} \theta_i \Delta x_{t-i} + e_t \tag{6.2}$$

$$x_t = \alpha_0 + \gamma DT_t * + \beta t + \rho x_{t-1} + \sum_{i=1}^{p} \theta_i \Delta x_{t-i} + e_t \tag{6.3}$$

$$x_t = \alpha_0 + \alpha_1 DU_t + d(DTB)_t + \gamma DT_t + \beta t + \rho x_{t-1} + \sum_{i=1}^{p} \theta_i \Delta x_{t-i} + e_t \tag{6.4}$$

Where the intercept dummy DU_t represents a change in the level; $DU_t = 1$ if (t > Tb), and zero otherwise; the slope dummy DT_t (also DT_t *) represents a change in the slope of the trend function; $DT_t * = t - TB$ (or DT_t *=t if t > TB) and zero otherwise; the crash dummy $(DTB)_t$=1 if t = TB+1, and zero otherwise.

If it is assumed that there is only a change in the level or intercept, equation (6.2) is applied for empirical studies; while if the slope of the trend function changes without any change in the level, equation (6.3) is appropriate; and finally, when there is a reason to believe that both changes in intercept and slope occur, equation (6.4) is applied in the estimation procedure. As can be seen from the above equations, the test statistics are the natural extension of the Dickey-Fuller (1981) test, i.e., the t statistic on the OLS estimation of ρ in the above equations.

It should be noted that in Perron (1989) procedure dating of the potential break is assumed to be known *a priori* in accordance with the underlying asymptotic distribution theory. Test statistics are then constructed by adding dummy variables representing different intercepts and slopes, thereby extending the standard Dickey-Fuller procedure.

However, this standard approach has been criticized, most notably by Christiano (1992), who has argued that data-based procedures are typically used to determine the most likely location of a break and this approach invalidates the distribution theory underlying conventional testing.

In response, a number of studies have developed different methodologies for endogenising dates, including Zivot and Andrews (ZA, 1992), Perron and Vogelsang (1992), Perron (1997), Lumsdaine and Papell (1997) and Bai and Perron (2003). These study have shown that by endogenously determining the time of structural breaks, bias in the usual unit root tests can be reduced.

According to Zivot and Andrews (1992), using the endogenously determined structural breaks may lead to the rejection or at least the weakening of the unit root hypothesis in some cases**.** Overall, ZA assume that the time of the structural break is unknown and must be established endogenously, argue that Peron (1989), who normally assumes that the time is a known event, over-estimates the evidence against the unit root hypothesis when the time of a structural break is unknown. Zivot and Andrews, like Perron, consider structural breaks of three alternative forms: a change in the intercept, a change in trend or both. Their model is robust with respect to the presence of a shift or broken trends in the time series. In addition, their model has the advantage of treating the break points as endogenous. However, Zivot and Andrews (1992) argued that identifying a potential structural break does not necessarily provide proof that such a break exists. In fact, it simply implies that this is the most likely position for one, if, indeed, one exists.

The purpose of this research is to employ the ZA (1992) test as well as IO and AO (Perron, 1997) models to examine for the existence of the structural breaks and testing for the stationarity of the Iranian macroeconomic data in the presence of structural breaks. The detection of structural breaks within these time series data will present clear evidence of the impact of this important change in the Iranian economy. This analysis also sheds some light on whether a particular break has an immediate or gradual effect on the series. For example if the results show that X has been subject to a structural break in 1975 and we also know that for sure that the oil shock occurred say in 1974, then one can conclude that X was affected gradually by this structural break. However, if the time of the break, according to the above tests, happened to be 1974 (*i.e.* the same as actual shock), then one can support the immediate effect argument. For this purpose in the following section this study use both Zivot-Andrews (1992) and Perron (1997) Innovational and

Additive outlier (IO, and AO) models to make robust conclusion about the time series property of the data for the series under investigation.

6.3.1. Zivot and Andrews Unit Root Test with One Structural Break

Zivot and Andrews (ZA, 1992) propose a variation of Perron's (1989) original test in which the time of the break is estimated, rather than assumed as an exogenous phenomenon. The null hypothesis in their method is that the variable under investigation contains a unit-root with a drift that excludes any structural break, while the alternative hypothesis is that the series is a trend stationary process with a one-time break occurring at an unknown point in time. In this methodology, a regression is run for every possible break date sequentially from the year after the starting date until the year before the last observation. By endogenously determining the time of structural breaks, ZA argue that the results of the unit root hypothesis previously suggested by earlier conventional tests such as the ADF test may be changed.

Their test is different from the usual unit root tests with respect to the treatment of the alternative hypothesis. The alternative hypothesis considered in the ZA method is more general and allows for shifts in the level or the growth rate of the series. In this methodology, *TB* (the time of break) is chosen to minimize the one-sided *t*-statistic of α=1. In other words, a break point is selected which is the least favorable to the null hypothesis. The ZA(1992) model endogenises one structural break in a series (such as y_t) as follows:

H0: $$y_t = \mu + y_{t-1} + e_t \tag{6.5}$$

H1:

Model A $$y_t = \hat{\mu}^A + \hat{\theta}^A DU_t(\hat{T}_b) + \hat{\beta}^A t + \hat{\alpha}^A y_{t-1} + \sum_{j=1}^{k} \hat{c}_j^A \Delta y_{t-j} + \hat{e}_t \tag{6.6}$$

Model B $$y_t = \hat{\mu}^B + \hat{\beta}^B t + \hat{\gamma}^B DT_t(\hat{T}_b) + \hat{\alpha}^B y_{t-1} + \sum_{j=1}^{k} \hat{c}_j^B \Delta y_{t-j} + \hat{e}_t \tag{6.7}$$

Model C $$y_t = \hat{\mu}^C + \hat{\theta}^C DU_t(\hat{T}_b) + \hat{\beta}^C t + \hat{\gamma}^C DT_t(\hat{T}_b) + \hat{\alpha}^C y_{t-1} + \sum_{j=1}^{k} \hat{c}_j^C \Delta y_{t-j} + \hat{e}_t \tag{6.8}$$

As can be seen, Model A allows for a one-time change in the intercept. Model B is used to test for stationarity of the series around a broken trend and finally Model C accommodates the possibility of a change in the intercept as well as a broken trend.

Model C is the least restrictive compared to the other two models; we thus base our empirical investigation on this model.

In the above equations *DUt* is a sustained dummy variable capturing a shift in the intercept, and DT_t is another dummy variable representing a shift in the trend occurring at time *TB*. The alternative hypothesis is that the series, y_t, is I(0) with one structural break. *TB* is the break date, and :

$$DU_t = \begin{cases} 1 \text{ if } t > TB \\ 0 \text{ if } t \leq TB \end{cases} \quad \text{and} \quad DT_t = \begin{cases} t - TB \text{ if } t > TB \\ 0 \text{ if } t \leq TB \end{cases}$$

The null is rejected if the α coefficient is statistically significant. The "trimming region" where we search for the minimum t-ration is assumed to within 0.05T-0.95T or $0.05T \leq TB \leq 0.95T$. In other words, according to the ZA test *TB* is endogenously estimated by running the above three equations (models A, B and C) sequentially allowing for *TB* to be any time within the above mentioned trimming region. The optimal lag length is determined on the basis of the SBC, AIC or the most significant *t* ratio known as the general to specific approach. In this research, the optimal lag length is determined on the basis of the t-test which is referred to as the 'general to specific' approach in the literature.

6.3.1.1 . Empirical Results Based on the Zivot and Andrews Unit Root Test

Table 6.2 summarizes the results of the ZA test in the presence of one structural break allowing for a change in both the intercept and trend (model C). The results obtained from the ZA model reveal that all variables examined contain unit root despite capturing one endogenously determined break in the data. This is also consistent with the results obtained by the conventional unit roots tests (ADF, and PP tests).

The estimated coefficients for equation (6.8) together with the corresponding *TBs* for each of the variables are presented in Table 6.2. Empirical results show that, (a) the estimated coefficients for μ and θ are all statistically significant, supporting the view that at least one structural shift in the intercept has occurred during the sample period for all variables; (b) the trend variable is significant in all cases indicating that all series exhibit an upward or downward trend; (c) the estimated coefficients for γ are statistically significant for all variables except *Ln (X)* and *Ln (Xno)* implying that with these two exceptions at least one significant structural shift in the trend has occurred in the variables under investigation.

Table 6.2: The Zivot-Andrews Test Results: Break in Both Intercept and Trend (model C) $y_t = \hat{\mu}^C + \hat{\theta}^C DU_t(\hat{T}_b) + \hat{\beta}^C t + \hat{\gamma}^C DT_t(\hat{T}_b) + \hat{\alpha}^C y_{t-1} + \sum_{j=1}^{k} \hat{c}_j^C \Delta y_{t-j} + \hat{e}_t$

Please see print copy for Table 6.2

The timing of any structural break (T_b) for each series using the ZA approach is also shown in Table 6.2. The computed break dates correspond closely with the expected dates associated with the effects of the oil boom in 1974, the Islamic revolution in 1978/9 and the gradual effects of the Iran-Iraq war beginning in 1980.

Given the fact that all of the estimated coefficients for the indicator and trend dummy variables are statistically significant (in six out of eight series for both intercept and trend and in the other remaining two series only for the intercept), one can argue that the estimated structural break dates are indeed statistically significant. Figure 6.1

shows the plots of the estimated $\hat{t}_\alpha$ within the trimming region using the ZA procedure. The lowest value for $\hat{t}_\alpha$ in each graph determines TBs.

Figure 6.1
Plots of the estimated timing of structural breaks by ZA procedure allowing for a break in both intercept and trend (model C)

Please see print copy for Figure 6.1

Please see print copy for Figure 6.1

As it is clear from the above graphs, most significant structural break in these variables coincided with the Islamic revolution of 1978/9, which led to the overthrow of the Shah and the House of Pahlavi. See *TBs* for *Ln (X)*, *Ln (XO)*, *Ln (K)*, and *Ln (OS)*. The ZA test also provides empirical support that the break in GDP *(Ln (Y)* takes effect in the middle of the Iraqi war due to the huge damage of the war in the economy. It also appears that the 1974-1975 oil shock created a major structural break in *Ln (Yno)* and *Ln (IM)*. This oil boom in Iran (or an oil shock in the western countries) resulted in quadrupling petrodollars, which in turn led to a sharp increase in the imports of goods and services.

As we have seen, test statistics proposed by Perron and Vogelsang (1992) and Perron (1997), identifies two types of structural break. These are: the Additive Outlier (AO) model, which is applied to series with a sudden change in the mean (the crash model), and the Innovational Outlier (IO) model, which identifies more gradual changes. Perron (1997: 356), for example, argues that "…if one can still reject the unit-root hypothesis under such a scenario it must be the case it would be rejected under a less stringent assumption". It should be noted that Perron and Vogelsang (1992) applied these two models for non-trending data, while Perron (1997) modifies them for use with trending data. As a matter of comparison with our findings, (based on the ZA (1992) model) as well as to identify both sudden and gradual effects of potential structural breaks on the stationarity of the data, in the following section we follow the Perron (1997) model and then we apply the Innovational Outlier and Additive Outlier models.

6.3.2. Innovational Outlier (IO) and Additive Outlier (AO) Models

According to Perron (1994; 1997), the IO1 model allows for gradual changes in the intercept and the IO2 model accommodates gradual changes in both the intercept and the slope of the trend function, such that:

$$\text{IO1: } x_t = \mu + \theta DU_t + \beta t + \delta D(T_b)_t + \alpha x_{t-1} + \sum_{i=1}^{K} c_i \Delta x_{t-i} + e_t \tag{6.9}$$

$$\text{IO2: } x_t = \mu + \theta DU_t + \beta t + \gamma DT_t + \delta D(T_b)_t + \alpha x_{t-1} + \sum_{i=1}^{K} c_i \Delta x_{t-i} + e_t \tag{6.10}$$

where T_b denotes the time of break ($1<T_b<T$) which is unknown, $DU_t=1$ if $t > T_b$ and zero otherwise, $DT_t= T_t$ if $t > T_b$ and zero elsewhere, $D(T_b)_t=1$ if $t=Tb+1$ and zero otherwise, x_t is any general ARMA process and e_t is the residual term assumed white noise. The null hypothesis of a unit root is rejected if the absolute value of the *t*-statistic for testing $\alpha=1$ is greater than the corresponding critical value. Perron (1997) suggests that T_b (the time of structural break) can be determined by two methods. In the first approach, equations (6.9) or (6.10) are sequentially estimated assuming different T_b with T_b chosen to minimize the *t*-ratio for $\alpha=1$. In the second approach, T_b is chosen from among all other possible break point values to minimize the *t*-ratio on the estimated slope coefficient (γ).

The truncation lag parameter or k is determined using the data-dependent method proposed by Ng and Perron (1995) and Perron (1997). In this method the choice of k depends upon whether the *t*-ratio on the coefficient associated with the last lag in the estimated autoregression is significant. The optimum k (or k^*) is selected such that the coefficient on the last lag in an autoregression of order k^* is significant and that the last coefficient in an autoregression of order greater than k* is insignificant, up to a maximum order k (Perron, 1997 and LP, 1997).

In contrast to the gradual change in the IO model, the AO model assumes structural changes take place instantaneously. Testing for a unit root in the AO framework is then given by a two-step procedure (Perron, 1994). To start with, the trend is removed from the series:

$$y_t = \mu + \beta t + \gamma DT_t^* + \tilde{y}_t \tag{6.11}$$

where $\tilde{y}_t$ is the detrended series. Since equation (6.11) assumes that a structural break only impacts on the slope coefficient, the following is then estimated to test for a change in the slope coefficient:

$$\tilde{y}_t = \alpha \tilde{y}_{t-1} + \sum_{i=1}^{K} c_i \Delta y_{t-i} + e_t \tag{6.12}$$

Similarly to the IO methodology, these equations are estimated sequentially for all possible values of T_b ($T_b = k + 2,\ldots,T-1$) where T is the total number of observations so as to minimise the *t*-statistic for $\alpha=1$. The lag length is data-determined using the general to specific proposed by Ng and Perron (1995), and the break date is assumed to be unknown and endogenously determined by the data. The null hypothesis is rejected if the *t*-statistic for α is larger in absolute value than the corresponding critical value. An alternative, which is more widely used is to select T_b as the value, over all possible break dates, that minimizes (or maximizes) the value of the *t*-statistic on $\gamma=0$ (Harris and Sollis, 2003). This approach has been used in this study.

6.3.2.1. Empirical Results Based on the IO and AO Models

Empirical literature shows that there is little evidence as to which of these models specified above are most appropriate to capture the effect of an endogenous structural break on the hypothesis tests. If a series truly exhibits a trend, then estimating a model (such as Perron and Vogelsang, 1992) that does not have a trend variable may fail to capture some important characteristics of the data. Therefore, prior to estimating these models we have to check the trend property of the variables under investigation. If there is no upward or downward trend in the data, the test power to reject the no-break null hypothesis is reduced as the critical values increase with the inclusion of a trend variable. On the other hand, if the series under investigation truly exhibits a trend, then estimating any of these models with no trend may fail to capture some important characteristics of the data (Ben David and Papell, 1997). Since the visual inspection of the time series data under investigation in this research indicated that these variables have upward or downward trends, we considered this by including the β_t in these equations. Nonetheless, since $t_{\hat{\gamma}}$ is highly significant in all estimates, the inclusion of a change (break) in slope is also justified *ex post*. Moreover, in order to decide which particular IO model is most relevant, the following model selection procedure is adopted. First, the least restrictive model (IO2) is estimated and if $t_{\hat{\gamma}}$ is significant at the 5 percent level or better, then the results are reported in Table 6.2. If $t_{\hat{\gamma}}$ is not statistically significant, then the results of an IO1 model are presented. In order to determine the sudden effect of an unknown structural break, the AO model is also estimated and the results are presented in Table 6.3.

In these models, we apply the method of determining the appropriate lag length endogenously. A data-dependent method for selecting the value of lag length *K* is applied in this research. According to Ng and Perron (cited in Ben-David and Papell, 1998), it is better to use the data-dependent method rather than making an *a priori* choice of a fixed *K*. They suggest starting with an upper bound of *Kmax*. We consider *K,* as *Kmax* if the last lag included in the estimated equation is significant. If the last lag that we consider is not significant, then *K* is reduced by one. We continue this procedure until the last lag become significant. If no lags are significant, then *K* is set to zero. Following Lumsdaine and Papell (1997), we consider the maximum (Kmax) equal to eight and if the coefficient on the eighth lag is significant based on a t-test (i.e. at least 1.645 in absolute value), then we let *K=Kmax*. If not, *K* is reduced by one, until significance is reached. Otherwise *K* is equal to zero.

Using the sequential approach, the regression equation is run with the values *Tb* of (2…t-1), for each time series. The values of the t-statistic for variable α are recorded and compared. From this comparison, the break point is then selected by the value of

Tb, which minimizes the t-statistic on the coefficient α. The unit root null hypothesis is rejected in favor of the alternative hypothesis if the t-statistic for α is significant and greater than the critical values tabulated by Perron (1997). The result of the Innovational Outlier (IO) model is reported in Table (6.2):

Table 6.3: Innovational Outlier Model for Determining the Break Date in Intercept (IO1) Or Both Intercept and Slope (IO2)

Please see print copy for Table 6.2

Table 6.4: Additive Outlier Model (AO) for Determining the Time of the Break

Please see print copy for Table 6.4

Based on the results in Tables 6.3 and 6.4, the empirical results of the analysis are summarised as follows. First, the empirical result based on the IO model do not provide any evidence against the null hypothesis of unit roots in these series. In other words, despite considering structural breaks in all series, all of the variable examined are found to be I(1). In fact, the IO model statistics indicate that all series under investigation are non-stationary. Similar results are obtained using the AO procedure, suggesting all variables are non-stationary. This is consistent with the results of the conventional unit root tests (ADF and PP tests) reported in Table 6.1 as well as the results of ZA test reported in Table 6.2. It then appears that capturing the most important structural break by the Perron (1997) model has not challenged any inferences about time series property of the data garnered by the conventional tests or the ZA model.

Second, the timing of any structural break (T_b) for each series using both the IO and AO approaches are shown in Tables 6.3 and 6.4, respectively. The IO and AO models shows that endogenously determined TBs closely approximate major structural breaks occurring during the war period in the1980s and regime change in 1979 (Islamic Revolution). The timing of the structural changes based on the IO model (impacting on both the intercept and the slope (IO2) or intercept only (IO1) of each series) are represented by a solid line in Figure 6.2, and with a dotted line for the AO model.

Figure 6.2
Plots of the Series and Estimated Timing of Structural Breaks by IO and AO Models

Please see print copy for Figure 6.2

Please see print copy for Table 6.2

In sum, the empirical results based on the IO and AO models reveal that applying the Perron (1997) method strengthens our finding based on the Zivot-Andrews (1992) model. Applying the Perron model in the presence of structural breaks, this study could not find enough evidence against the null hypothesis of unit root for all of the variables under this analysis. In the first section of this Chapter, the standard ADF test and Phillips-Perron unit root tests were run, without considering structural change, and these find not enough evidence for the rejection of the unit root null hypothesis for all of the variables under study at log level which is consistent with the finding of this study based on the ZA (1992) test and Perron (1997) IO and AO models. The results of the (AO) method show that most of the break dates occur in the late seventies and early and mid eighties. These dates can be associated with and the effect of revolution in 1978 and war with Iraq beginning in 1980 and finally the oil crash in 1986. The last date shows the huge oil price decline, which had a negative effect on the Iranian economy since it is a major oil exporting country.

Although the Perron and ZA methodologies are the most advanced so far achieved for the examination of structural breaks in non-stationary time series, it is important to note that these tests are unable to detect the presence of multiple structural breaks. Therefore, the possibility exists that other potentially significant breaks occurred during the period of analysis. Only the most significant of these will be detected through the use of Perron and ZA frameworks. In other words, when we allow for a single potential break, non-rejection of the unit root hypothesis may be due to the existence of multiple structural breaks. Especially in a country like Iran, faced with events like sharp oil price fluctuations, war and revolution, one really should consider the possibility of there being more than one break in the trend function of the variables under study. For these reasons, in the following section the Lumasdaine and Papell (LP, 1997) methodology, which takes into account the existence of two potential structural breaks is applied.

6.4. Unit Root Test with Two Structural Breaks

As noted above, the approach used by Zivot and Andrews (1992) and Perron (1989; 1997) captures only one (the most significant) structural break in each variable. What if there have been multiple structural breaks in a series? Considering only one endogenous break may not be sufficient and under these circumstances it could lead to a loss of information (LP, 1997). Computationally the determination of more than one structural break (even two) is very cumbersome. LP introduced a new procedure to capture two structural breaks and argued that unit root tests that account for two structural breaks (if significant) are more powerful than those which only allow for a single break. According to Lumsdaine and Papell (1997) considering only one endogenous break is insufficient and leads to a big less of information when actually more than one break exist. They introduced a ground for multiple structural breaks analysis and permit for existing of the two structural breaks under the alternative hypothesis of unit root test.

As an extension of the Zivot and Andrews (1992) (model C as discussed in equation 6.8), LP modified the ADF test by taking into account two potential structural breaks as follows:

$$\Delta y_t = \mu + \beta t + \theta DU1_t + \gamma DT1_t + \omega DU2_t + \psi DT2_t + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + \varepsilon_t \qquad (6.13)$$

$$DU1_t = \begin{cases} 1 \text{ if } t > TB1 \\ 0 \text{ if } t \le TB1 \end{cases} \quad \text{and} \quad DU2_t = \begin{cases} 1 \text{ if } t > TB2 \\ 0 \text{ if } t \le TB2 \end{cases}$$

$$DT1_t = \begin{cases} t - TB1 \text{ if } t > TB1 \\ 0 \text{ if } t \le TB1 \end{cases} \quad \text{and} \quad DT2_t = \begin{cases} t - TB2 \text{ if } t > TB2 \\ 0 \text{ if } t \le TB2 \end{cases}$$

The two indicator dummy variables (i.e. $DU1_t$ and $DU2_t$) capture structural changes in the intercept at time *TB1* and *TB2*, respectively. The other two dummy variables (i.e. $DT1_t$ and $DT2_t$) capture shifts in the trend variable at time *TB1* and *TB2*, respectively. The optimal lag length (*k*) is determined based on the general to specific approach (the *t* test) suggested by Ng and Perron (1995). The break points (*TB1* and *TB2*) are selected based on the minimum value of the t statistic for α. Following LP (1997) and Ben-David *et al.* (2003) this study assumed the lag length (*k*) to vary up to K_{max}=8. Starting, as LP (1997) suggest, with an upper value of k (e.g. 8 as Kmax), if the inclusion of the last lag is significant, then it is considered as Kmax. If it is not significant, then k is reduced by one until the last lag becomes significant. The null hypothesis of unit root is rejected in favor of an alternative hypothesis of stationarity around two breaks, if the t-statistic for α is larger in absolute values than the appropriate critical values. The "trimming region", where the minimum t-ratio is sought, starts from the second observation and ends at the penultimate observation where $TB1 \neq TB2$.

6.4.1. Empirical Results Based on the Lumsdaine and Papell Approach

Table 6.5 presents the two most important structural breaks which affected the macroeconomic variables of the Iranian economy using the procedure proposed by Lumsdaine and Papell (1997). Table 6.4 also presents the time of structural breaks for each and every variables in the second column. For majority of the variables the endogenously determined break dates closely correspond to (a) the oil boom in the 1974-75; (b) the effect of Islamic revolution in 1979 and finally(c) the outbreaks of the Iraqi destructive war in 1980s. It should be noted that as a net energy exporter the 1973-74 oil price supply shock did not have the same deleterious effects in Iran as in other countries (oil importing) around the world. However, a large trade surplus (with fixed exchange rates), along with huge increase in private and government consumption very significantly in advance of any productivity growth at the time, brought about Iran's own version of "stagflation" in the 1974-76 period.

Table 6.5: Estimating the Time of Structural Breaks By the Lumsdaine and Papell (LP) Approach (model C)

$$\Delta y_t = \mu + \beta t + \theta DU1_t + \gamma DT1_t + \omega DU2_t + \psi DT2_t + \alpha y_{t-1} + \sum_{i=1}^{K} c_i \Delta y_{t-i} + \varepsilon_t$$

Please see print copy for Table 6.5

The empirical results show that the t statistics for μ , β θ, γ, ω and ψ are significant in almost all of the cases. Given the fact that all of the estimated coefficients for the indicator and trend dummy variables are statistically significant for the variables, one can argue that the estimated structural break dates are indeed significant in the model.

The LP test results are presented in Table 6.5. Given that the estimated coefficients for θ, γ, ω and ψ are highly significant for all of the variables except *Ln(Yno)* and *Ln(Xno)*, one can argue that these structural changes at time *TB1* and *TB2* have impacted on both slope and the intercept for all of the variables under investigation except *Ln(Yno)* and *Ln(Xno)*.

In the case of *Ln(Xno)*, while θ, ω and ψ are significant, γ is not. This suggests that the second structural break occurred at *TB2* for this variable has affected both slope and the intercept but the first one exerted a significant change in intercept only. Finally based on the magnitude of t-ratios for θ, γ, ω and ψ , while the first structural break in *Ln (Yno)* has shifted both trend and the intercept (because θ and γ are highly significant), the second one has no significant effect (*i.e.* see the t-ratios for both ω and ψ) whatsoever.

Figure 6.3 shows the log and the growth rate of each of the variables employed as well as their corresponding two LP structural breaks- the solid line denotes *TB1* and a dashed line is used to point to *TB2*. A cursory look at Figure 1 also show that the resulting break dates for the variables under investigation obviously coincide with major turning points in the intercept and / or the trend of the variables under investigation.

Figure 6.3
Plots of the Series and Endogenously Estimated Timing of Structural Breaks by Lumsdaine and Papell Test (Model C)

Please see print copy for Figure 6.3

Please see print copy for Figure 6.3

If the t-statistic reported in Table 6.5 is compared with the critical values reported in LP (1997), some of the variables, (which contain unit root based on the conventional unit root or ZA and Perron's IO and AO models), appear to be stationary. Unlike ZA and Perron's IO and AO models, LP (1997), used the Monte Carlo simulation and calculated their own critical values for their sample based on 5000 replications. Unfortunately, these critical values are specific to this sample size. The empirical literature shows that the critical values are heavily dependent on the sample size and therefore we cannot make use of the critical values reported by LP (1997) to make a decision about the stationarity of the series under investigation in this research. It should be noted that calculation of critical values by Monte Carlo simulation is beyond the scope of this study. Therefore, by applying the LP testing procedure, we are only able to determine whether there are two significant structural breaks in the data and we are unable to adequately determine the stationarity of the data.

6.5. Summary and Concluding Remarks

This study uses annual time series data (1960-2003) to determine the most important years when structural breaks occurred in a number of macroeconomic variables in the Iranian economy. First, the Zivot and Andrews approach has adopted to allow the data to determine the single most important structural break in each series. Then both the Innovational Outlier (IO) (assuming gradual changes in intercept and / or slope) and the Additive Outlier (AO) (assuming instantaneous changes in intercept) models are used. The empirical results based on all these models provide no evidence against the null hypotheses of unit roots in the series under investigation. In other words, despite considering structural breaks in all series, all variables examined are found to be I(1). This is consistent with the results obtained by conventional unit root testing (ADF, and PP test).

Following these tests, we employed the Lumsdaine and Papell (1997) procedure (LP) to specify a model able to accommodate the potential existence of two significant structural breaks in the data. It should be noted that we could not make use of the critical values reported by LP (1997) to make a final decision about the stationarity of the series under investigation in this research, as the critical values reported in LP were relevant only to their own sample because the procedure they used was sample-size dependent. However, by applying the LP procedure, it was possible to determine the existence and the timing of the most significant structural breaks in these variables and to do so *endogenously*. These endogenously determined and significant breaks did, in fact, occur and, as one would expect, they coincided with either the war period (1980s), the time of the regime shift (1979), external factors such as the 1974-75 oil shock or the oil price collapse in 1996.

As mentioned earlier, the ZA (1992), the Perron (1997), and the LP (1997) approaches are the most advanced methods to endogenously detect one or at most two significant structural breaks, but these models are still unable to identify multiple structural breaks. Attempts to apply such methods in the presence of multiple breaks may yield conflicting results. Further research to refine procedures and resolve such inconsistencies will be needed, but such investigation is beyond the scope of this present study. It could be argued that a procedure which would allow for multiple structural breaks would perhaps be more appropriate to the Iranian economy but the data would need to be more long-term or at least obtained quarterly or monthly, rather than yearly. Moreover, as Ben-David and Papell (1997) note, tests that allow for multiple structural breaks, such as Bai and Perron (2003), are restricted to stationary and non-trending data which is not the case for the variables under investigation in this research.

CHAPTER 7
TRADE-GDP NEXUS IN IRAN: AN APPLICATION OF NEW COINTEGRATION TECHNIQUES IN THE PRESENCE OF STRUCTURAL BREAKS*

7.1. Introduction

As mentioned in the previous chapters, when in the 1980s export promotion policies in Asian Newly Industrialized Countries (NICs) led to remarkable economic growth, attention was placed on the linkage between exports and economic growth in other developing countries. Feder (1982), Balassa (1985) and Ghatak *et al*. (1997) suggested that export expansion might generate positive externality through more efficient allocation of resources, efficient management and improved production techniques, specialization, competition and the economy of scale. Hence various development theories have emerged in the literature suggesting that export expansion further accelerates economic growth due to the above-mentioned factors. This is referred to as the export-led growth (ELG) hypothesis.

Endogenous growth models make use of the same idea to analyze the broad externality effects of exports on the economy, but they address the role of imports as well. These models emphasize the fact that trade works as a conduit of knowledge spillover. In turn, this knowledge spillover enables the economy to achieve increasing returns, and human capital also has a role in increasing economic growth through the same knowledge spillover effect of trade (Sengupta, 1993). In fact aaccording to the endogenous growth theory, factors such as physical capital (R&D effects), human capital (representing knowledge spillover effects), export expansion (proxying the positive externality effects), and capital and intermediate imports (capturing learning-by-doing effects) are the major determinants of economic growth.

Drawing upon the existing literature on the trade-growth nexus and following Feder (1982), Ram (1987), Lucas (1988), Salehi-Esfahani (1991), Sengupta (1993), Ghatak *et al.* (1997) and Van Den Berg (1997), the following two models are considered in order to identify a long-run relationship between trade and economic

* Modified versions of this chapter have already been published in *International Journal of Applied Econometrics and Quantitative Studies*,(2005) 2 (4), *American Journal of Applied Science,(2005)* 2 (7) and *Applied Econometrics and International Development*, (2005) 5 (4).

growth in an oil-based economy. We include export in the typical production function based on the Feder model (hereafter model 1), which was explained in Chapter 4. We will also estimate what we might call the “ extended Feder model” ((hereafter model 2), which was specified in Chapter 5 for an oil-based economy. In fact, the following two equations in logarithmic form are used to examine the trade-GDP nexus in Iran:

Feder Model (Model 1):

$$Ln(y_t) = \alpha_0 + \alpha_1 Ln(k_t) + \alpha_2 Ln(l_t) + \alpha_3 Ln(x_t) + e_{1t} \tag{7.1}$$

This is similar to the neoclassical formulation of the source of economic growth. In this equation, GDP is specified as a function of the physical capital, labour force and exports which reflects gains from shifting resources away from the low productive sector (non-export sector) to the highly productive export sector. As mentioned earlier, the export sector has a positive externality effect on the production sector for domestic use stemming from exposing the economy to a more competitive environment. The economy can benefit also from improved production techniques, better quality management and labour force and the continuous flow of the imported inputs in this environment Therefore, in the extended Feder model (model 2), like Salehi-Esfahani (1991) and Ven Den Berg (1997), we include total imports as a new factor in the following equation. According to Salehi-Esfahani, by providing better quality inputs, capital and intermediate imports can affect productivity. This model is a kind of production function, which is augmented by the addition of trade factors, exports (X) and imports (M):

Extended Feder Model (Model 2):

$$Ln(y_t) = \beta_0 + \beta_1 Ln(k_t) + \beta_2 Ln(hc_t) + \beta_3 Ln(xo_t) + \beta_4 L(xno_t) + \beta_5 Ln(m_t) + e_{2t} \tag{7.2}$$

Equation (7.2) is also used to analyse the relationship between the growth of GDP, physical and human capital, intermediate imports, and exports (oil and non-oil exports). It should be noted that in Feder-type models GDP is considered to be simply a function of the ordinary labour force together with other relevant factors. We follow the endogenous growth theory and consider instead human capital (the number of employed workforce with a university degree) rather than the total labour force in our empirical models based on the second model. Moreover, in model (2) the possible effects of exports on economic growth have been disaggregated into oil (xo) and non-oil (xno). The data used in this research are expressed in 1997 constant prices and have been collected from the Central Bank of Iran (CBI, 2001b; 2004), Tabibian *et al.* (2000) and the International Financial Statistics (IFS, 2004). In the above equation (7.2), y denotes real GDP, k is gross capital formation, m is total real imports and hc is human capital (represented in this research by the number of employed persons with a tertiary education). In this equation, oil and non-oil exports are shown by xo and xno, respectively.

As mentioned in Chapter 6, the Iranian economy has been subjected to a multitude of structural changes and regime shifts between 1960 and 2003. Thus, the time series properties of the data were analysed first using Perron's Innovational outlier (IO) and additive outlier (AO) models, then by the Zivot-Andrews (ZA) test and finally using the Lumasdaine and Papell (LP) procedures. The empirical results based on both the IO and AO models as well as the ZA test indicated that there is not enough evidence against the null hypothesis of unit roots for all of the variables under investigation. The resulting structural breaks endogenously determined by different methodologies coincided with the important political / economic factors such as the 1979 Islamic revolution and the Iran-Iraq war beginning in 1980.

This chapter examines the major determinants of GDP growth in Iran using annual time series data for the period 1960 to 2003 by taking into account these potential structural breaks. Therefore, in the following section of this chapter, the Johansen-Juselius (1990), the Gregory-Hansen (1996) and the Saikkonen and Luetkephol (2000) cointegration approaches are employed in order to determine the long-run drivers of economic growth in the presence of structural breaks. These last two cointegration techniques accommodate potential structural breaks, which could undermine the existence of a long-run relationship between GDP growth and its main determinants. The reason for using all of these different methodologies is to see whether the results of the different approaches are consistent and support one another, or not.

The structure of the rest of this chapter is as follows: Section 7.2 briefly explains and presents the Johansen-Juselius (1990) cointegration results without considering potential structural breaks. Section 7.3 discuss cointegration analysis with structural breaks and presents the results of the Gregory-Hansen (1996) cointegration approach, in the presence of data-determined (i.e. endogenously determined) potential structural breaks and finally Section 7.4 discusses the results of cointegration analysis in the presence of pre-determined structural breaks using the Saikkonen and Lutkephol (2000b) approach. Then, based on the number of cointegrating vectors found, the Error Correction version of the ARDL model was applied in section 7.5 in order to determine the short-run and long-run coefficients of the cointegration vectors and hence identify the long- and short-term relationships between exports, imports and economic growth in the presence of other relevant variables. Finally Section 7.6 presents some concluding remarks.

7.2. The Johansen-Jeselius Cointegration Technique

The Engle-Granger two-step procedure has been used over the last two decades because it is a residual-based cointegration technique which is easily implemented. This procedure, however, has certain drawbacks. For example, according to Enders (2004), one of its most serious shortcomings is that it can identify only one long-run relationship while any given set of variables may, in fact, contain more than one such relationship. In order to overcome this difficulty, Johansen-Juselius (1990) (hereafter JJ) introduce a 'full information maximum likelihood' approach. Individual variables need not be identified as endogenous/exogenous as this approach treats all variables in the system as endogenous and using this technique enables us to find all existing cointegration relationships in the system.

This procedure is based on the following unrestricted VAR model:

$$X_t = \prod_1 X_{t-1} + \prod_2 X_{t-2} + ... + \prod_k X_{t-k} + \varepsilon_t, \quad t=1,2,\ldots \qquad (7.3)$$

where X_t is an $(n \times 1)$ vector of variables (say X_{1t}, X_{2t}, ….., X_{nt}), and $\prod_i$ = an $(n \times n)$ matrix of coefficients. ε_t is the set of error terms which are normally distributed. In this methodology, each variable is integrated of order one. Hence, to ensure the stationarity of the variables, this process can be rewritten in the first differentiated form. It is important to note, however, that the first differentiated variables indicate only short-run relationships and by using the differentiated form of the variables, some long-term information in the data could be lost. The JJ approach decomposes the matrix $\prod$ to ascertain long-run information between the variables. This procedure can be rewritten as:

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + ... + \Gamma_{k-1} \Delta X_{t-k-1} + \Gamma_k X_{t-k} + v_t \qquad (7.4)$$

where Γ is defined as ($\prod$- I) and I is an ($(n \times n)$ identity matrix. In this approach, when a linear combination of two or more I(1) variables is stationary, a cointegration relationship could exist. Two well known tests, the Maximal Eigenvalue test ($\lambda_{\max}$) and the trace test (λ_{trace}) are often utilized. These are used to determine the number of cointegrating vectors in a system. The null hypothesis that there are at most r cointegrating vectors is evaluated by the trace test, the statistic of which is calculated as follows:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1-\hat{\lambda}_i) \qquad (7.5)$$

The Maximal Eigenvalue test, instead, evaluates the null hypothesis that there exist r cointegration vectors against the alternative of the existence of r+1 cointegration vectors. This test statistic is calculated as follows:

$$\lambda_{\max}(r, r+1) = -T \ln(1-\hat{\lambda}_{r+1}) \qquad (7.6)$$

In both equations T is the number of usable observations and λ is the calculated values of the characteristic roots from the estimated matrix. The empirical literature indicates that the results of these two tests, may not necessarily be consistent with each other. In such circumstances, especially when the span of the data is limited, the Trace statistic result is to be preferred. The number of lags in both of these procedures can be determined using either the AIC (the Akaike Information Criterion) or the SBC (the Schwarz Bayesian Criterion).

7.2.1 Empirical Results Based on the Johansen-Jeselius Cointegration Technique

All of the variables in the VAR system are I(1), as we have already established by Perron (1997) tests as well as by using the Zivot-Andrews (1992) approach, as reported in Chapter 6. By applying the conventional unit root tests (ADF, PP), we also found that all of the variables under investigation in log level were I(1). Therefore, in this Chapter, we can use the Johansen-Juselius (1990) methodology in order to test for the existence of any long-run relationship among the variables in models (1) and (2). Because the Johansen-Jeslius approach uses the VAR model, the results of which are sensitive to lag length, it is vital to be very careful in the selection of the lag order in the model. If we choose a lag length, which is too short, the residuals may be auto-correlated. On the other hand, if the lag lengths are too long, the may be a reduced degree of freedom. In order to determine the lag length in a VAR model, the (AIC) and (SBC) are applied. In fact, this latter (SBC) enables the lag length to be determined much more appropriately and this simpler approach is preferable especially given the short span of the data. After determining the lag length, the JJ cointegration test was conducted to identify the number of cointegrating vectors, by using the λ_{trace} test explained earlier. Table (7.1) shows the results of the cointegration test on equation 7.2 (model 1). Based on the λ_{trace} statistics, the null hypothesis of no cointegrating vector is rejected at the 5 percent level. This implies that there is at most one cointegrating vector for model (1) linking GDP to physical capital, labour force and exports in the Iranian economy.

Table 7.1: Johansen-Jeselius Test for Cointegration (Model 1)

Hypothsized No. of CE(s)	λ_{Trace} statistics	5% Critical Value	10 % Critical Value	λ_{Max} statistic	5% Critical Value	10 % Critical Value
None	83.302*	75.980	71.810	37.364*	34.400	31.7300
At most 1	45.938	53.480	49.950	24.106	28.270	25.8000
At most 2	21.832	34.870	31.930	9.602	22.040	19.8600
At most 3	12.229	20.180	17.880	7.515	15.870	13.8100
At Most 4	4.713	9.160	7.5300	4.713	9.160	7.5300

Note: * indicates that the corresponding null hypothesis is rejected at the 5% level.

Table 7.2 shows the cointegration results for model 2. The reported λ_{trace} statistics again strongly reject the null hypothesis of no-cointegrating vector (r=0) and so we cannot reject the hypothesis that there is at most one cointegrating vector at the 95 percent confidential level. This means that our cointegration test results in model (2) remain robust despite the fact that total exports are disaggregated into non-oil and oil exports and Imports, as well as human capital (defined as the number of employed workers with tertiary education) are also included. In either case there is at most one linear combination between GDP and its main long-run drivers in both models (1) and (2).

Table 7. 2: Johansen-Jeselius Test for Cointegration (Model 2)

Hypothsized No. of CE(s)	λ_{Trace} statistics	5% Critical	10 % Value	λ_{Max} statistic	5% Critical	10 % Value
None	127.520*	102.560	97.870	59.854*	40.530	37.650
At most 1	67.666	75.980	71.810	32.662	34.400	31.730
At most 2	35.003	53.480	49.950	18.799	28.270	25.800
At most 3	16.204	34.870	31.930	7.001	22.040	19.860
At most 4	9.202	20.180	17.880	6.655	5.870	13.810
At mos 5	2.546	9.160	7.530	2.546	9.160	7.5300

Note: * indicates that the corresponding null hypothesis is rejected at the 5% level.

As mentioned earlier, structural breaks can distort the cointegration results especially in the context of the Iranian economy, which has been plagued with various structural breaks such as the 1979 Islamic revolution and the eight-year Iraqi war as well as a number of drastic policy changes during the sample period. In the following section two recent cointegration methodologies: Gregory-Hansen (1996); Saikkonen and Lutkephol (2000), both of which take into account the existence of structural breaks in the cointegration analysis, are explained and applied.

7.3. Cointegration Analysis with Structural Breaks

As had been noted as far back as 1989 by Perron, ignoring the issue of potential structural breaks can render invalid the statistical results not only for unit root tests but also in terms of cointegration tests. One has to be aware of the potential effects of structural breaks on the results of cointegration test, as they usually occur because of war, regime shifts or major policy changes. Indeed, ignoring the existence of the significant structural break can invalidate not only the statistical inference about unit root test for individual variables but also can distort the results of cointegration tests. In view of this critical issue, Hendry (1996) argues that it is important to distinguish between breaks in the individual variables and breaks in the cointegrating vectors. Kunitomo (1996) posits that in the presence of a structural change, traditional cointegration tests, which do not allow for this, may produce "spurious cointegration results”. Gregory *et al.* (1996) also recognized the effect of potential structural breaks on the result of the ADF test for cointegration. They showed that, in the presence of a structural break, the ADF test tends to under-reject the null hypothesis of no-cointegration. That is to say, potential cointegration relationships may be masked due to the existence of the structural breaks. The under rejection of the null hypothesis here is similar to under- rejection of the unit root null hypothesis, in the presence of the structural breaks, explained in the previous chapter.

In this study, therefore, considering the effects of potential structural breaks is very important, especially because the Iranian economy has been faced with structural breaks like revolution and war in addition to numerous policy changes.

7.3.1. The Gregory-Hansen Cointegration Test with a Potential Structural Break

Given the fact that empirical results based on the JJ cointegration techniques have determined only one cointegrating vector in the system, one can subsequently use the Gregory-Hansen approach (1996) (hereafter, GH). This latter approach is based on the Engle-Granger cointegration technique. In fact, Gregory-Hansen addressed the problem of estimating cointegration relationships in the presence of a potential structural break by introducing a residual-based technique so as to test the null hypothesis (no cointegration) against the alternative of cointegration in the presence of a break (such as regime shift).

While conventional cointegration techniques such as the Engle-Granger or the JJ procedure do not consider the existence of potential structural breaks at all, or others (like SL 2000) do so based on break dates which are known a priori, the advantage of the Gregory-Hansen methodology is that this testing procedure determines the time of the break endogenously. In other words, in this approach the break point (TB) is unknown and is determined by finding the minimum values for the ADF t statistic. Using the RATS program, the optimal number of lags can be selected automatically by general to specific t-tests, AIC or SBC.

The ADF-t-test has been extended by GH (1996) in order to test the null hypothesis of no cointegration relationship against the alternative, that there exists a cointegration in the presence of a potential structural break. By taking into account the existence of a potential unknown and endogenously determined one-time break, the GH approach allows for structural shifts in either the intercept alone, in both the trend and the level shift, or for a full break. In order to avoid the invalid rejection of the null hypothesis, GH (1996) introduced three alternative models.

The first model includes an intercept (or constant) (C) and a level shift dummy. This model is illustrated as follows:[1]

$$x_{1t} = \mu_1 + \mu_2 DU_t + \alpha'_1 x_{2t} + e_t \tag{7.7}$$

In this case, the intercept dummy variable DU_t takes the value of one after the break date and zero otherwise.

The second model (C/T), contains an intercept and trend with a level shift dummy and is shown as follows:

$$x_{1t} = \mu_1 + \mu_2 DU_t + \mu_3 t + \alpha'_1 x_{2t} + e_t \tag{7.8}$$

The third alternative model is the full break model (regime shift -C/S), which includes two dummy variables, one for the intercept and one for the slope, without including trend in the model. This model allows for change in both intercept and slope as illustrated below:

$$x_{1t} = \mu_1 + \mu_2 DU_t + \alpha'_1 x_{2t} + \alpha'_2 x_{2t} DU_t + e_t \qquad t=1,\ldots,n \tag{7.9}$$

In the above equations, $DU_t = 0$, if $t \le [n\tau]$ and $DU_t = 1$ if $t > [n\tau]$, where the unknown parameter $\tau \in (0,1)$ is defined as the relative timing of the change point. The cointegration slope coefficient before the regime shift is denoted by α_1 and change in the slope coefficient is denoted by α_2. Finally, μ_1 represents the intercept before the level shift, and the change in the intercept at the time of the shift is represented by μ_2.

7.3.2. Empirical Results Based on the Gregory –Hansen (GH) Procedure

As mentioned above, the literature shows that it is important to take into consideration the effects of potential structural breaks in the cointegration analysis. This is especially important in the present research because the Iranian economy has been faced with a regime shift. We will now apply the GH approach in order to determine the time of the structural break and also to test for the existence of cointegration relationships among

[1] The description here is based on Gregory and Hansen (1996).

our variables of interest. Among the above-mentioned GH (1996) three cases of cointegration with a structural break, this research considers the regime shift model (C/S), which allows for both change in the intercept as well as change in the slope, because this case is more relevant to the Iranian economy which was faced with regime change. However, as the critical value in GH (1996) is not reported for more than five variables, it is not possible to apply this procedure for the extended Feder model (model 2) in this research), which has six variables. Therefore, the GH test will be applied only to the Feder model (model 1), of this research, which has only four variables. The empirical result based on the GH cointegration procedure (case C, or “full break”), indicates that the reported statistic (-7.194) is smaller than its respective 5% critical value (-6.41). This confirms the rejection of the null hypothesis of no cointegration in favor of the existence of at least one cointegration relationship in the presence of a single structural break. The following graph shows that the endogenously determined time of the break coincides with the effect of the 1978 strikes in Iran, which preceded the 1979 revolution.

Figure 7.1
Plots of the GH Cointegration Test (Model C/S)

Gregory-Hansen Cointegration Tests

Please see print copy for Figure 7.1

Thus, as the above graph clearly shows, the most important structural break in the Iranian economy took place in 1978 and this was identified endogenously by the GH procedure. It should be noted that in Chapter 6 we used the Perron (1997) tests and determined the time of the break separately for each variable, while here the time of the break has been determined for all the variables in the model together. The 1978 time of the break is, of course, consistent with effects (e.g. strikes and suspension of oil production) related to the regime shift (Islamic Revolution) in Iran. Since the timing of this structural break has now been determined endogenously via the models, in subsequent methodologies applied in this research, this time will be considered as a known regime shift dummy.

7.4. Saikkonen And Lutkephol Cointegration Tests

Saikkonen and Lütkepohl (2000 a, b, c) have proposed a test for cointegration analysis that allows for possible shifts in the mean of the data-generating process. Because many standard types of data generating processes exhibit breaks caused by exogenous events that have occurred during the sample period, they suggest that it is necessary to take into account the level shift in the series for any proper inference regarding the cointegrating rank of the system. They argue that "structural breaks can distort standard inference procedures substantially and, hence, it is necessary to make appropriate adjustment if structural shifts are known to have occurred or are suspected" (2000b: 451).

The Saikkonen and Lütkepohl (SL) test investigates the consequences of structural breaks in a system context based on the multiple equation framework of Johansen-Jeslius, while earlier approaches like Gregory-Hansen (1996) considered structural breaks in a single equation framework. Others conventional cointegration tests did not consider the potential existence of the structural breaks in the system at all. According to Saikkonen and Lütkepohl (2000b) and Lütkepohl and Wolters (2003), an observed n-dimensional time series $y_t =$ $(y_{1t},\ldots, y_{nt})$, y_t is the vector of observed variables (t=1,…, T) which are generated by the following process:

$$y_t = \mu_0 + \mu_1 t + \gamma_1 d_{1t} + \gamma_2 d_{2t} + \gamma_3 d_{3t} + \delta_1 DT_{0t} + \delta_2 DU_{1t} + x_t \qquad (7.10)$$

Where DT_{0t} and DU_{1t} are impulse and shift dummies, respectively, and account for the existence of structural breaks. DT_{0t} is equal to one, when $t=T_0$, and equal to zero otherwise. Step (shift) dummy (DU_{1t}) is equal to one when ($t>T_1$), and is equal to zero otherwise. The parameters γ_i (I=1,2,3), μ_0, μ_1, and δ are associated with the deterministic terms. The seasonal dummy variables $d_{1t,}$ $d_{2t,}$ and $d_{3t,}$ are not relevant to this research since our data are annual. According to SL (2000b), the term x_t is an unobservable error process that is assumed to have a VAR (p) representation as follows:

$$x_t = A_1 x_{t-1} + ... + A_p x_{t-p} + \varepsilon_t \qquad t=1,2, \qquad (7.11)$$

By subtracting x_{t-1} from both sides of the above equation and rearranging the terms, the usual error correction form of the above equation is given by:

$$\Delta x_t = \prod x_{t-1} + \sum_{j=1}^{p-1} \Gamma j \Delta x_{t-j} + u_t \qquad (7.12)$$

This equation specifies the cointegration properties of the system. In this equation, u_t is a vector white noise process; $x_t = y_t - D_t$ and D_t are the estimated deterministic trends. The rank of Π is the cointegrating rank of x_t a D_t nd hence of y_t (SL, 2000b).

The possible options in the SL procedure, as in Johansen, are three: a constant, a linear trend term, or a linear trend orthogonal to the cointegration relations. In this methodology, the critical values depend on the kind of the above-mentioned deterministic trend that is included in the model. More interestingly, in SL, the critical values remain valid even if dummy variables are included in the model, while in the Johansen test; the critical values are available only if there is no shift dummy variable in the model. The SL approach can be adopted with any number of (linearly independent) dummies in the model. It is also possible to exclude the trend term from the model; that is, μ=0 may be assumed *a priori*. In this methodology, as in Johansen's, the model selection criteria (SBC, AIC, and HQ) are available for making the decision on the VAR order. In the following section, we have applied SL tests for the cointegration rank of a system in the presence of structural breaks.

7.4.1. Empirical Results Based on the Saikkonen-Lutkephol (SL) Cointegration Procedure

As explained above, Saikkonen and Lütkepohl (2000b) derived the likelihood ratio (LR) test in order to determine the number of cointegrating relations in a system of variables, by considering for the possibility of potential structural breaks. We now apply a maximum likelihood approach, based on SL, for testing and determining the long-run relationship in the model under investigation. As mentioned earlier, in this procedure SL assumed that the break point is known *a priori*. In Chapter 6, we determined the time of the break endogenously by using the Zivot-Andrews (1992) procedure and the Perron (1997) innovational outlier (IO) and additive outlier (AO) models. The empirical results based on these methods showed that the most significant break for the variables under investigation is consistent with the time of the revolution and the Iraqi-war. Therefore, at this stage we include two dummy variables (regime change / revolution in 1979) and the Iraqi war (beginning in 1980) in order to take into account the effects of structural breaks on the system. Since there is no lag structure for the dummy series, these two dummies are included in the system, but not in the cointegration space. For this reason, the dummy result is not present in the cointegration results. Following the SL procedure we consider three cases: impulse dummy and shift with intercept included; impulse dummy and shift with trend and intercept included; and finally, impulse dummy and shift with a trend statistically independent (orthogonal) to the cointegration relation included. The cointegration results in these three cases are presented in Table 7.3. The optimal number of lags is determined by SBC, which is more appropriate for the short span of the data. The hypothesis of the long-run relationship among non-stationary variables is tested and the result is reported in Table 7.3. This table indicates that the hypothesis of no cointegration (r=0) is rejected at the 5% significance level and the existence of one cointegration vector is not rejected in any of the three cases mentioned above for model (1).

Table 7.3: Cointegration Result Based on SL Test For Model (1)

Please see print copy for Table 7.3

The hypothesis of the long-run relationship between non-stationary variables is tested using model (2) and the result is reported in Table 7.4. A similar conclusion is found in the presence of structural breaks for two cases of C and C/O in model (2). In other words, the hypothesis (r=0) can be rejected in favor of the alternative hypothesis of r=1 at the 5% significance levels for each case. However, taking into consideration the break in the case of the shift dummy with intercept and trend (C/T) included, the null hypothesis of the existence of at least two cointegration vector cannot be rejected among the variables of model (2).

Table 7.4: Cointegration Results Based on SL Test for Model (2)

Please see print copy for Table 7.4

From all the results presented in the tables above, for a Feder-type model (1), we cannot reject the null hypothesis of at least one cointegrating vector. Furthermore, the results of cointegrating vectors for the augmented Feder type model with oil and no-oil export (model 2), which we specified especially for an oil-based economy, show that the hypothesis of one cointegrating vector cannot be rejected. Taking into consideration the structural breaks in the context of the SL procedure, we find the same result in all of the three cases in model (1) and two of the cases for model (2). Table 7.4 indicates that in the case of C/T, we cannot reject the null hypothesis of two cointegrating vectors.

In sum, by considering all of these cases, the existence of at least one cointegrating vector is approved by both the traditional and the new version of the Johansen procedure, which takes into account potential structural breaks. The main conclusion drawn in the above section has not changed: in the presence of structural breaks (the Islamic Revolution and war), and applying models (1) and (2), there is indeed one cointegrating vector, and this represents the existence of a long-term relationship between exports and economic growth in the Iranian economy when we include the other relevant variables in the models.

Since both traditional cointegration test (like Johansen), as well as tests for cointegration in the presence of structural breaks (like GH (1996) and SL (2000)) have all shown that there is only one cointegrating vector for both models, we can now use the ARDL procedure to determine short-run and long-run coefficients of the cointegration vector in the context of error correction modeling.

7.5. The ARDL Cointegration Approach

A significant volume of past research has employed Johansen's cointegration technique to determine the long-term relationships between various variables of interest. A few empirical studies explained the cointegration in the presence of potential structural breaks. In fact, this remains the technique of choice by those who argue that it is the most accurate methods to apply to I(1) variables. Recently, however, an emerging body of work led by Pesaran and Shin (1996); Pesaran and Pesaran (1997); and Pesaran *et al*. (2001) has introduced an alternative and a new version of the cointegration techniques known as the 'Autoregressive Distributed Lag' or ARDL bound test. It is argued that ARDL has a number of advantages over the conventional Johansen cointegration techniques.

To start with, the ARDL is a more statistically significant approach for determining cointegrating relationships in small samples (Ghatak and Siddiki 2001), while the Johansen co-integration techniques require large data samples for the purposes of validity. A further advantage of the ARDL is that while other cointegration techniques require all of the regressors to be integrated of the same order, the ARDL can be applied whether the regressors are I(1) and/or I(0), i.e. whether the results are all unit root or, indeed, even if mixed results are obtained. This means that it avoids the pre-testing problems associated with standard cointegration, which requires that variables are already classified I(1) or I(0) (Pesaran *et al*, 2001). In this research, having first applied the Perron (1997) Innovational and Additive Outlier models, it was observed that in the presence of one structural break, the null hypothesis of a unit root could not be rejected in any of the cases, a result which is consistent with the use of conventional unit root tests. Taking into account the existence of *two* structural breaks, however, and applying the Lumasdaine and Papell (1997) method, empirical results indicated that the null hypothesis of unit root *could* be rejected for some of the variables under analysis. Generally speaking, if not completely sure about the exact unit root properties of the data, then the ARDL is the more appropriate model for empirical work.

Bahmani-Oskooee and Nasir (2004: 485), for example, argue that the first step in any cointegration technique "is to determine the degree of integration of each variable in the model", but this can depend on the specific unit root test used: different tests could lead to contradictory results. For example, applying conventional unit root tests like the Augmented Dickey Fuller and the Phillips-Perron tests, one may incorrectly conclude that a unit root is present in a series that is actually stationary around a one-time structural break (Perron, 1989; 1997). The ARDL is then useful because it avoids this problem.

Yet another difficulty of the Johansen cointegration technique, which the ARDL avoids, concerns the large number of choices which must be made. These include decisions regarding the number of endogenous and exogenous variables (if any) to be included, the treatment of deterministic elements, as well as the order of VAR and the optimal number of lags to be specified. The empirical results are generally very sensitive to the method and various alternative choices available in the estimation procedure (Pesaran and Smith, 1998). Finally, with the ARDL it is possible that different variables have differing optimal number of lags, while in Johansen-type models this is not possible.

According to Pesaran and Pesaran (1997) the ARDL procedure is represented by the following equation:

$$\phi(L,p)y_t = \sum_{i=1}^{k} \beta_i(L,q_i)x_{it} + \delta' w_t + u_t \qquad (7.13)$$

where

$$\phi(L,p) = 1 - \phi_1 L - \phi_2 L^2 - .....\phi_p L^p$$

and

$$\beta_i(L,q_i) = 1 - \beta_{i1} L - \beta_{i2} L^2 - ..... - \beta_{iqi} L^{qi}, \qquad i=1,2,\ldots,k$$

Where y_t denotes the dependent variable, X_{it} is the ith dependent variables, L is a lag operator, and w_t is the $S \times 1$ vector representing the deterministic variables employed, including intercept terms, dummy variables, time trends and other exogenous variables. The optimum lag length is generally determined by minimising either the Akaike

Information Criterion (AIC) or the Schwarz Bayesian Criterion (SBC). Using the ARDL specific model, the long-run coefficients and their asymptotic standard errors are then obtained. The long-run elasticity can then be estimated as follows:

$$\hat{\theta}_i = \frac{\hat{\beta}_{i0} + \hat{\beta}_{i1} + ... + \hat{\beta}_{qi}}{1 - \hat{\phi}_1 - \hat{\phi}_2 - ...\hat{\phi}_p} \qquad \forall \text{ i=1,2,…,k} \tag{7.14}$$

The long-run cointegrating vector is given by:

$$y_t - \hat{\theta}_0 - \hat{\theta}_1 x_{1t} - \hat{\theta}_2 x_{2t} - ... - \hat{\theta}_k x_{kt} = \varepsilon_t \qquad \forall t = 1,2,\ldots,\text{ n} \tag{7.15}$$

In this equation, the constant term is equal to:

$$\hat{\theta}_0 = \frac{\hat{\beta}_0}{1 - \hat{\phi}_1 - \hat{\varphi}_2 - ....\hat{\varphi}_p} \tag{7.16}$$

We can now rearrange equation (7.13) in terms of the lagged levels and first differences of $y_t, x_{1t}, x_{2t}, ..., x_{kt}$ and w_t to obtain the short term dynamics of the ARDL as follows:

$$\Delta y_t = -\phi(1,\hat{p})EC_{t-1} + \sum_{i=1}^{k} \beta_{i0}\Delta x_{1t} + \delta' \Delta w_t - \sum_{j=1}^{\hat{p}-1} \varphi^* y_{t-j} - \sum_{1=1}^{k} \sum_{j=1}^{\hat{q}_{i-1}} \beta_{ij} {}^* \Delta x_{i,t-j} + u_t \tag{7.17}$$

and finally, one can define the error correction term in the following manner:

$$EC_t = y_t - \sum_{i=1}^{k} \hat{\theta}_i x_{it} - \psi' w_t \tag{7.18}$$

In equation (7.17) φ^*, δ' and $\beta_{ij}{}^*$ are the short-run dynamic coefficients, and $\phi(1,\hat{p})$ denote the speed of adjustment.

7.5.1. Empirical Result Based on the ARDL Approach

Since this study aims to detect the short-run as well as the long-run relationships between exports, economic growth and other relevant variables in the specified models, we will make use of the already well-known, though relatively new Autoregressive Distributed Lag (ARDL) technique. Following Pesaran *et al.* (2001) and Bahmani-Oskooee and Nasir (2004), the error correction representation of the ARDL model for both specified model (1 and 2) are represented below:

ECM-ARDL (1):

$$\Delta \ln y = \alpha_0 + \sum_{j=1}^{n} b_j \Delta \ln y_{t-j} + \sum_{j=0}^{n} c_j \Delta \ln k_{t-j} + \sum_{j=0}^{n} d_j \Delta \ln l_{t-j} + \sum_{j=0}^{n} d_j \Delta \ln x_{t-j} + \delta_1 \ln y_{t-1}$$
$$+ \delta_2 \ln k_{t-1} + \delta_3 \ln l_{t-1} + \delta_4 \ln x_{t-1} + D78 + DU80 + \varepsilon_{1t} \qquad (7.19)$$

ECM-ARDL (2):

$$\Delta \ln y = \alpha_0 + \sum_{j=1}^{n} b_j \Delta \ln y_{t-j} + \sum_{j=0}^{n} c_j \Delta \ln k_{t-j} + \sum_{j=0}^{n} d_j \Delta \ln lhc_{t-j} + \sum_{j=0}^{n} e_j \Delta \ln xo_{t-j}$$
$$+ \sum_{j=0}^{n} f_j \Delta \ln xno_{t-j} + \sum_{j=0}^{n} g_j \Delta \ln m_{t-j} + \delta_1 \ln y_{t-1} + \delta_2 \ln k_{t-1} + \delta_3 \ln lhc_{t-1} + \delta_4 \ln xo_{t-1}$$
$$+ \delta_5 \ln xno_{t-1} + \delta_6 \ln m_{t-1} + D78 + DU80 + \varepsilon_{1t} \qquad (7.20)$$

The parameters δ_i, i=1,2,3,4,5,6 function as the long multipliers, while the $b_j, c_j, d_j, e_j, f_j, g_j$ are the short–run dynamics coefficients of the underlying ARDL model. As mentioned earlier, in the first step we need to capture the usual F-statistic for testing the null hypothesis (of no cointegration) defined by (H_0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ and H0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0$) among the levels of the included variables in models (1) and (2) respectively. In doing so, first equations (7.19) and (7.20) are estimated without the EC part, then the EC parts are added on the already estimated first parts of the above equations. Then F statistics are calculated to check the null hypothesis (that all coefficients are jointly equal to zero).

At this stage, the calculated F-statistic is compared with the critical value tabulated by Pesaran *et al.* (2001). These critical values are calculated for different regressors and whether the model contains an intercept and/or a trend. In fact, these critical values covering all possible classifications of the variable into I(1) and I(0) or even fractionally integrated. The null hypothesis of no cointegration will be rejected if the calculated F-statistic is greater than the upper bound. If the computed F-statistic falls below the lower bound, then the null hypothesis of no cointegration cannot be rejected. Finally, the result is inconclusive if it is between the lower and the upper bound. In such an inconclusive case an efficient way of establishing cointegration is by applying the ECM version of the ARDL model (Bahmani-Oskooee and Nasir, 2004).

Since we use forty-four annual observations, we choose 2 as the maximum lag length in the ARDL model and the calculated F-statistic is equal to 3.34 and 2.96 for model (1) and (2), respectively. Given that these fall between the lower bound and the upper bound critical value reported in Pesaran *et al.* (2001) at the 5 percent level, consequently we use the ECM term to determine the long-run relationship among the variables of interest, a procedure recommended in the literature when faced with an inconclusive case. We have also calculated the F-statistic when each of *Ln(k), Ln(hc), Ln(xo), Ln(xno),* or *Ln(m)*, appear as a dependent variable separately in the testing procedure. In all of these cases, the F test statistics are less than the corresponding critical values tabulated in Pesaran *et al.* (2001). Therefore, the null hypothesis of no cointegration cannot be rejected and the possibility of a long-term relationship exists if and only if *Ln(y)* appears as a dependent variable followed by its 'forcing variables' (i.e. *Ln(xo), Ln(xno), Ln(m), Ln(k),* and *Ln(hc)* in both models.

It should be noted, however, that despite the inconclusiveness of the bound testing, the result is consistent with the finding of a rank of one with the application of the Johansen-Jeselius methodology, and the Saikkonen and Lutkephol procedure. These finding plus the Gregory-Hansen technique have all confirmed the existence of at least one cointegration relation between the variables under study using both model (1) and model (2). In other words, in neither model (1) nor model (2) could the null hypothesis (of at least one cointegrating vector) be rejected.

Therefore, next we estimate the long-run coefficients of the ARDL model. One of the more important issues in applying ARDL is choosing the order of the distributed lag function. Pesaran and Smith (1998) argue that the SBC can be used in preference to other model specification criteria because it often has more parsimonious specifications: the small data sample in the current study further reinforces this point. For these two models, the optimal numbers of lags for each of the variables are shown as ARDL (2,1,0,0) and ARDL (1,2,0,2,1,1), respectively. Table 7.5 shows the long-run coefficients of the variables under investigation.

Table 7.5: The Estimated Long-Run Coefficients Results

Model (1): ARDL (2,1,0,0)

Regressor	Coefficient	t-Ratio[Prob]
$Ln(k_t)$	0.385	11.14[.000]
$Ln(l_t)$	0.032	0.286[.776]
$Ln(x_t)$	0.413	6.917[.000]
Intp	1.308	4.410[.000]
D78	0.096	3.101[.004]
DU80	0.081	2.534[.016]

Model (2): ARDL (1,2,0,2,1,1)

Regressor	Coefficient	t-Ratio[Prob]
$Ln(k_t)$	0.555	16.24[.000]
$Ln(hc_t)$	0.021	1.422[.167]
$Ln(xo_t)$	0.373	8.980[.000]
$Ln(xno_t)$	0.036	3.084[.005]
$Ln(m_t)$	-0.134	-6.080[.000]
Intp	1.209	12.65[.000]
D78	0.097	5.062[.000]
DU80	0.187	10.65[.000]

Note: The SBC is used to select the optimum number of lag in the ARDL model, which is used to calculate the long-run coefficient estimates.

As presented, the long-term coefficients for models (1) and (2) follow a similar pattern. The empirical results reveal that in the long run, even a one percent increase in physical capital leads to a 0.38 percent and 0.55 percent increase in GDP for models (1) and (2), respectively. While a one percent increase in human capital does lead to a 0.02 percent increase in GDP for model (2), the empirical results for model (1) show that growth in the labour force has no statistically significant effect on GDP. This means that neither the labour force nor human capital in Iran have substantial or statistically significant effect on GDP. This is likely due to the low productivity of the labour force, and the supply surplus of labour. Part of the reason for the lack of significance of human capital could be due to the definition used in this research, of the number of employed with tertiary education. Perhaps a wider definition may have been more significant. If we consider the effect of total exports on GDP, a one percent increase in total exports leads to a 0.41 percent increase in GDP in model (1). This means that total exports have a very significant and sizable effect on GDP.

Similarly, the results for model (2), where total exports are disaggregated into oil and non-oil exports, shows that a one percent increase in oil exports leads to a 0.37 percent increase in GDP. Moreover, empirical results in Table 7.5 show that a one percent increase in non-oil exports leads to 0.036 percent increases in GDP. It is obvious that non-oil exports have an effect on the Iranian economy, which, though statistically significant, is less than expected. It is the oil sector, which still generates the bulk of total exports (petrodollars) and acts as the leading sector of the economy. The results also show that a one percent *increase* in total imports led to a 0.13 percent *decrease* in GDP in model (2). Though this is theoretically unexpected, it is statistically significant and the reason for it was the Iranian government's repeated imposition of trade barriers, particularly on imports, due to exchange revenue limitations and international debt. In fact, this finding of a negative sign on the coefficient of imports in the case of Iran has also been observed by Jalali-Naini (2003) who ascribed it to the effect of policies which curtailed imports. He noted that "in the years where severe import restriction is imposed, imports are below trend and hence assume a negative value and [this] influences output accordingly as a shift factor" (2003: 11).

Because of the nature of the presently available data, this study uses aggregated imports data. Future studies could usefully be undertaken using import data disaggregated into intermediate and capital imports, an approach recommended by endogenous growth theories as possibly yielding results useful for even more effective policy analysis. After estimating the long-term coefficients, we obtain the error correction representation of the ARDL model. Table 7.6 reports the short-run coefficient estimates obtained from the ECM version of the ARDL model.

Table 7.6. Estimated Short-Run Error Correction Model (ECM)

Please see print copy for Table 7.6

As discussed, the error correction term indicates the speed of the adjustment which restores equilibrium in the dynamic model. The ECM coefficient shows how quickly/slowly variables return to the equilibrium path and it should have a statistically significant coefficient with a negative sign. Bannerjee *et al.* (1998) holds that a highly significant error correction term is further proof of the existence of a stable long-term relationship. Table 7.6 shows that the expected negative signs of ECM are highly significant. The estimated coefficients of ECM_{t-1} are equal to -0.40 and -0.60 for models (1) and (2) respectively, suggesting that deviation from the long-term GDP path is corrected by 40 percent in model (1) and 60 percent in model (2) over the following year. This means that the adjustment takes place relatively quickly, i.e. the speed of adjustment is relatively high, especially in model (2). Figure 7.2 and 7.3 represents the forecasting errors and the plots of the actual and forecast values. The graphical evidence presented in Figures 7.2 and 7.3 indicate the estimated model tracks the historical data very well**,** including the times of structural change.

Figures 7.2
Plots of Actual and Forecasted Values for the Level of LY and Change in LY
(Model 1)

Please see print copy for Figure 7.2

Figures 7.3
Plots of Actual and Forecasted Values for the Level of LY and Change in LY (Model 2)

Please see print copy for Figure 7.3

Diagnostic and Stability Tests

Diagnostic tests for serial correlation, functional form, normality, hetroscedasticity, and structural stability of the model are presented in Tables 7.7 and 7.8 at the end of this Chapter. These tests show that both models (1) and (2) generally pass all diagnostic tests in the first stage where there is no evidence of autocorrelation and the model passes the test for normality. Following Pesaran and Pesaran cited in (Bahmani-Oskooee, 2001), the stability of the regression coefficients is evaluated by stability tests and they can show whether or not the regression equation is stable over time. This stability is appropriate in time series data, especially when we are uncertain about when structural change might have taken place. The null hypothesis is that the coefficient vector is almost the same in every period and the alternative is simply that it is not (Bahmani-Oskooee, 2001). More specifically, when analysing the stability of the long-run coefficients together with the short-run dynamics, the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUM) point to the in-sample stability of the model (see CUSUM and CUSUMQ in Figure 7.4 and Figure 7.5)

According to Bahmani-Oskooee (2001), the null hypothesis (i.e. that the regression equation is correctly specified) cannot be rejected if the plot of these statistics remains within the critical bound of the 5 percent significance level. As is clear from Figures 7.4 and 7.5, the plots of both the CUSUM and the CUSUMQ are within the boundaries. That is to say, the stability of the parameters has remained within its critical bounds of parameter stability and hence these statistics confirm the stability of the long-run coefficients of the GDP function in models 1 and 2.

Figure 7.4
Plots of CUSUM and CUSUMQ Statistics for Coefficients Stability Tests (Model 1)

Please see print copy for Figure 7.4

Figure 7.5
Plots of CUSUM and CUSUMQ Statistics for Coefficients Stability Tests (Model 2)

Please see print copy for Figure 7.5

7.6. Summary and Concluding Remarks

In order to determine the long-run relationship between exports and economic growth in the Iranian economy in the presence of other relevant variables, a number of different cointegration techniques have been applied. The relatively small sample size of the available data and the existence of structural breaks such as regime change have led us to apply some new techniques, which can take into account the effects of such breaks on the long-term relationship. Some econometricians argue that the degree of cointegration becomes uncertain in the presence of structural breaks. The results of the Johansen approach, which does not take account of structural breaks, showed the existence of the one-cointegration relationship in the system for both estimated models. In addition, we employed the Gregory-Hansen (1996) technique and the Saikkonen and Lutkephol

(2000) cointegration approach to determine the long-run factors contributing to economic growth in the presence of structural breaks.

The Iranian economy has been subject to numerous shocks and regime shifts such as the 1974-75 oil shock, the upheavals consequential to the 1979 Islamic Revolution, the destructive eight-year (1980-1988) war with Iraq, the freezing of the country's foreign assets, a volatile international oil market, economic sanctions, and international economic isolation. Because of these, in this research it was important to use the GH (1996) and SL (2000) cointegration approaches in the presence of the structural breaks. The GH empirical results indicate that there is one cointegrating vector which links GDP with physical capital and the labour force and exports. In fact, the GH procedure confirmed again the existence of the one-cointegration vector for model (1). This procedure also established endogenously the existence and time of a structural break in the system. The time of the structural breaks endogenously determined by the GH procedure coincided with the effects of the Islamic revolution.

Under the assumption that the break point is known *a priori*, we applied an LR-type test based on the SL (2000) approach. In the presence of such structural breaks (revolution and war), the SL cointegration tests conducted in this study similarly indicate that there is one cointegrating vector which links GDP with physical capital, the labour force and exports (model 1). The SL cointegration test results for model (2) also remain robust despite disaggregating exports into the two categories of oil and non-oil exports as well as including human capital and imports. In fact, the results of using SL and taking into account the existence of the structural break, indicate that we cannot reject the null hypothesis (i.e. the existence of at least one cointegration vector) in all of the three cases in model (1) and two of the three cases for model (2). Therefore since in most cases the existence of one cointegration vector was established, then an ARDL cointegration approach was then applied to estimate and validate the long- and short-term determinants of economic growth in the Iranian economy.

Applying the ECM version of the ARDL model shows that the error correction coefficient, which determines the speed of adjustment, has an expected and highly significant negative sign. The results indicate that deviation from the long-term growth rate in GDP is corrected by approximately 40 percent and 60 percent, in the following year for model (1) and (2) respectively. The estimated model passes a battery of diagnostic tests and the graphical evidence (CUSUM and CUSUMQ graphs) indicates that the model is stable during the sample period. Finally, the estimated long-term coefficients show that while the effects of gross capital formation and oil exports are highly significant and impact strongly on GDP, those of the non-oil exports, the labour force and human capital remain even less substantial than previously expected. Consequently, in order to protect GDP from excessive reliance on oil exports, the diversification of the export base must appear right at the top of the government's priority list. One viable option involves a more intensive investment in the petrochemical industry as a whole. In this vein more efficacious non-oil export promotion policy should be considered of paramount importance. In order to pursue such a policy, further research is required on the GDP/export nexus, where "oil" is removed from the model. More specifically, cointegration and causality analyses between non-oil GDP and non-oil exports may yield a better understanding of potential short-term and/or long-term interplay among these variables. Obviously, such an understanding will be useful, not to say fundamental, to the implementation of a more effective non-oil export promotion policy.

Table 7.7. Autoregressive Distributed Lag Estimates (ARDL) for Model (1)

Model (1): ARDL (2,1,0,0) selected based on Schwarz Bayesian Criterion

Regressor	Coefficient	Standard Error	t-ratio[Prob]
LY (-1)	0.4120	0.1167	3.5300[.001]
LY (-2)	0.1860	.0839	2.2159[.034]
LK	0 .2471	.03141	7.8661[.000]
LK (-1)	-0.0922	.03603	-2.5588[.015]
LL	0 .0132	.04726	.27822[.783]
LX	0.1663	.01874	8.8761[.000]
INTP	0.5262	.10625	4.9523[.000]
D78	0.0388	.01395	2.7816[.009]
DU80	0.0325	.01023	3.1799[.003]

R-Squared .99776 R-Bar-Squared .99722
S.E. of Regression .011460 F-stat. F(8, 33) 1840.2[.000]
Mean of Dependent Variable 5.2630 S.D. of Dependent Variable .21739
Residual Sum of Squares .0043336 Equation Log-likelihood 133.1640
Akaike Info. Criterion 124.1640 Schwarz Bayesian Criterion 116.3445
DW-statistic 2.0430

****

Diagnostic Tests

****

Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ (1)= .068041[.794]	F (1, 32)= .051925[.821]
B: Functional Form	CHSQ (1)= .0074918[.931]	F(1, 32)= .0057091[.940]
C: Normality	CHSQ (2)= .10967[.947]	Not applicable
D: Hetroscedasticity	CHSQ(1)= .16590[.684]	F(1, 40)= .15863[.693]

Table 7.8. Autoregressive Distributed Lag Estimates (ARDL) for Model (2)

Model (2): ARDL (1,2,0,2,1,1) selected based on Schwarz Bayesian Criterion

Regressor	Coefficient	Standard Error	t-ratio[Prob]
LY (-1)	0.3985	0.09455	4.2147[.000]
LK	0.2933	0.03641	8.0559[.000]
LK (-1)	-0.0389	0.04425	-0.8805[.387]
LK (-2)	0.0795	0.03162	2.5167[.018]
LHC	0.0123	0.00885	1.3975[.174]
LXO	0.2459	0.02046	12.018[.000]
LXO (-1)	-0.0929	0.02050	-4.5325[.000]
LXO (-2)	0.0711	0.01857	3.8278[.001]
LXNO	-0.0047	0.00958	-0.4933[.626]
LXNO (-1)	0.0268	0.00932	2.8831[.008]
LM	-0.0189	0.02263	-0.8380[.410]
LM (-1)	-0.0621	0.02404	-2.5848[.016]
INTP	0.7273	0.14438	5.0377[.000]
D79	0.0588	0.01166	5.0483[.000]
DU80	0.1124	0.01798	6.2534[.000]

R-Squared 0.99898 R-Bar-Squared 0.99843
S.E. of Regression 0.0084759 F-stat. F (14, 26) 1823.1[.000]
Mean of Dependent Variable 5.2553 S.D. of Dependent Variable .21422
Residual Sum of Squares 0.0018678 Equation Log-likelihood 146.7526
Akaike Info. Criterion 131.7526 Schwarz Bayesian Criterion 118.9008
DW-statistic 2.2548 Durbin's h-statistic -1.0250[.305]

****

Diagnostic Tests

****

Test Statistics	LM Version	F Version
A: Serial Correlation	CHSQ (1)= 2.0252[.155]	F (1, 25)= 1.2991[.265]
B: Functional Form	CHSQ (1)= 4.0846[.043]	F (1, 25)= 2.7662[.109]
C: Normality	CHSQ (2)= 2.8432[.241]	Not applicable
D: Hetroscedasticity	CHSQ (1)= .44464[.505]	F (1, 39)= .42759[.517]

CHAPTER 8
SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

8.1. Introduction

The main purpose of this study was to examine the relationship between trade and GDP growth in an oil-based developing economy (Iran) over the past four decades. Making use of time series analyses, this study attempts to shed light on the sources of economic growth. In fact, this research has a three main objectives: to examine the trade/GDP nexus, to identify the major factors which determine GDP growth, and to examine the implications of the Iranian government's non-oil export promotion policies. In particular, this research examined the hypothesis of export-led growth in the context of an oil-based economy. In this regard, adopting a Feder-type model, we focused on export externality and factor productivity effects in the export sector relative to the non-export sector. In doing this, total exports were disaggregated into oil and non-oil exports, and examined in the presence of other relevant variables. In other words, in order to study the diversification effects of the Government's non-oil export promotion policy on the trade-GDP nexus, non-oil exports were also incorporated into the empirical analysis.

In order to determine the trade-GDP nexus in Iran, we applied both conventional and more recent econometric methods like unit root tests, cointegration techniques in the presence of structural breaks, as well as error correction versions of the ARDL model. The present chapter outlines the major findings of the study and looks at the policy implications of the study.

8.2. Summary and Conclusions of the Present Study

Chapter 1 presented the major objective of this study, namely to analyse the major determinants of economic growth for an oil-based developing country. Using a series of different econometric methodologies this study examined the relationship between trade and GDP growth, based on a Feder model and an extended Feder type model. Exports were assumed to have a positive effect on GDP expansion. In order to check the validity of this assumption, an attempt was made to analyse the effects of oil and non-oil exports on the process of economic growth in Iran. Chapter 1 has introduced four research questions: (1) is there a positive relationship between exports and economic growth in Iran? (2) are there significant structural breaks in the Iranian economy? (3) did oil and non-oil exports have any significant effect on economic growth and 4) is there a positive relationship between imports, human capital and gross capital formation and the GDP in Iran?

Chapter 2 of this research explores Iran's economic performance during the period (1960-2003). The most outstanding feature of the Iranian economy before the revolution was the 1973-74 oil boom, which fostered a sharp upward trend in economic growth. During the first decade after the 1979 revolution, the Iranian economy was subjected to a number of major problems, disruptions and shocks such as the revolution itself, the destructive Iran-Iraq war, the oil price collapse of 1986 and continuing U.S. sanctions which impacted on the economy adversely, preventing it from fully realizing its potential. In particular, the enormous cost of a devastating war with Iraq deprived the country of many opportunities for development.

During the second decade after the 1979 revolution, which was characterized by the post-war reconstruction and the implementation of the First, Second and Third Five-Year Development Plans (FYDPs), the economy began taking an upward trend. This was also due to a number of effective economic policies: trade liberalization, foreign exchange reform, and the non-oil exports promotion policy. Through offering shares in the Tehran stock exchange market and establishing free trade zones in order to attract foreign direct investment (FDI), these FYDPs were aimed at privatization of the economy.

While providing a general picture of the main features of the Iranian economy, the sectoral composition of the Iranian GDP was discussed as well. Quantitative analysis showed that Iran's dependency on oil has continued to affect the economy very significantly. In terms of GDP, it was found that GDP performance closely followed the performance of the value added in the oil sector. This dependency became even worse during the first decade after the revolution, which coincided with political turmoils, eight years of war with Iraq, diplomatic isolation and erratic economic policies. The composition of GDP changed dramatically after the revolution. While the agricultural and industrial shares in GDP had a modest increase, the share of the oil and gas sector in GDP decreased significantly due to the war damage and to a lack of investment in the sector. Further, the service sector share in GDP increased markedly. The increase in this sector was due to the expansion of bureaucracy and the armed forces, the unstable economic situation and the government's interventionist economic policies, rather than sound and timely development policies.

Chapter 3 turned to the analysis of the structure of Iran's foreign trade sector, looking at the share of trade represented by individual exports and imports, as well as at the importance of both the oil- and non-oil sectors in Iran's GDP. The external sector of the Iranian economy has also been riddled with an imbalance in its external accounts especially after the Islamic revolution. What we have observed in Chapter 3 is essentially the dominant role played by oil exports as compared to total exports in the Iranian economy. Oil dependency was the most important characteristic of the Iranian economy in both the pre- and post-revolutionary periods. Oil revenues not only allow the importation of consumer goods, but are also regarded as the main financing source of capital and intermediate goods for Iranian industry. Despite government policies aimed at promoting non-oil exports and diversification, Iran's dependence on oil revenue has continued and the country's GDP growth rate has remained tied to fluctuations in the price of oil on the international market.

The extreme decline and wild fluctuations in oil revenues, however, had left the government with almost no other option but to devise means to increase non-oil exports. The share of non-oil exports over the value of total exports increased from 10 percent during the first decade after the revolution to around 20-25 percent during the second decade after the revolution. Despite this, the contribution of non-oil exports to the trade balance surplus remained and still remains negligible, as non-oil exports are not large enough to compensate for the large value of Iran's imports. Following the implementation of the non-oil export promotion policy, the composition of the non-oil exports has also changed. While the share of total non-oil exports represented by manufactured goods increased, the share of total non-oil exports represented by agricultural products and traditional goods (such as carpets, pistachio nuts, caviar, and saffron), instead, decreased.

In Chapter 4, by reviewing the pertinent literature, we explained earlier models of the trade-GDP relationship and then re-examined this relationship in the light of new endogenous growth models. The earlier model of the welfare gain of trade was based on the theory of comparative advantage. The crux of these earlier theories is that international trade is the way to achieve static productivity efficiency and international competitiveness. Economic growth is merely a result of this strategy. Next attention was directed to trade-GDP nexus, analyzing it using new endogenous growth models. It was argued that importing countries gain knowledge, especially through technology embedded in the product traded and that such countries can take advantage of knowledge spill-over as well as technology transfer through international trade. 'Learning by doing' is another feature of endogenous growth models which is related to trade and this concept describes a channel through which human capital and knowledge of individuals or an economy accumulate.

Following this theoretical background, we turned our attention to empirical issues, examining them in the light of a comprehensive literature review in the area of the export-led growth hypothesis. The earliest empirical research on this nexus used correlation and production function studies of export-led growth (ELG), while more recent studies make use of causality and cointegration techniques. Correlation studies have shown that there is a positive correlation between export expansion and economic growth. Other researchers applied Feder-type models by including exports in a production function framework and they showed that the rate of growth in exports, added to labour force and investment growth resulted in GDP growth, i.e. ELG. Finally, there were other studies which included intermediate and capital imports in the model and some showed that there is a positive correlation between trade and GDP.

Finally, causality and cointegration studies of the relationship between exports, imports and GDP growth were then discussed. Some economists argued that export expansion is a consequence, rather than the cause, of economic growth and instead of using typical production function models, they performed causality tests to examine this relationship. The results were mixed: some found evidence ELG, some found GLE and some found bi-directional causality between exports and economic growth. Other empirical studies re-examined the question by using cointegration and error correction models. It was argued that by taking into account the long-run information in the data, the results from cointegration and error correction models are more statistically valid. Hence, the present study followed these more recent approaches in order to examine the relationship between exports and economic growth in Iran.

Based on the theoretical considerations and the empirical results as well as the main features of the Iranian economy presented in the previous chapters, Chapter 5 presented the underlying economic reasons behind the structural characteristics using an extended Feder-type model for an oil-based economy. In this model, the positive effects of the export sector on the rest of the economy were highlighted. In the same manner, the second model (the extended Feder model) was also used to examine the effects of disaggregating exports into the oil- and non-oil sectors in the effects of other variables like physical and human capital as well as imports on GDP growth. Specification of these models allowed us to evaluate the effects of changes in explanatory variables on the trade-GDP nexus in Iran. In these models, following Feder (1982), Balassa (1985) and Ghatak *et al*. (1997), we assumed that export expansion might generate positive externality through more efficient allocation of resources, efficient management and improved production techniques, specialization, competition and the economy of scale. We followed endogenous growth models, which make use of the same idea to analyze the broad externality effects of exports on the economy, but address the role of imports and human capital as well. In fact, following endogenous growth theory factors such as physical capital (R&D effects), human capital (representing knowledge spillover effects), export expansion (proxying positive externality effects), and capital and intermediate imports (capturing learning-by-doing effects) were considered as the major determiners of economic growth in the model specification of this study.

It should be noted that until now, most empirical research concerning the trade-GDP nexus had been done using conventional econometrics tests. Because the Iranian economy has been faced with significant structural breaks, applying only conventional tests would most likely result in misleading empirical findings (so-called ‘spurious regression’). For this reason, therefore, in Chapter 6 more recent methodologies like IO and AO unit root tests were applied to investigate the non-stationarity (or otherwise) of the Iranian macroeconomic data.

Chapter 6 dealt with the investigation of the stationarity of macroeconomic data in the Iranian economy. An overview of the Iranian economy in Chapter 2 had already revealed that the country had undergone a number of structural changes, e.g. the Islamic revolution, the destructive eight-year (1980-1988) war with Iraq, the freezing of the country's foreign assets, the volatile international oil market, as well as economic sanctions and international economic isolation. Leybourne and Newbold (2003) argued that if structural breaks are not dealt with appropriately, the empirical results obtained from the use of cointegration techniques could be spurious and misleading. For this reason, this research first used the Zivot and Andrews (1992) approach (ZA), allowing the data to determine endogenously, the single most important structural break in each series. Then in order to assure the robustness of our findings both the Innovational Outlier (IO) (assuming gradual changes in intercept and/or slope) and the Additive Outlier (AO) (assuming instantaneous changes in intercept) models were applied. The empirical results based on all these models provided no evidence against the null hypotheses of unit roots in the series under investigation. In other words, despite considering structural breaks in all series, all variables examined are found to be I(1). This is consistent with the results obtained by conventional unit root testing (ADF, and PP test). Following these tests, we employed the Lumasdaine and Papell (1997) procedure (LP) to specify a model able to accommodate two significant structural breaks in the data. The two breaks endogenously determined by this approach, however, are significant and consistent, as in virtually all cases they point to the same year of the structural breaks as was indicated by IO and AO or ZA procedures. The most significant structural breaks in these variables were determined *endogenously* and indeed occurred, as one would expect, either in the war period (1980s), at the time of the regime shift (1979), or contemporaneously with external factors such as the 1974-75 oil shocks or the oil price collapse in 1996.

In Chapter 7 the nature of economic growth in Iran was investigated using recent cointegration techniques. In order to overcome and avoid a number of potential problems which previous studies of the trade-GDP nexus had encountered, we adopted cointegration techniques as well as the ARDL approach, applied to a special form of the production function, which treats exports as a kind of production factor. The relatively small sample size of the available data and the existence of structural breaks like regime change have led us to apply some new techniques which can take into account the effect of such a break in the long-term relationship. The results of the Johansen approach, which does not take account of structural breaks, showed the existence of at least one cointegration relationship in the system for both estimated models. We employed the Gregory-Hansen (1996) technique and the Saikkonen - Lutkephol (2000) cointegration approach to determine the long-run factors contributing to economic growth in the presence of the structural breaks. The GH empirical results indicated that there is one cointegrating vector which links GDP with physical capital, labour force and exports. In fact, the GH procedure confirmed again the existence of the one cointegration vector. This procedure also established endogenously the existence and time of a structural break in the system. The endogenously determined time of the structural breaks by the GH procedure coincided with the effect of the Islamic revolution. Under the assumption that the break point is known *a priori*, we applied an LR-type test based on the SL (2000) approach, an improvement developed from the Johansen cointegration test. In the presence of such structural breaks (the 1979 Revolution and Iraqi-war), the SL cointegration tests conducted also indicated that there is one cointegrating vector which links GDP with physical capital, labour force and exports (model 1). These cointegration test results also remained robust despite disaggregating exports into the two categories of oil and non-oil exports as well as including human capital and imports in (model 2). In fact, the results of using SL and taking into account the existence of the structural break, indicated that we could not reject the null hypothesis (i.e. the existence of at least one cointegration vector) in all of the three cases in (model 1) and two of the three cases for (model 2).

In sum, conventional cointegration approaches like Johansen and more recent techniques like GH and SL yield similar results. Empirical results confirm that there exists at least one cointegration vector no matter which model is considered. Applying the ECM version of the ARDL model showed that the error correction coefficient, which determines the speed of adjustment, had an expected and highly significant negative sign. The results indicated that deviation from the long-term trend in GDP was corrected by approximately 0.40 percent and 0.60 percent, in the following year for (model 1) and (model 2), respectively. The estimated models passed a battery of diagnostic tests and the graphical evidence (CUSUM and CUSUMQ) indicates that both models were fairly stable during the sample period. Finally, the positive signs of the coefficients representing total exports (in model 1), oil exports (in model 2) and gross capital formation (in both models) in the cointegration vectors (long run equilibrium relationships) are statistically significant. In fact, this implies that these factors have played some positive role in the Iranian economy which is not explained by other factors such as the labour force, non-oil exports or total imports. The estimated long-term coefficients showed that while the effects of gross capital formation and oil exports are highly significant and impact strongly on GDP, those of the non-oil exports, labour force and human capital remain less important than previously expected. Consequently, in order to protect the economy from excessive reliance on oil exports, the diversification of the export base must appear right at the top of the government's priority list. One viable option involves a more intensive investment in the petrochemical industry as a whole. In this vein, more efficient and efficacious non-oil export promotion policy can be considered of paramount importance. In order to pursue such a policy, further research is required on the GDP-export nexus, where "oil" is removed from the model. More specifically, cointegration and causality analyses between non-oil GDP and non-oil exports may yield a better understanding of potential short-term and/or long-term interplay among these variables. Obviously, such an understanding will be useful, not to say fundamental, to the implementation of a more effective non-oil export promotion policy.

8.3. Policy Implications and Recommendations

It is evident that even the best policies cannot achieve the expected outcomes over-night. It is however, necessary to look at long-term results. Keeping this in mind, the following policy directions are proposed.

(1) Export promotion strategies are conducive to economic growth. In fact export expansion helps economic growth on both the supply and the demand side. In particular, the diversion of resources from the non-export sector to the export sector can improve the overall productivity of the economy. In addition, this favours the economy of scale and externalities due to the learning-by-doing effect. Iran should use policies to make non-oil exports more competitive in order to gain access to international markets. For this reason, joining the WTO and increasing the share of and diversity of non-oil exports in total exports should be considered as top priorities. Increasing the quality of non-oil export products, stabilizing the exchange rate, deregulating the banking sector as well as reforming the public sector would also lead to non-oil export expansion.

(2) Our empirical findings show smaller than expected effects of the non-oil export sector on the economic growth process in Iran. This is primarily because most of the Iranian non-oil exports are labour intensive (unskilled labour-based commodities) like traditional exports (e.g. carpet, handmaiden products, saffron, and caviar). Therefore, to promote non-oil exports, the Iranian government should encourage exporters to improve their competitive advantage and change their export pattern from traditional and unskilled labour-intensive products to more technological based and human capital-intensive goods. Increasing the

share of manufactured goods in total exports will be very important in this regard.

(3) Oil will undoubtedly continue to be the leading sector of the Iranian economy, pulling the other sectors in its wake. In order to exploit its comparative advantages, Iran should use oil as much as possible in the domestic industrial sector through vigorous expansion of energy-based industries such as petrochemical industries. In addition, since the price of both crude oil and natural gas fluctuates heavily, the Iranian government needs to look beyond these unrefined products. More investment in other petrochemical products (e.g. plastics, *et al.*) will be necessary in order to exploit Iran's comparative advantage in oil- and gas-based industries as well as protect the country from the wild fluctuations of these resources in their unrefined state.

(4) Export instability often reduces economic growth due to 'Dutch Disease' because it creates uncertainty as to the availability of foreign exchange, which is the primary source of government expenditure on development projects. Therefore any sharp decline in the oil price leads to a significant decline in capital imports as well as in government spending on investment projects and this leads to a dramatic decline in economic growth. On the other hand, temporary increases in the international oil price often fail to stimulate the economy because the oil revenues go to the government rather than to the private sector. This induces inefficiency in the economy and in the allocation of resources. For these reasons, the Iranian government should cooperate with other members of the OPEC countries to stabilize as much as possible the price of oil on the international market.

(5) The empirical findings of this research indicate that physical capital is vital to economic growth. This means that the efficiency of investment projects needs to be improved. Moreover, physical infrastructure must be upgraded and modernized. Another issue regarding gross capital formation is that of 'capital flight'. The recent political uncertainty in

Iran due to the conflict with the USA and European countries over Iran's nuclear energy program has a very negative effect on capital formation in Iran. In addition, this political uncertainty induces dangerous capital flight and in turn decreases economic growth. Some unofficial reports claim that this conflict has already led to serious capital flight from the country to overseas, and especially to the United Arab Emirate. Therefore it is very important that the Iranian policy makers take the necessary measures to resolve this political uncertainty as soon as possible. In other words, political stability is required in order to secure oil revenues, and hence capital formation and economic growth in Iran. Once the political environment is stable, structural reforms will be the key to improve growth performance over the medium and long term.

(6) The Iranian government has established low interest loans and other facilities to encourage industry, however they have continued to place too many restrictions, like trade barriers, on this sector. These are among the factors that have led to a lack of competitiveness in the manufacturing sector. Channeling investment into productive industries, which have the potential for global competition, is also recommended. Finally, it will be necessary to set a clear agenda for the attraction of FDI and the linking of privatization and liberalization programs in order to enhance the quality, efficiency and competitiveness of domestic production. Such a strategy will lead to further economic growth and development in Iran.

(7) Increased efficiency of human capital resources through education investment appears be an important explanatory factor in Iran's growth, but labour growth has had no statistically significant effect on the process of economic growth in Iran and this is probably because of low productivity and labour surplus. In addition, our empirical results show that human capital has had a less-than-expected effect on the growth process. Obviously, more needs to be done. The Iranian government should place more emphasis on education in order to improve the quality, skills and productivity of the labour force. More resources are

needed for primary and secondary education, as well as job training programs. As the IMF (2004) estimates Iran's illiteracy rate at 20 percent, despite previous progress in this area, it is obvious that education efforts need to be redoubled. The efficiency of human capital must be improved by further investment in education.

(8) The statistically insignificant impact of imports on the process of economic growth in Iran were perhaps due to inefficient governmental controls with its overzealous intervention policies of import restrictions and non-tariff barriers. This situation has led to uncertainty and encourages rent-seeking activities and can even favour corruption. Therefore, it is recommended that the Iranian government establish a relatively low and uniform tariff system and replace non-tariff barriers with tariffs. Furthermore, the elimination of barriers to the importation of capital and intermediate goods which are to be used for exporting commodities is highly recommended.

(9) Given the positive relationship between trade liberalisation and GDP expansion, an open trade policy will be an effective strategy for Iran in the long run. Therefore, it is recommended that the Iranian government continue the policy of trade liberalization, enhancing its international competitiveness by reducing barriers and restrictions on exports and imports. There is a political dimension to this issue as well. American economic sanctions cause Iran to pay much more for its capital imports. Since the U.S. and most European countries remain off-limits to Iran, it can only deal with countries like the U.A.E. and Turkey, which act as intermediates in the exchange, thus ramping up the cost. In order to offset this, in addition to diplomatic and other initiatives aimed in the long run at the elimination of such sanctions, Iran should increase its trade relationship with countries such as the newly industrialized countries of East Asia. In other words, more South-South trade should be considered as another way of overcoming the deleterious effects of the US trade embargo. It should be noted that a stable political and macroeconomic environment will play a significant role in this process.

(10) The performance of the Iranian Free Trade Zones needs to be re-examined and steps need to be taken to encourage the type of domestic and foreign direct investment that would provide more linkages between the domestic economy and international companies as well as aiding the transfer of technology.

As mentioned earlier, at present the Iranian economy is suffering due both to inefficient domestic policies and harmful international isolation and sanctions. Therefore, in order to take advantage of the dynamics of trade liberalization to promote growth, a series of complex multi-dimensional policies needs to be implemented.

Such policies could include:

- The establishment of institutions and mechanisms geared at fostering domestic R&D and investment in human capital. Once inefficient state-subsidized enterprises are privatized, an example of these might be joint ventures with foreign multinational concerns.

- The expansion of trade liberalization through policies aimed at reducing income inequality and wage disparity. This will help prevent political instability and social tensions from deterring foreign investment in export promoting industries.

- The stabilization of the exchange rate in order to prevent overvaluation, which can blunt the international competitiveness of potential export industries.

- The achievement of macroeconomic stability through monetary and fiscal policies reforms which target inflation. Internal and external balances are necessary for macroeconomic stability, which leads to the trade-growth nexus dynamic.

- The achievement of fiscal and current account sustainability in order to stabilize the debt/GDP ratio and avoid the need for debt rescheduling due to balance of payment crises.

- Strengthening of domestic financial institutions prior to capital account liberalisation in order to integrate the economy with the global market without becoming vulnerable to speculative attacks and currency crises.

8.4. Suggestions for Future Research

As indicated earlier, while the ZA (1992), the Perron (1997), and the LP (1997) approaches are the most advanced methods to endogenously detect one or at most two significant structural breaks in the data, these models are still unable to identify multiple structural breaks. Attempts to apply such methods in the presence of multiple breaks may yield conflicting results. Further research to refine these procedures and resolve such inconsistencies will be needed.

In order to capture multiple structural breaks, developing a new computer algorithm is needed to facilitate the testing of the strengths of the export-growth nexus. The same algorithm could be used to test the strength of the cointegration relationship among other vectors of macroeconomic time series data, both for Iran and for other developing countries data which are influenced by the potential presence of multiple structural breaks.

The procedures implemented in this research in regard to Iran could be applied to other developing countries, especially other oil-exporting countries. The structural breaks would, of course, be specific to the countries under consideration. In fact, non-oil exporting countries, which instead may have for example a dominant agricultural export economy, could use similar procedures to determine the relationship between agricultural exports and GDP growth in their economy.

The present study has examined the relationship between export (oil and non-oil) and GDP. Future research that would exclude oil from GDP could help identify any potential relationship between these and would be useful for future policy decisions. In other words, investigation into the effects of non-oil exports on GDP minus oil (GDP excluding oil) would extend this study. Another issue for further research is the role of exports in individual sectors of the economy and their economic performance (i.e. the sectoral value added). This would allow us to formulate policies specific to individual sectors of the economy.

A third area for future research pertains to the existence of possible feedback relationships among the variables included in the models used in this study using Granger causality tests. This as well as other areas of bi-directional causality could be explored using a simultaneous equation model as well. The presence of strong feedback effects would rationalize the use of relevant estimation methods, which overcome the problem of simultaneous equation bias in modeling the trade-growth nexus. The 2SLS, 3SLS and FIML methods can address this problem of simultaneous equations bias.

Fourth, in the case of Iran the use of computable general equilibrium (CGE) modeling which has already been applied by researchers to analyse the efficacy of poverty reduction programs could perhaps be extended to analyse the effects of trade liberalisation on sectoral growth. Applying this methodology can shed light on the sector-specific effects of badly designed policies such as inefficient subsidies, exchange rate overvaluation, oil price changes, etc.

Alternatively, future research on the trade-GDP nexus might involve the development of a wide array of data (e.g. quarterly data, aggregated and disaggregated data or sectoral data). For instance, the total GDP could be disaggregated into tradable and non-tradable and potential links between the two sectors could be investigated in order to formulate narrowly targeted economic growth policies. Similarly, non-oil output could be disaggregated into tradable and non-tradable, and non-oil tradable goods could be further disaggregated into agriculture and industrial and mining products.

Finally, studies that investigate the specific relationship between non-oil exports and TFP growth may also generate some useful policy insights. The analysis of the effects of trade performance on macroeconomic factors such as the balance of payments will provide better understanding of the effect of trade expansion on the process of economic growth in Iran. The study could be further extended to include other relevant variables for determining economic growth. In other words, future research in this area could also consider other variables like the effect of the exchange rate, tariffs, government expenditure, balance of payment constraint and the rate of inflation. This could enable the quantification of the negative effects on the trade-growth nexus of badly designed or implemented policies related to such issues as exchange rate management, trade and protection or monetary and fiscal stability.

BIBLIOGRAPHY

Ahmad, J and A. Kwan (1991), "Causality Between Exports and Economic Growth: Empirical Evidence From Africa," *Economics Letters,* 37: 243-48.

Al-Yousif, Y. K. (1997), "Exports and Economic Growth: Some Empirical Evidence From the Arab Gulf Countries", *Applied Economics*, 29: 263-7.

Amirahmadi, H. (1990), *Revolution and Economic Transition: the Iranian Experience*, Albany: State University of New York Press, USA .

Amirkhalkhali, S and A. Dar (1995), "A Varying-Coefficients Model of Export Expansion, Factor Accumulation and Economic Growth: Evidence From Cross-Country, Time Series Data," *Economic Modeling,* 12: 435-41.

Amuzegar, J. (1993), *Iran's Economy Under the Islamic Republic*, London and New York: I.B. Tauris & Co Ltd. .

Azimi, H (1992), *Circles of Underdevelopment in the Economy of Iran*, Nashre- Nei Publication Co, Tehran [in Persian].

Bahmani-Oskooee, M. (1993), "Black Market Exchange Rate Versus Official Exchange Rates in Testing Purchasing Power Parity: An Examination of the Iranian Rial," *Applied Economics*, 25(4): 465-72.

Bahmani-Oskooee, M. (2001), "How Stable is M2 Money Demand Function in Japan?," *Japan and World Economy* ", 13: 455-461.

Bahmani-Oskooee, M., and J. Alse (1993), "Export Growth and Economic Growth: An Application of Cointegration and Error Correction Modeling," *The Journal of Developing Areas*, 27: 535-42.

Bahmani-Oskooee, M., H. Mohtad, and G. Shabsigh (1991), "Exports, Growth and Causality in LDCs: a Re-Examination," *Journal of Development Economics*, 36: 405-15.

Bahmani-Oskooee, M. and A. Nasir (2004), "ARDL Approach to Test the Productivity Bias Hypothesis," *Review of Development Economics,* 8(3): 483-88.

Bai, J., and P. Perron, (2003), "Computation and Analysis of Multiple Structural Changes Models," *Journal of Applied Econometrics*, 18: 1-22

Balasa, B. (1978), "Exports and Economic Growth: Further Evidence, " *Journal of Development Economic, 5*: 181-89.

Balassa, B. (1985), " Exports, Policy Choices, and Economic Growth in Developing Countries After the 1973 Oil Shock," *Journal of Development Economics* , 18(1): 23-35.

Baldwin, R. E (2003)," Openness and Growth: Whats's the Empircal Relationship? *NBER working papers*, No. 9578, Cambridge, Mass: National Bureau of Economic Research.

Bannerjee, A., J. Dolado, and R. Mestre (1998), "Error-Correction Mechanism Tests for Cointegration in Single Equation Framework," *Journal of Time Series Analysis*, 19(3): 267-83.

Barro, R. J. and X. Sala-i-Martin (1995), *Economic Growth,* New York, McGraw-Hill.

Ben-David, D., R. Lumsdaine, and D.H. Papell, (2003),"Unit Root, Postwar Slowdowns and Long-Run Growth: Evidence From Two Structural Breaks, " *Empirical Economics*, 28(2): 303-319.

Ben-David, D. and D.H. Papell (1997), "Slowdowns and Meltdowns: Post-war Growth Evidence from 74 Countries," *The Review of Economics and Statistics* 80(4): 561-571.

Bhagwati, J. (1958)," Immiserizing Growth: a Geometric Note", *Review of Economic Studies*, 25(3):201-5.

Bhagwati, J (1978), *Foreign Trade Regimes and Economic Development*, Cambridge, Mass., Ballinger.

Braconier, H. and F. Sjoholm (1999), " National and International Spillovers from R&D: Comparing a Neoclassical and an Endogenous Growth Approach," *Review of Economics* 134 (4): 8-663.

Central Bank of Iran, ‘CBI’ Bulletin (Various issues between 1980 and 2001).

Central Bank of Iran 'CBI' Annual Review (different issues).

Central Bank of Iran (CBI, 2000), *Economic Report* and Balance sheet 1377(1999), Research and Policy Department, Tehran.

Central Bank of Iran (2001a), Economic Report and Balance sheet 1378 (March 20, 2000), Economic Research and Policy Department, Tehran.

Central Bank of Iran (2001b), *Iran's National Accounts,* and Tehran: Bureau of Economic Accounts, Bank Markazi Iran.

Central Bank of Iran (2002a) Economic Trend, 2001 / 02, No.24, Bank Markazi Iran, Tehran.

Central Bank of Iran (2002b), Economic Report and Balance Sheet 1379(2000/01), Economic Research and Policy Department, Tehran,

Central Bank of Iran (2003), Economic Trends, 2002/03, Fourth quarter, no.31.

Central Bank of Iran (2004), *Iran's National Accounts*, Tehran: Bureau of Economic Accounts.

Chaudhri, D.P., and E.J Wilson (1995), "Sources of Modern Economic Growth: Theoretical and Empirical Explorations with Asian Focus", mimeo.

Chow, P. C. Y. (1987), "Causality Between Export Growth and Industrial Development: Empirical Evidence From The NICs", *Journal of Development Economics* 26: 55-63.

Chowdhury, K. (1992), "On Trade And Economic Growth: Further Evidence," *University Of Wollongong Working Paper*, No. 92-7: 13.

Chuang, Y-C. (1998), "Learning by Doing, the Technology Gap and Growth," *International Economic Review,* 39:697-721.

Christiano, L (1992)," Searching For A Break in GNP," *Journal of Business and Economic Statistics,* July.

Cihan C and D. Dutta (2005), "Trade Liberalization and Economic Growth in Turkey: An Empirical Model of Endogenous Growth Analysis," *Working Paper series No*: *ECON2005-7*, School of Economics and Political Science, University of Sydney.

Coe, D. and E. Helpman (1995), "International R & D Spillover," *European Economic Review*, 39(5): 859-887.

Coe, D., E. Helpman, and A. W. Hoffmaister (1997), "North-South R & D Spillovers," *Economic Journal*, 107: 134-149.

Dadkhah, K. M (1996),"Iran and Global Financial Markets: Direct Foreign Investment versus International Borrowing," *Conference on Iran and Emerging Global Order*, 28-31 March, Conventory University, Conventory.

Dadkhah, K. M and H. Zangeneh (2001)," Liberalizing Foreign Trade: An Imperative for the Health and Growth of the Iranian Economy," *Journal of Iranian Research and Analysis*, 17(2):64-86.

Dickey, D. A. and W. A. Fuller (1979), "Distributions of the Estimators for Autoregressive Time Series with a Unit Root," *Journal of the American Statistical Association,* 74(366): 427-81.

Dickey, D. A. and W. A. Fuller (1981)," Likelihood Ratio Statistics for Autoregressive Time Series with a Unit root," *Econometrica*, 49(4): 1057-72.

Dodaro, S. (1993), "Exports and Growth: A Reconsideration of Causality, "*Journal of Developing Area,* 27: 227-44.

Dutta, D and N. Ahmed (2004), "Trade liberalization and industrial growth in Pakistan: A cointegration analysis," *Applied Economics*, 36 (13):1421-29.

Economist Intelligence Unit, 'EIU' (2000), "*Country Profile Iran*, *Annual Report* ", London.

Enders, W.(2004) *, Applied Econometrics Time Series*, 2nd edition , New Jersey, J.Wiley.

Engelbrecht, H-J. (1997), " International R& D Spillovers, Human Capital and Productivity in OECD Economies: An Empirical Investigation," *European Economic Review,* 41: 1479-1488.

Engle, R. F., and C. W. J. Granger (1987), "Cointegration and Error Correction: Representation, Estimation and Testing," *Econometrics, 55*(2): 251-76.

Eviews 5 User's Guide (2004), Irvine, California, Quantitative Microsoftware.

Export promotion Center of Iran 'EPCI' Different Reports Between 2001 and 2002.

Feder, G. (1982), "On Exports and Economic Growth," *Journal of Development Economics*, 12: 59-73.

Fosu, A. K. (1990),"Exports and Economic Growth: the African Case," *World Developmen*t, 18: 831-5.

Frankel, J. A. and D. Romer (1999), " Does Trade Cause Growth," *The American Economic Review*, June 1999, pp. 379-399.

Ghatak, S., C. Milner, and U. Utkulu (1997), "Exports, Export Composition and Growth: Cointegration and Causality Evidence for Malaysia," *Applied Economics,* 29(2): 213-23.

Ghatak S. and J. Siddiki (2001), "The use of ARDL Approach in Estimating Virtual Exchange Rates in India", *Journal of Applied Statistics*, 28(5): 573-583

Giles, D., J. Giles, and E. McCann, (1992), "Causality, Unit Roots and Export-Led Growth: The New Zealand Experience," *Journal of International Trade and Economic Development,* 1: 195-218.

Giles, J., and C. Williams (2000)," Export-Led Growth: A Survey of the Empirical Literature and Some Non-Causality Results Part 1", *Econometrics working paper, No. EWP0001, University of Victoria, Canada.*

Greenaway, D. and D. Spasford (1994), "What Does Liberalization Do for Exports and Growth," *Weltwirtschaftliches Archiv,* 130: 152-74.

Gregory, A.W., and B.E. Hansen (1996), " Residual-based Tests for Cointegration in Models with Regime Shifts," *Journal of Econometrics*, 70(1): 99-126.

Gregory, A.W., J.M. Nason and D.G. Watt. (1996), "Testing for Structural Breaks in Cointegrated Relationships," *Journal of Econometrics*, 71: 321-341.

Grossman, G., and E. Helpman (1990a)"Comparative Advantage and Long Run Growth," *American Economic Review,* 80: 796-815.

Grossman, G., and E. Helpman (1990b), " The New Growth Theory: Trade, Innovation and Growth," *American Economic Review*, 80(2):86-91.

Grossman, G., and E. Helpman, (1991),"Trade, Knowledge Spillovers and Growth," *European Economic Review*, 35: 517-526.

Grossman, G. M. and E. Helpman (1994)," Endogenous Innovation in the Theory of Growth," *Journal of Economic Perspectives*, Winter 23-44.

Haerian Ardakani. M. (1996), " The Role of Oil Exports in the Economic Development of Iran, 1960-1992", PhD Dissertation, Department of Economics, University of Wollongong, Australia.

Hakimian, H (1999), Institutional Changes and Macroeconomic Performance in Iran: Two Decades after the Revolution (1979-1999)," *ERF working paper* No.9909.

Hakimian H, and M. Karshenas (2000), "Dilemmas and Prospects for Economic Reform and Reconstruction in Iran," in P. Alizadeh (Eds.) *Iran's Economy: Dilemmas of an Islamic State*, London: I.B. Tauris, pp. 29-62.

Harris, R. and R. Sollis (2003), *Applied Time Series Modeling and Forecasting*, John Wiley, New York.

Hendry, D. (1996). " A Theory of Co-breaking," Paper Presented at the Time Series Meeting Organized by NBER-NSF.

Ibrahim, I. and C. R. MacPhee (2003), "Export Externalities and Economic Growth, "*Trade and Economic Development,* 12(3): 257-283.

International Monetary Fund 'IMF' (2002), Islamic Republic of Iran: Selected issues and Statistical Appendix: IMF Country Report, No.02/212.

International Monetary Fund (2004), *International Financial Statistics*, International Financial Statistics Online Service, (http://ifs.apdi.net/imf/logon.aspx), IMF, Washington D.C.82.

Iran Chamber of Commerce, Industries and Mines (ICCIM), Weekly, Different issues.

Iran Chamber of Commerce, Industries and Mines 'ICCIM' (1999), "Export Policies of the Third Plan," available at < http://www.iccim.org/english/magazine/iran_commerce1999/04.htm >

Iran Chamber of Commerce, Industries and Mines 'ICCIM' (2002), "Non-Oil Exports in Post-Revolution Era", available at <http://www.iccim.org/english/magazine/iran_commerce-2002/14.htm>

Iran Exports Magazine (2002), Non-oil Exports, January 2002, No.68:28-30.

Jalali-Naini, A (2003) Economic Growth in Iran: 1950-2000, ERF working paper, January.

Jayme Jr, F. G. (2001)."Notes on Trade and Growth", *UFMG Working Paper,* No. 166: 25.

Johansen, S. and K. Juselius (1990), "Maximum Likelihood Estimation and Inference on Cointegration - with Application to the Demand For Money", *Oxford Bulletin of Economics and Statistics* 52(2): 169-210.

Jones, L. E., and R.E. Manuelli (1990),"A Convex Model of Equilibrium growth: Theory and Policy Implication", *Journal of Political Economy*, 98(5): 1008-1038.

Jung, W.S and P.J. Marshall (1985),"Exports, Growth and Causality in Developing Countries", *Development Economics,* 18: 1-12.

Karshenas, M. and H. Pessaran (1995), "Economic Reform and Reconstruction of the Iranian Economy ", *Middle East Journal*, 49(1): 89-111.

Karunaratne, N.D. (1996)," Growth and Trade Dynamics under Regime Shifts in Australia," *Journal of Economic Studies*, 23(2): 55-69.

Karunaratne, N.D. (1998), "Exogeniety Modeling of Growth and Trade ", in S. Paul (Eds.), *Trade and Growth*: *New Theory and the Australian Experiences*, St. Leonards, N.S.W: Allen & Unwin, PP. 132-143.

Keller, W. (1998),"Are International R & D Spillovers Trade-Related? Analyzing Spillovers Among Randomly Matched Trade Partners", *European Economic Review*, 42: 1469-1481.

Khan, A. H and N. Saqib (1993),"Exports and Economic Growth: the Pakistan Experience", *International Economic Journal,* 7: 53-64.

Khoshgou, M.R (2002), "Role of the Exports in National Economy", Iran Exports Magazine, No.68: 12-15: available at<http://www.iranexportsmagazine.com/Archive/Mag68>

Krueger, A. O (1978), *Foreign Trade Regimes and Economic Development: Liberalization Attempts and Consequences*, Cambridge, Mass: Ballinger Publishing Company.

Krueger, A. O (1986), "Problems of Liberalization" In Aremeane M. Choksi and Demetris Papageorgiou (Eds.), *Economic Liberalization in Developing Countries*, Oxford , New York, Basil Blackwell, PP.15-31.

Krugman, P. R. (1986), *Strategic Trade Policy and the New International Economics.* Cambridge, Mass., MIT Press.

Krugman, P. R., and M. Obstfeld (2000), *International Economics: Theory and Policy,* Reading, Mass.; Harlow, Addison-Wesley.

Kugler, P. (1991). "Growth, Exports and Cointegration: an Empirical Investigation'." *Weltwirtschaftliches Archiv,* 127: 73-82.

Kunitomo, N. (1996), "Tests of Unit Roots and Cointegration Hypotheses in Econometric Models", *Japanese Economic Review*, 47(1): 79-109.

Lee F.Y and W. E. Cole (1994) Simultaneity in the Study of Exports and Economic Growth, *International Economic Journal*, 8(1): 33-40.

Leybourne, S.J and P. Newbold (2003), "Spurious Rejections by Cointegration Tests induced by Structural Breaks", Applied *Economics*, 35(9): 1117-21.

Long, N. and K. Wong (1997), Endogenous Growth and International Trade: A Survey, in Jensen, B and Wong, K (Eds.), *Dynamics, Economic Growth and International Trade*, University of Michigan Press.

Lucas, R. E. (1988), "On the Mechanics of Economic Development", *Journal of Monetary Economics*, 22(1): 3-42.

Lumsdaine, R. L., and D.H. Papell (1997),"Multiple Trend Breaks and the Unit Root Hypothesis", *Review of Economics and Statistics*, 79(2): 212-218.

Lütkepohl, H., and J. Wolters (2003), " Transmission of German Monetary Policy in the Pre-Euro Period", *Macroeconomic Dynamics*, 7: 711-733.

MacKinnon, J.G (1991), " Critical Values for Cointegration Tests", in Engle, R.F, and Granger, C.W (Eds), *Long-run Economic Relationships*, Oxford University Press, Oxford.

Management and Planning Organization of Iran 'MPOI' (1994), The Documents of second Five-year Plan for Economic, Social and Cultural development of the Islamic Republic of Iran (1994-1998), Vol.11, Tehran(in Persian).

Management and Planning Organization of Iran 'MPOI' (2002), *Challenges and Features of the Development in Iran*, Institute For Management and Planning Studies, Tehran. (in Persian).

Mankiw, N. G., D. Romer, and D.N. Weil, (1992), "A Contribution to the Empirics of Economic Growth", *Quarterly Journal of Economics,* 102(2): 407-437.

Mazarei, A. (1996), " The Iranian Economy Under Islamic Republic: Institutional Change and Macroeconomic Performance (1979-1990)", *Cambridge Journal of Economics*, 20(3): 289-314.

McCombie, J. and A. Thirlwall. (1999), "Growth in an International Context: a post

Keynesian view, " in Deprez, J. and J. Harvey (Eds.), *Foundations of International Economics: Post Keynesian Perspectives,* London, Routledge.

Metwally, M.M., (1993)," International Interdependence and Economic Development in Asian countries," *The India Economic Journal*, 40 (3): 58-75.

Metwally M,M, and Tamaschke, H.U.,(1980), "Oil Exports and Economic Growth in Middle East", *Kyklos*, 33: 499-522.

Michaely, M. (1977), " Exports and Growth: An Empirical Investigation," *Journal of Development Economics,* 4: 49-53.

National Iranian Oil company (NIOC) Reports, various issues, Tehran, NIOC.

Ng, S., and P. Perron (1995)," Unit Root Tests in ARMA Models with data Dependent Methods for the Selection of the Truncation Lag", *Journal of the American Statistical Association*, 90: 268-281.

OPEC, (2000) *Annual Report 1999*, Public Relations & Information Department Vienna.

Pack, H. (1994), "Endogenous Growth Theory: Intellectual Appeal and Empirical Shortcoming", *Journal of Economic Perspectives*, 8(1): 55-72.

Paul, S. (1998), "Exports and Growth review of empirical evidence", in S. Paul (Eds.), *Trade and Growth*: *New Theory and the Australian Experiences*, St. Leonards, N.S.W.: Allen & Unwin.

Perron, P. (1989), "The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis", *Econometrica*, 57(6): 1361–1401.

Perron, P. (1994),"Unit Root and Structural Change in Macroeconomic Time series", in Rao. B. (Eds.), *Cointegration for the Applied Economist*, London, Macmillan.

Perron, P. (1997)," Further Evidence on Breaking Trend Functions in Macroeconomic Variables", *Journal of Econometrics,* 80(2): 355-385.

Perron, P. and T. Vogelsang (1992), "Nonstationarity and Level Shifts with an Application to Purchasing Power Parity", *Journal of Business and Economic Statistics* 10(3): 301-320.

Pesaran, M.H. (1995)," Planning and Macroeconomic Stabilisation in Iran", *DAE Working Papers Amalgamated Series No. 9508*, Department of Applied Economics, Cambridge University, Cambridge.U.K.

Pesaran, M.H (2000), " Economic Trends and Macroeconomic Policies in Post-Revolutionary Iran, *Journal of Money and Banking*, Central Bank of Iran 1(2): 26-66.

Pesaran, M.H. and B. Pesaran (1997), *Working with Microfit 4.0: Interactive*

Econometric Analysis, Oxford: Oxford University Press.

Pesaran, M.H., and Y. Shin (1996), "Cointegration and Speed of Convergence to Equilibrium", *Journal of Econometrics*, 71(1-2): 117-43.

Pesaran, M. H., Y. Shin and R.J. Smith (2001), "Bounds Testing Approaches to the Analysis of Level Relationships", *Journal of Applied Econometrics* 16(3): 289-326.

Pesaran, M. H. and R. Smith (1998)," Structural Analysis of Cointegration VARs", Journal of *Economic Surveys* 12(5): 471-505.

Phillips, P. and P. Perron. (1988), "Testing for a Unit Toot in Time Series Regression" *, Biometrica* 75(2): 335-346.

Ram, R. (1987)," Exports and Economic Growth in Developing Countries: Evidence from Time Series and Cross-section Data", *Journal of Economic Development and Cultural Change,* 36: (1): 121-30.

Razzaghi, E. (1992), *The Iranian Economy*, Tehran: Ney Publishing House [in Persian].

Rebelo, S. (1991), "Long-Run Policy Analysis and Long-Run Growth", *Journal of Political Economy*, 99: 500-521.

Ribeiro Ramos, F. (2001), "Exports, Imports, and Economic Growth in Portugal: Evidence from Causality and Cointegration Analysis," *Economic Modelling*, 18(4): 613-623.

Riezman, R. G., P.M. Summers and C.H. Whiteman (1996), "The Engine of Growth or It's Handmaiden? A Time Series Assessment of Export-Led Growth", *Empirical Economics,* 21: 77-113.

Rodriguez, F., and D. Rodrik (1999), " Trade Policy and economic Growth: A Skeptic's Guide to the Cross- National Evidence", *NBER working paper Series*, 7081, National Bureau and Economic Research.

Rodrik, D. (1999), "The New Global Economy and Developing Countries: Making Openness Work", *Policy Essay,* No. 24, Overseas Development Council, Washington, DC.

Romer, P. M. (1990), "Endogenous Technological Change", *Journal of Political Economy,* 98(5): 71-102.

Romer, P. M. (1994), "New Goods, Old Theory, and the Welfare Costs of Trade Restrictions", *Journal of Development Economics,* 43: 5-38.

Saikkonen, P. and H. Lütkepohl (2000a), "Testing for the Cointegrating Rank of a VAR Process with an Intercept", *Econometric Theory,* 16(3): 373-406.

Saikkonen, P. and H. Lütkepohl (2000b),"Testing for the Cointegrating Rank of a VAR process with Structural Shifts," *Journal of Business and Economic Statistics*, 18(4): 451-464.

Saikkonen, P. and H. Lütkepohl (2000c)," Trend Adjustment Prior to Testing for the Cointegrating Rank of a Vector Autoregressive Process", *Journal of Time Series Analysis* 21: 435-456.

Salehi Esfahani, H (1991)," Exports, Imports, and Economic Growth in Semi-Industrialized Countries", *Journal of Development Economics,* 35(1): 93-116.

Salehkhou, R (1999), *The Islamic Republic of Iran: your Partner in Trade,* Institute for Trade Studies and Research, Tehran.

Sana'te Haml-O-Naghl (1995), "The Performance of Iran's Export in the First Development Plan," available at <http://www.irvl.net/Firan5.HTM>

Sengupta, J. K. (1993), "Growth in NICs in Asia: Some Tests of New Growth Theory", *Journal of Development Studies*, 29(2): 342-57.

Shafaeddin, M (2001), "Diversification, Employment and Development: Towards A Long-Term Strategy for an Oil-Exporting Country; The Case of Iran," *ERF working paper*, No.200113.

Sharma, S. C. and D. Dhakal (1994), "Causal Analysis Between Exports and Economic Growth in Developing Countries", *Applied Economics,* 26: 1145-57.

Sprout, R. V. A. and J. H. Weaver (1993), "Exports and Economic Growth in a Simultaneous Equations Model", *Journal of Developing Areas,* 27: 289-306.

Tabibian, M., M. Rashidi, and K. Sadighi (2000), *Pre-Data Process System (PDS)*, Institute for Research and Economic Development, Tehran.

Tayebi, S.K (1996), *Econometric Modeling of Imports Demand in Developing Countries: The Case of Iran (1970-1993)*, PhD Dissertation, Department of Economics, University of Wollongong, Australia.

Tyler, W., (1981), "Growth and Export Expansion in Developing Countries: Some Empirical Evidence", *Journal of Development Economics, 9*: 121-30.

Valadkhani, A. (1996), *A Macroeconometric Model For the Iranian Economy*, PhD Dissertation, Department of Economics, University of Queensland, Australia.

Valadkhani, A. (2004), " What Determine Private Investment in Iran?," *International Journal of Social Economics,* 31(5/6): 457-468.

Van, P. H., and H. Y. Wan (1997)," Interpreting East Asian Growth", in Jensen, B and Wong, K (Eds.), *Dynamics, Economic Growth and International Trade*, University of Michigan Press.

Van den Berg, H. (1996), "Trade as the Engine of Growth in Asia: What the Econometric Evidence Reveals", *Journal of Economic Integration*, 11(4): 510-38.

Van den Berg, H. (1997), "The Relationship Between International Trade and Economic Growth in Mexico", *North American Journal of Economics and Finance,* 8(1): 1-21.

Van den Berg, H., and J. R. Schmidt (1994), "Foreign Trade and Economic Growth: Time Series Evidence From Latin America", *Journal of International Trade and Economic Development,* 3: 249-68.

Vohra, R.(2001)," Exports and Economic Growth: Further Time Series Evidence from Less-developed Countries", *International Applied Economic Research, 7(3): 345-350.*

Weinhold, D. and J.E. Rauch (1997), "Openness, Specialization and Productivity Growth in Less Developed Countries", *NBER working paper*, No. 6131. National Bureau and Economic Research.

Yaghmaian, B. (1994), "An Empirical Investigation of Exports, Development and Growth in Developing Countries: Challenging the Neo-Classical Theory of Export-Led Growth," *World Development*, 22: 1977-95.

Yavari, K (1996), *Oil shocks, Exchange Rates and Resource Allocation in Iran (1960-1992)*, PhD Dissertation, Graduate Department of Economics, University of Toronto, Canada.

Yousefi, M.G (1994), The Impact of Oil Export on the Economy of OPEC Countries: An Empirical Investigation, *The Indian Economic Journal*, 42(3): 131-145.

Zangeneh, H (1997), "Direction and Evaluation of the International Trade in Iran: An Empirical Appraisal", *Research in Middle East Economics,* 2: 165-191.

Zivot, E., and D.W.K. Andrews (1992),"Further Evidence on the Great Crash, the Oil Price Shock, and the Unit Root Hypothesis", *Journal of Business and Economic Statistics*, 10(3), 251-70.

LIST OF CANDIDATE'S PUBLICATIONS

Pahlavani, M (2005), "Cointegration and Structural Change in the Exports-GDP Nexus: The Case of Iran", *International Journal of Applied Econometrics and Quantitative Studies*, 2 (4), www.usc.es/~economet/eaa.htm

Pahlavani, M., Valadkhani, A. and Worthington, A, (2005), "The Impact of Financial Deregulation on Monetary Aggregates and Interest Rates in Australia", *Applied Financial Economics Letters*, 1 (3), www.tandf.co.uk/journals.

Pahlavani, M., Wilson, E.J, and Worthington, A.C (2005) "Trade-GDP Nexus in Iran: An Application of the Autoregressive Distributed Lag (ARDL) Model", *American Journal of Applied Science,* 2 (7),http://www.ansinet.org/sciencepub/journals.html

Valadkhani, A, Layton, A. and Pahlavani, M. (2005), "Multiple structural Breaks in Australia's Macroeconomic Data: An Application of the Lumsdaine and Papell test", *International Journal of Applied Econometrics and Quantitative Studies,* 2 (3). www.usc.es/~economet/eaa.htm

Pahlavani, M. (2005) "Sources of Economic Growth in Iran**:** A Cointegration analysis in the Presence of Structural Breaks", *Applied Econometrics and International Development*, 5 (4). http://www.usc.es/~economet/aeid.htm

Pahlavani, M., Valadkhani, A. and Andrew Worthington (2005) "Testing for Structural Breaks in Australia's Monetary Aggregates and Interest Rates: An Application of the Innovational Outlier and Additive Outlier Models", *University of Wollongong, Working paper series*, WP 05-02, March. http://www.uow.edu.au/commerce/econ/workingpapers/wp05-02ab.html

Valadkhani, A, Layton, A. and Pahlavani, M. (2005), "Multiple structural Breaks in Australia's Macroeconomic Data: An Application of the Lumsdaine and Papell test", *University of Wollongong, Working paper series*, WP 05-17, July. http://www.uow.edu.au/commerce/econ/workingpapers/wp05-17ab.html

Pahlavani, M. (2005), "Analysing the Trade-GDP Nexus in Iran: A Bounds Testing Approach", *University of Wollongong, Working paper series*, WP 05-25, October. http://www.uow.edu.au/commerce/econ/workingpapers/WP05-25.pdf

Pahlavani, M., Valadkhani, A and Wilson, E.J. (2005) "Structural breaks in Australia's macroeconomic data: An application of the Perron and Zivot-Andrews tests", accepted for presentation at "*2005 Midwest Macroeconomic Meeting"* in Iowa City, USA, (20th May)

Pahlavani, M., and Ed Wilson (2005) "Structural Breaks, Unit Roots and Postwar Slowdowns in the Iranian economy", Presented and Published at *2005 International Conference in Economics and Finance*, 26-27 May, Labuan, Malaysia,.http://wwwkal.ums.edu.my/icef2005

Pahlavani, M., Valadkhani, A and Wilson (2005), "An Empirical Investigation of Structural Breaks and Stationarity in Australia's Macroeconomic Time series", Presented and Published at 2005 New Zealand Association of Economists, 29 Jun-1 July, Christchurch, New Zealand. http://www.nzae.org.nz/conferences/2005/

Pahlavani, M. and Ed Wilson (2005) "Unit Roots, Structural changes and Economic growth in Iran", Presented and Published at 2005 *Singapore Economic Review Conference (SERC)*, 4-6 August, Pan Pacific Hotel, Singapore. http://www.serc2005.org/index.html

Pahlavani. M., and Ed Wilson (2005) "An application of the New Cointegration Techniques in Export-GDP Nexus in Iran", Presented and Published at Beijing International Conference on Applied Business Research, 1-4 December, Beijing, China. http://www.bicabr.net/01.htm

Pahlavani. M., and A. Valadkhani (2005) "Identifying Multiple Structural Breaks in Monetary Aggregates and Interest Rates in Australia", Presented and Published at 2nd International Business Research Conference, 5-8 December, University of Technology Sydney, Australia. http://www.worldbizconference.com