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The effects of the fluctuations in oil  
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economy

Abdusalam F. Yahia  
University of Wollongong

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# **THE EFFECTS OF THE FLUCTUATIONS IN OIL PRICES ON THE PERFORMANCE OF THE LIBYAN ECONOMY**

A thesis submitted in fulfilment of the  
requirement for the award of the degree

**DOCTOR OF PHILOSOPHY**

From

**UNIVERSITY OF WOLLONGONG**

By

**ABDUSALAM FARAJ YAHIA**

**BS in Economics (Libya)  
MA In Economics (Libya)**

**School of Economics  
Faculty of Commerce  
University of Wollongong  
Australia  
2008**

## **DECLARATION**

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This thesis is submitted to the University of Wollongong in fulfilment of the requirement for the Degree of Doctor of Philosophy

This thesis represents my own work and contains no material, which has been previously submitted, for a degree or diploma at this university or any other institution, except where acknowledgement is made.

**Abdusalam F. Yahia**

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---

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## PREFACE

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The Socialist People's Libyan Arab Jamahiriya is a small oil-producing developing economy in North Africa. Its economy depends heavily on oil revenue. Oil exports accounted for 92-97 percent of annual total Libyan exports and contributed 40-60 percent of annual GDP during the period 1963-2006. The Libyan economy, like other Middle Eastern oil producers, has been subject to several strong external shocks resulting from fluctuations in oil prices since September 1973.

Economic conditions of the Libyan economy worsened in the 1990's as a result of international sanctions. Since the ending of the UN sanctions in 1999, Libya has been implementing measures to reform and open its economy. Libya needs strong and sustained economic growth to meet the demands of its rapidly growing labour force, which require high investment in physical and human capital and an efficient use of the country's resources. However, the achievement of these objectives depends on oil prices.

The aim of this thesis is to find out the impact of the fluctuations in oil prices on the performance of the Libyan economy during the period of 1963-2004. The thesis tries to contribute to literature by examining the effects of fluctuations in oil prices on Libyan economic growth; Libyan investment; the patterns of Libyan imports and trade relationship with its major trading partners. This thesis also attempts to assess the impact of fluctuation in oil prices on the performance of the Libyan balance of payments.

Many researchers devoted their time and skill in tackling problems related to trade and growth. However, the impact of fluctuations in oil exports on the performance of oil-producing economies came to the interest of some researchers only recently and more precisely since the oil embargo in late 1973. Despite the growing literature on the impact of fluctuations in oil exports on the performance of oil-producing countries in the Middle East, it appears that many gaps still exist in the current literature. In particular no attempt has been made to examine the impact of fluctuations in oil prices

on the performance of the Libyan economy and in particular on Libyan economic growth, Libyan gross fixed capital formation, Libyan imports, the feedback effects in Libyan trade with its major importers and effects of fluctuations in oil prices on the performance of the Libyan balances of payments.

Sophisticated economic models and econometric techniques have been utilized in this thesis in order to achieve its objectives. These models and techniques include single equation models, simultaneous equations models, forecasting models and co-integration analysis.

The fluctuations in oil prices had very important effects on the Libyan labor force, sectoral employment, Libyan social and development indicators, contribution of various economic activities, Libyan expenditure, Libyan composition of foreign trade and Libyan balance of payments.

The impact of fluctuations in oil prices on Libyan economic growth using the “export as an engine of growth model” and applying a “Koyck distributed lag scheme” suggest that there are spread effects from oil exports to the rest of the economy. However, when both the component and inflationary effects are excluded (but not the real gain from the rise in export prices) the results suggest no evidence of spread effects. This conclusion is supported by sectoral output analysis. The use of co-integration analysis to examine the long-term trade relationship between Libyan GDP and its oil exports suggest that there is no long-term relationship between Libyan oil exports and non-oil GDP. In other words, the two variables do drift too far apart from each other over time.

The impact of fluctuations in oil prices on investment in the Libyan economy was assessed using an accelerator model of investment to capture investment behavior in the Libyan economy. It was revealed that the Libyan capital formation is strongly influenced by spending on components of aggregate demand other than investment and the downturn in oil prices had a serious adverse effect on investment. There seems to be an existence of some bottlenecks. Also, investment in the Libyan economy was mainly autonomous public investment in infrastructure. To find out if there is a long-term



relationship between investment and other components of aggregate demand (private consumption + public consumption + net exports) in the Libyan economy, the co-integration technique was used. The long-run elasticity of investment expenditure in the Libyan economy, with respect to Libyan expenditure on other components of aggregate demand, was higher than the short-run elasticity during the period of boom of oil exports. However, there is no evidence of long-term relationships between investment and other components of aggregate demand in the Libyan economy.

The analyses of the trade relationship between Libya and its major trading partners, using a simultaneous-equations model, suggest that an increase in Libyan's exports to a major trading partner contributes to growth in Libyan GDP. The increase in Libyan income expands its imports from its major trading partners. This in turn contributed to growth in the income of the trade partners. The level of Libyan imports from its major trading partners does not seem to have any significant effect on the level of the GDP of its major trading partners except Greece, Turkey and Tunisia.

The relationship between imports of various commodity groups and per capita income in the Libyan economy during variety periods of fluctuation in oil prices were evaluated using two-digit SIT classifications and five forms of import income function. It has been indicated that the reduction in oil revenue during the period of low oil prices has completely upset the import-income relationship, which was developed during the boom years, while the rise in oil revenue has recreated an improvement in the relationship.

Single and simultaneous-equations models are developed and tested to examine the impact of the external and internal forces on Libyan balance of payments. The results are used in forecasting the future behavior of this balance under various scenarios. The analysis indicates that the ratio of trade balance to GDP has fluctuated sharply with changes in the world price of oil. The decline in oil exports combined with deficit in the services balance and net current transfers depleted the gains from trade surplus in the Libyan economy. This resulted in a continuous decline in the current account surplus.

## Papers of this Ph.D. Degree Published and Accepted for Publication in International Refereed Journals

1. "Impact of Fluctuations in Oil Prices on Libyan Economic Growth", *The Middle East Business and Economic Review*, Vol. 19. No. 1, June 2007, pp.39-55.
2. "Impact of Fluctuations in Oil Prices on Investment in the Libyan Economy", *Global Review of Business and Economic Research*, vol.3, no.1, January-June 2007, pp. 1-12.
3. "Impact of Fluctuations in Oil Prices on Libyan Balance of Payments", *International Journal of Applied Business and Economic Review*, Vol.5, No.2, December 2007, pp.147-163
4. " Trade Relationship between Libya and its Major Trading Partners" accepted and scheduled for publication in the *Journal of World Economic Review*, Vol. 2, No. 1, June, 2008
5. "The Effect of the Fluctuations in Oil Prices on the Import Patterns of the Libyan Economy" accepted and scheduled for publication in the *Middle East Business and Economic Review*, Vol. 20, No. 1, June, 2008.

## Papers of this Ph.D. Degree Presented in International Conferences in Two Countries

- 1: A paper entitled "The impact of economic sanctions and oil price fluctuations on employment in the Libyan Economy" has been presented in the 48th Annual Conference of the New Zealand Association of Economists held on 27-28 June 2007, Christchurch.
- 2: A paper entitled "The impact of fluctuation in oil prices on Libyan trade with its major trading partners ", has been presented at the Monash University, Malaysian Conference entitled "Business, Environment, International Competitiveness and sustainable Development of the Asia Pacific Economies " held on 3-4 December 2007.

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# **CHAPTER ONE**

## **INTRUDUCTION**

### **1.1: Motivation / Background**

Existing literature on the economic performance of the Libyan economy that was developed mainly by Baryun (1980), Abohobiel (1983), Abosedra (1984), Abosedra, (1992), Buzakuk (1988), Bakar and Russell (1999) and Bahgat (2004) has many gaps. Perhaps the most important gap relates to the impact of fluctuations in oil prices on the performance of the Libyan economy.

Oil prices were subject to much more fluctuation than the prices of other international goods over the last four decades. The price of a barrel of oil was less than \$2 from the creation of the Organization of Petroleum Exporting Countries (OPEC)<sup>1</sup> in 1960 and continued at that level until 1973. An oil boom began, following the embargo in the late 1973, when the price per barrel was raised to US\$12. The rise in oil price kept increasing and reached \$US36.0 per barrel in 1981. However, this boom did not last very long. The year 1982 brought the oil-producers to the brink. The price per barrel went down to less than \$US8.0. From 1986 to 1998, oil prices enjoyed relative stability at approximately \$US16 per barrel. However, this price was reduced sharply in 1998 (to less than \$US10.0 per barrel) and rose sharply in 2003 to its level in 1981 (i.e. to US\$36 per barrel) OPEC (2004). The price per

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<sup>1</sup> Organization of Petroleum Exporting Countries (OPEC) was established in September 1960, Information about OPEC is available online: [http://www.opec.org/aboutus/history/hi\\_story.htm](http://www.opec.org/aboutus/history/hi_story.htm).

barrel of oil reached its highest level (over US \$90 per barrel) for members of OPEC in 2007.

The Socialist People's Libyan Arab Jamahiriya is a small developing oil producing country located in north of Africa<sup>2</sup>. Libya is generously endowed with energy resources. Being a major oil producer, Libya joined the Organization of Petroleum Exporting Countries (OPEC) in 1962. Libya's total population in 2005 was approximately 6 million and its per capita income was approximately US\$5500 (IMF, 2006).

The Libyan economy continues to be strongly affected by the oil sector. This sector contributed 40-60 percent of GDP since 1974. The remaining economic activities include services (which contributed 25-35 percent of GDP) and sectors of agriculture, industry, transportation, and construction, (which contributed 15-25 percent of GDP) (IMF, various issues)

The predominance of the oil sector in the Libyan economy is also highly noticeable in the country's external and fiscal accounts. During 2000-06, hydrocarbon exports accounted for 97 percent of total exports receipts and were the main source of official reserves, that increased by US\$26 billion during this period (IMF, 2006).

Government expenditure is the most important, if not the only, control variable in the Libyan economy. Other control variables such as taxes, open market operations, interest rates, money supply and the exchange rates play very minor roles, if any. This is due to institutional and religious reasons. Being a Muslim country,

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<sup>2</sup> The name of the state of Libya has changed many times. Throughout the last two decades, it has officially been called the "Socialist People's Libyan Arab Jamahiriya" (Bakar and Russell, 1999).

Libya is reluctant to use interest rates (which are referred to as “riba” or “usury”) in stabilizing economic fluctuations (Metwally, 2000). Libya is also very concerned about inflation, so expansion in the money supply is kept in line with growth in income. Moreover, personal income taxes are minimal. Government expenditure is the main vehicle through which oil revenue filters to the rest of the economy.

The Libyan economy has been subject to strong external shocks since the oil embargo in late 1973. Following the sharp rise in oil prices in 1974, the economic behavior of the Libyan economy has changed radically. Most, if not all domestic variables revolve around the export sector and the relatively weak absorptive capacity of the Libyan domestic economy has forced this country to rely on the outside world for most of its supplies and encouraged the country to seek foreign avenues for investing its external surplus.

Economic conditions of the Libyan economy worsened in the 1990s as a result of international sanctions (Security Council, 2003)<sup>3</sup>. Since the ending of the UN sanctions in 1999, Libya has been implementing measures to reform and open its economy, but progress in developing a market economy has been slow and discontinuous. Libya needs strong and sustained economic growth to meet the needs of its rapidly growing labor force, which requires high investment in physical and human capital and an efficient use of the country’s resources. However, the achievement of these objectives depends on oil prices.

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<sup>3</sup> Indeed, the Libyan economy has suffered for an extended time from very strong sanctions which have been imposed by the USA (imposed in the 1980s and reinforced later in the 1990s), the UK in 1984 and lastly by the UN in 1992. For more details, see (Bahgat, 2004).

The aim of this thesis is to find out the impact of the fluctuations in oil prices on the performance of the Libyan economy. The thesis tries to contribute to literature by examining the effects of fluctuations in oil prices on Libyan economy.

## **1.2: Objectives of the Study**

As stated above, this study represents an investigation of the impact of fluctuations in oil prices on the Libyan economy. Specifically:

1. To examine the impact of fluctuations in oil prices on Libyan economic growth,
2. To evaluate the impact of fluctuations in oil prices on Libyan gross fixed capital formation.
3. To assess the feedback effects of fluctuation in oil prices on Libyan trade with its major importing countries.
4. To assess the effects of fluctuations in oil prices on the import patterns in Libya.
5. To test the effects of fluctuations in oil prices on the performance of the Libyan balances of payments.

## **1.3: Hypotheses of the Study**

This study is based on the following hypotheses:

1. The Libyan economy will continue to depend on oil revenue.
2. Fluctuations in oil prices would affect the Libyan economy in achieving steady growth.
3. Libyan investment is largely related to its oil revenue.

4. An increase in Libya's exports to a major trading partner contributes to growth in Libyan GDP. The increase in Libyan income expands its imports from its major trading partners. This in turn contributes to growth in Libya's income.
5. A rise in oil prices results in a substantial growth of Libyan imports.
6. The Libyan balance of payments is affected by fluctuations in oil prices.

#### **1.4: Methodology**

The following techniques will be used to achieve the objectives of the thesis:

1. The thesis will use the export as an engine of growth model and use Koyck distributed lag regression technique (Koyck, 1954; Zvi, 1967) to test the relationship between Libyan oil export growth and Libyan GDP over time. It also aims to examine the impact of export growth on total non-oil output (i.e. the domestic product of industries other than mining), and to test responses of these sectors' outputs on expansion in oil exports.
2. An accelerator model of investment is used to capture the impact of fluctuation in oil prices on investment behavior in Libyan economy. There are many reasons for this choice. Firstly, models, which assume free market conditions and little or no government intervention, are obviously not appropriate for the Libyan economy where markets are imperfect and the government plays a strong role in the economy. Secondly, asset and capital markets are not highly organized and the rate of interest is often kept lower than the market rate. Thirdly, lack of data on wealth, assets, debt, nominal wages, capital stock etc. renders it very difficult to apply most investment models.

3. Simultaneous-equations models will be used to examine the trade relationship between Libya and its major trading partners. The analysis emphasizes the role played by the interaction of international trade and the degree of feedback.
4. Various models of relationship between income and imports will be tested and used to capture the effects of fluctuations in oil prices on patterns of Libyan imports.
5. Single and simultaneous-equations models are developed and tested to examine the impact of fluctuations in oil prices on the main components of the balance of payments of the Libyan economy. In addition, these models will be used to forecast the future behavior of the Libyan balance of payments under various scenarios.
6. Co-integration analysis will be used to examine the long-term relationship between Libyan GDP and oil exports as well as Libyan capital formation and each components of Libyan GDP.

### **1.5: Thesis structure**

This thesis is divided into nine chapters:

Chapter two is gives a literature review. Its main aim is to consider the literature that is relevant to the theme of this thesis. This chapter consists of eight sections. Section two reviews the literature related to the impact of fluctuations in oil exports on trade and economic growth of oil producing countries. Section three reviews some of the most important research contributions to the assessment of the impact of fluctuations in oil exports on gross fixed capital formation in oil-producing countries. Section four reviews research related to the effects of the fluctuations in oil exports on real efficiency of government expenditure. Research related to the

impact of fluctuations in oil exports on feedback effects of trade between oil exporters and their major importers are reviewed in section five. Section six reviews literature on the effects of fluctuations in oil exports on the balance of payments of oil-producing countries. Section seven reviews literature related to the impact of fluctuations in oil exports on the Libyan economy. The final section summarizes existing gaps in the literature and highlights the expected contribution of this thesis towards closing some of these gaps.

Chapter three examines the structure of the Libyan economy and its response to the fluctuating oil prices. The chapter is divided into five sections. Following the introduction, section two analyzes the composition of the Libyan population, labor force, and basic social indicators. Section three examines the structure of Libyan aggregate supply by economic sectors and the structure of Libyan aggregate demand by type of expenditure. Section four examines the composition of Libyan foreign trade and its balance of payments. Finally, section five summarizes the main conclusions.

Chapter four assesses the impact of fluctuations in oil prices on Libyan economic growth during the period of 1963-2005. It is divided into six sections. Section two compares the rates of growth of the Libyan oil sector and Libyan non-oil sectors over the last four decades. Section three examines the relationship between oil exports and economic growth in the Libyan economy. The response of sectoral output to expansion in oil exports is examined in section four. Section five tests if there is a long-term relationship between Libyan oil exports and its GDP. Section six summarizes the main findings of the chapter.



The aim of chapter five is to assess the impact of fluctuations in oil prices on investment behavior in the Libyan economy. This chapter is divided into six sections. Following the introduction, section two briefly reviews the literature on the determinants of the investment function. Section three examines the behavior of investment in the Libyan economy. Section four empirically tests the investment function in Libya. Section five uses cointegration analysis to test long-term relationship between investment and other components of aggregate demand in the Libyan economy. Finally, section six summarizes the main conclusions of the Chapter.

Chapter six examines the impact of fluctuations in oil prices on Libya's trade relationship with its major trading partners. The chapter is divided into five sections. After a brief introduction, section two examines the magnitude of trade between Libya and its major trading partners. Section three develops a simultaneous equation model to test the interaction of international trade and the degree of feedback between Libya and its major trading partners. Section four gives the regression results of the simultaneous equations model for ten trading partners. Finally, the main chapter conclusions are summarized in section five.

The aim of chapter seven is to analyze the impact of the fluctuations in oil prices on the import patterns of the Libyan economy. The research is a disaggregated study of the relationship between imports of the various commodity groups and per capita income. The chapter is divided into six sections. Section two reviews the import-income relationship. The third section develops a number of models to set the relationship between imports and income. The method of estimation for each model

is discussed in the fourth section. The fifth section analyses the data and gives the regression results. The sixth section summarizes the main findings of the chapter.

Chapter eight examines the impact of fluctuations in oil prices on the Libyan balance of payments. The chapter is divided into six sections. Section two presents the relevant literature on the balance of payments. Section three examines the performance of the Libyan balance of payments during the period 1973-2005. Section four examines the effects of fluctuations in oil prices on the main components of the balance of payments. Section five forecasts the future behavior of Libyan balance of payments under various scenarios. Finally, the main conclusions of this chapter are summarized in section six.

Chapter 9 gives the conclusions of this thesis

## **CHAPTER TWO**

### **Review of Literature**

#### **2.1: Introduction**

Many researchers devoted their time and skill in examining problems related to trade and growth. However, the impact of variations in oil exports on the performance of oil-producing economies came to the interest of some researchers only recently and more precisely since the oil embargo in late 1973. The main purpose of this chapter is to review the literature that is relevant to the theme of this thesis. The thesis aims at finding out the impact of fluctuations in oil prices on the Libyan economy.

This chapter consists of eight sections. Section two reviews the literature related to the impact of fluctuations in oil exports on trade and economic growth of oil producing countries. Section three reviews some of the most important research contributions to the assessment of the impact of fluctuations in oil exports on gross fixed capital formation in oil-producing countries. Section four reviews research related to the effects of the fluctuations in oil exports on real efficiency of government expenditure. Research related to the impact of fluctuations in oil exports on feedback effects of trade between oil exporters and their major importers are reviewed in section five. Section six reviews literature on the effects of fluctuations in oil exports on the balance of payments of oil-producing countries. Section seven reviews literature related to the impact of fluctuations in oil exports on the Libyan economy. The final section summarizes existing gaps in the literature and highlights the expected contribution of this thesis towards closing some of these gaps.

## **2.2: Literature Review on Impact of Fluctuations in Oil Exports on Trade and Economic Growth of Oil Producers**

Economic growth in oil-producing countries depends heavily on revenues from oil exports. Many researchers have examined the relation between oil exports and growth in the members of the Organization of Petroleum Exporting Countries (OPEC). Metwally and Tamaschke 1980 studied the interaction between oil exports and economic growth in eight members of OPEC namely Libya, Kuwait, Iran, Saudi Arabia, Iraq, Qatar, UAE, and Algeria over the period 1960-1980. The empirical results of their study confirmed that the fluctuations in oil exports seems to have an insignificant effect on the economic activity in the small oil exporter such as Libya and suggested that there is a need for more data to assess investment chances produced by an increase in oil exports. For this reason, this thesis attempts to use Libyan data to do this assessment.

Shojai (1984) tried to find out the impact of oil boom during the period 1973 to 1979 on selected OPEC Countries. Abdel-Rahman and Metwally (1985) examined the impact of the oil boom on the same countries over the period 1970-82. The main findings of their study show that the relationships between exports and GDP and between exports and non-oil GDP are statistically significant. However, their empirical results did not confirm evidence of spread impacts, except for the manufacturing sector. Also these studies refer only to the period of rise in oil prices and did not show the impact of fluctuations in oil prices.

Yousefi (1994) investigated the impact of fluctuations in oil exports on the economic growth of OPEC countries over the period 1966-80. The main finding of the model suggested that current period oil revenues did not have a positive impact on the economy of some oil producers. It also indicated that while income oil had a negative

impact on the non-oil sector, the lagged oil revenues were more significant in explaining the fluctuation in the non-oil sector. Moreover, this study indicates that the short-run effect of oil revenue on growth of manufacturing industries of some oil producers was very weak. However, this model did not show the impact of the decline in oil prices since 1982

The behavior of the import functions has been the subject matter of a number of empirical studies. One may mention the contributions by Khan and Ross (1975, 1977), Abbott and Seddinghi (1996), Hughes and Thirlwall (1979), Beenstock (1976), Gandolfo and Petit (1983), Khan and Knight (1988), Basu and McLeod (1991), Balassa (1978, 1985), (Esfahani, 1991), Abeyasinghe (2001) and (Balaguer and Cantavella-Jorda, 2004). Traditional studies assume that imports depend upon the price of imports in domestic currency, the price of domestically produced substitutes, as well as real income (Houthakkar and Magee (1969), Khan and Ross (1975), Murray and Ginman (1976), Thursby and Thursby (1984)). But again these empirical studies did not show how the fluctuations in oil prices affected the import functions of the oil producers.

Metwally and Tamaschke (1980) have argued that in estimating the import-income relationship in the oil producers one must take into account the real gains from trade that a country enjoys when its export prices increase faster than its import prices. Therefore, using a deflated income in estimate the import function may not be the most right structure in the case of these countries. This argument would only be effective during periods of fluctuations in oil prices that took place over the periods 1973-1981, 1982-1998 and 1999.

### **2.3: Literature Review on Impact of Fluctuations in Oil Exports on Investment in Oil-Producing Countries**

One of the most important factors that have a crucial role in every economy is investment. Being a part of aggregate demand, investment is an essential determinant of the general level of economic growth. Arguments have been put forward by Rana, (1988), Tatom (1988), Love (1989), Metwally (1989) Aljerayed (1993) Al-Yousif (1997) and Khan and Reinhart (1990). These arguments suggest that oil exports determine investment directly in the oil-producing countries. However, the majority of these arguments did not take into account the impact of fluctuations in oil prices on investment in oil producing countries which is one of the main aims of this thesis.

Metwally (2004) used an accelerator model of investment to capture investment behavior in the GCC countries. This model suggests that only in the large economies (e.g. Saudi Arabia), there was some evidence of growth effect. It would be important to find out if there would be some evidence of growth effects in the Libyan economy, which is much smaller than Saudi Arabia.

### **2.4: Literature Review on Impact of Fluctuations in Oil Exports on Performance of Government Expenditure in Oil Producing Countries**

Government expenditure in the Middle-Eastern oil producing countries is the main vehicle through which oil revenue filters to the rest of the economy (Metwally and Tamaschke, 1980). However, it is important to find out if the decline in oil prices since 1982 has forced the Libyan economy to reduce its imports of goods and services. This meant a reduction in government expenditure, particularly those related to capital works.

The fluctuations in oil prices raise questions about the long-term relationship between oil exports and government expenditure (for both consumption and investment purposes) in the Libyan economy.

Both government expenditure (for consumption and investment purposes) and oil exports in the oil-producing countries increased at substantial rates over the last three decades. Research by Metwally (2000) relating to GCC countries showed that an economy which plays a role of a “swing producer” gets a much higher oil exports than other oil producers during the rise in oil prices. It would be important to find out the mean value of Libyan oil exports per year during periods of fluctuations in oil prices.

Shaan and Handy (1991) and Haddad, (1993) argued that the rate of growth in government expenditure followed closely the rate of growth in oil in some but not all oil producers. Metwally and Perera (1993) suggest that a linear combination of value of oil exports and government expenditure is stationary only in non-OPEC members. It would be essential to find out if the rate of growth in the Libyan economy, which is a member of OPEC, would have an impact on its balance of payments.

## **2.5: Literature Review on Impact of Fluctuations in Oil Exports on Feedback Effects of Foreign Trade of Oil-Producing Countries**

Metwally and Daghistani (1986) argued that oil prices and economic growth in the industrialized countries are significant determinants of current export proceeds in all members of the GCC. They also argued that the industrial production of the industrialized countries was not significantly influenced by the imports of GCC countries.

Salvatore (1983) found that the relationship between trade and growth was clearly positive. His conclusions were not as pessimistic as the views which regard trade as a retarding force for development, they were not as optimistic as those views which regard trade as an engine of growth as well.

Tamaschke (1988) tested the same interaction for the Australian economy during the period 1955-83. His results suggest that exports had a strong effect on Australian income while imports had a negligible effect on Australian exports.

Lee (1989) studied the trade interdependence between Taiwan, the USA and Japan for the period 1952-85. He concluded that, in the logarithmic form of the GNP equation, the coefficient of labor force, in addition to that of exports, is statistically significant. He also concluded that, imports and GNP of USA are the two significant determinants of the Taiwanese exports in both models, whereas these exports do not depend on Japanese economic condition. Imports are significantly determined by GNP and lagged imports or lagged exports.

Tamaschke (1990) tested the relationship between exports and income of Queensland and Alberta during 1961-83. The results suggest a strong relationship between exports and income. It was also found that growth in services is very sensitive to exports growth. There was no evidence of feedback effects in both cases.

Salehi Esfahani (1991) tested the interdependence of exports, GDP and imports for 31 semi-industrialized countries excluding the major oil exporters during the periods: 1960-73, 1973-81 and 1980-86. It was found that most semi-industrialized countries have on average suffered from import shortage and their exports have mainly provided foreign exchange for relieving this input constraint.



Metwally and Vadlamudi (1992) analyzed the trade relationship between Australia and fifteen Middle-Eastern countries during the period 1971-88. They found that the Australian income was not affected by its imports from Middle Eastern countries, and there was no feedback effect due to the small share of Middle Eastern countries in Australian market.

Sprout and Weaver (1993) also performed a study to test the export-growth relationship. They found that the effect of export growth varies widely among different LDC countries. They also found that the structure of the export sector plays an important role in the growth of the economy; the larger the export sector the greater the growth. The authors concluded that primary exporters who fail to diversify, experience less economic growth from export expansion than those exporters which have diversified exports.

Metwally (1993b) studied the interdependent of trade and economic development in ten Asian countries for the period 1974-88. The results suggest that, there is a degree of interdependence between each of the economies under study and the rest of the world.

Perdikis and Asseery (1994) analyzed the trade relationship between Cyprus, United Kingdom, the rest of the European Economic Community (EEC) and the GCC countries between 1965 and 1987. They found that Cyprus' exports to United Kingdom, other EU and the GCC countries are important determinants of its income and that, Cyprus' exports to United Kingdom, other EU and GCC are significantly influenced by its trading partner's income. They also found that the incomes of Cyprus' trading partners are significantly affected by exports of these countries to the world, excluding Cyprus, while imports of Cyprus from its trading partners are affected by its income.

Metwally and Tamaschke (2001) studied trade relationship between the GCC and the EU. Their econometric results suggest that there is a significant feedback effect in the relationship between the rate of growth of the EU and the GCC demand for imports.

## **2.6: Literature Review on Impact of Fluctuations in Oil Exports on Balance of Payments of Oil Producing Countries**

The balance of payment is an overall statement of a country's economic transactions with the rest of the world over some period, often a year (Erdgmand, 1983; Charles and Sprinkle, 2005). The balance of payment represents a major macroeconomic variable that is related with other macroeconomic variables. Some of these macro-variables can be instruments for economic policies (interest rate, exchange rate, government expenditure, taxes), or they can represent performance indicators that may be used as objectives for economic policies (growth, inflation, unemployment rates), or it can be target values for other macroeconomic variables such as (money supply). Implementation of economic reform policies directed toward improving the balance of payment should have a positive effect on other variables, mainly the GDP growth rate. Hence, the balance of payment should be analyzed within the context of other macro-variables (instruments, indicators, objectives, values), (Bird, 1997).

Previous studies indicate that the stability of the balance of payments reflect the effectiveness of the stabilization programs of economic policies. In order to avoid or reduce the effect of the imbalance between aggregate demand and aggregate supply, policy makers must interfere effectively with the appropriate economic policies. The persistence of such imbalances, particularly in developing countries results in deterioration and a deficit in the balance of payments accompanied with high inflation.

To reduce the deficit in the balance of payments, countries either deplete their reserves of foreign exchange or borrow from international sources. In both cases, these actions will only increase aggregate demand and affect the equilibrium at aggregate level negatively, (Khan et al, 1991). Previous studies indicate that developing countries tend to spend any additional resources on increasing imports (World Bank, 1994; Fischer, 1997).

The adjustment process to correct for the imbalance in the balance of payments starts with stabilization programs aiming to bring the balance of payments to acceptable levels with low inflation. The interaction between stabilization programs, structural reform, and economic instrument policies aiming to sustain development and growth is reflected in the balance of payment. Santaella, (1995), had collected data on 78 developing countries, which were involved in stabilization programs and structural reforms with the IMF, during 1973-1991. The analysis of economic indicators showed that, prior to the implementation of stabilization programs, the 78 selected countries suffered deterioration in the balance of payments and weaknesses in investments, growth, government budget, and high inflation and external debt. However, the economic indicators improved toward the end of study period after implementation of stabilization programs. Santaella concluded that developing countries usually do not implement stabilization programs and initiate structural reform until the balance of payments indicators deteriorate to crisis levels (Santaella, 1997)

Few studies, to our knowledge, analyzed the performance of the balance of payments of oil producing countries. Al-Habib and Metwally (1986) examined the balance of payments in the GCC over the period 1970-1983. The main finding shows

that the sharp increase in oil revenues did not lead to diversification of the economy by generating other important sources of income. Furthermore, the value of the import elasticity with respect to GDP was greater than the one in cases of Kuwait, Oman, Qatar, and Saudi Arabia and roughly one in cases of Bahrain and the UAE. For these countries to have a high-income elasticity of demand for imports while their oil exports are declining would result in a large balance of trade deficit. Many other authors including Weisskoff (1979), Arab and Metwally (1987a) and Al-Faris (1997) estimated different price elasticities of demand for imports.

Haifa (1984) investigated changes of the balance of payments in some members of OPEC countries. He conducted the monetary approach to the balance of payments in order to identify the foreign reserve flows in countries. The main finding of this study suggested that reserve flows in these countries have been positively affected by the increase of GDP, domestic prices and the growth rate of money supply in the world market.

It is the *purpose* of this study to analyze in depth the extent of such effects on the different components of the balance of payments for Libya. In general, this study intends to cover the gap between the abundance of international research on the balance of payments and the limited studies on the Libyan economy.

## **2.7: Literature Review on Impact of Fluctuations in Oil Exports on the Libyan Economy**

The Libyan economy depends heavily on oil exports. A small number of researchers have attempted to assess the impact of fluctuation in oil exports *on some Libyan economic activities*.

Heitman (1969) attempted to analyze the effect of oil income on the Libyan economy before the oil embargo. He concluded that government expenditure depends heavily on the oil revenues and oil exports

Abohobiel (1983) tested a macroeconomic model for the Libyan economy using quarterly data over the period 1962-1977. However, there was no study regarding fluctuations in oil prices.

Younis, (1993) tried to assess the impact of fluctuations in GDP growth on the food and nutrition status in the Middle East countries over the period of 1960-1985. The empirical results of this study indicate that food consumption was significantly affected by the changes in income per capita. It was also concluded that there was a negative relationship between income and the crude birth rate. Furthermore, the results show that income elasticities of rice, corn, wheat and total grain consumption were inelastic.

Baryun (1980) attempted to assess the factors that affected the Libyan balance of payments during the period 1962-1977. He concluded that the impact of the increase in oil exports, following the oil embargo, on the Libyan balance of payments had been subject to the adopted monetary and fiscal policies. However, there was no investigation regarding the impact of fluctuations in oil prices.

Aljerrah, (1993) tried to find the optimal exchange rate method in some Middle Eastern countries. It was suggested that economies of these counties could have enjoyed more advantages from exchange rate systems if they used the exchange rate regime.

## **2.8: Existing Gaps in the Literature**

Despite the growing literature on the impact of fluctuations in oil exports on the performance of oil-producing countries in the Middle East, it appears that many gaps still exist in the current literature. In particular, no attempt has been made to examine the impact of fluctuations in oil prices on the performance of the Libyan economy.

This thesis attempts to fill the gaps in the present literature. It aims to extend the existing literature by using in-depth regression analysis, co-integration analysis and simultaneous-equations models in testing the impact of fluctuations of oil prices on the performance of the Libyan economy. In particular, it attempts to achieve the following objectives:

1. To test the impact of fluctuations in oil prices on economic growth of the Libyan economy.
2. To evaluate the impact of fluctuations in oil prices on Libyan investment and examine the long run relationship between oil exports and investment
3. To assess the effects of fluctuations in oil prices on the import patterns in Libya.
4. To assess the feedback effects of Libyan trade with its major trading partners.
5. To examine the impact of fluctuations in oil prices on the balance of payments and the resource balance of Libya.
6. To offer suggestions regarding the application and for an optimal economic policy to minimize the impact of fluctuation in oil prices on the performance of the Libyan economy.

## **CHAPTER THREE**

### **The Structure of the Libyan Economy and its Response to Fluctuations in Oil Prices**

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*(A paper related to this chapter entitled “The impact of economic sanctions and oil price fluctuations on employment in the Libyan Economy” has been presented in the 48th Annual Conference of the New Zealand Association of Economists held on 27-28 June 2007, Christchurch.)*

#### **Abstract**

This Chapter analyzes the composition of the Libyan population, labor force, and basic social indicators and examines the structure of Libyan aggregate supply by economic sectors and the structure of Libyan aggregate demand by type of expenditure. It also examines the composition of Libyan foreign trade and its balance of payments.

It is discovered that Libyan dependence on expatriates to conduct its economic activities has declined sharply over the last four decades.

It is found that the petroleum and mining sectors form the mainstay of the economy in Libya. The second most important sector is the service sector representing wholesale and retail trade, transportation and communication, finance and insurance and real estate. The contribution of the manufacturing sector to Libyan GDP is very small and the contribution of the agricultural sector is declining.

It is also found that most of Libyan expenditures on imports are related to machinery and transport equipment; manufactured goods classified by material and food and live animals.

### **3.1. Introduction**

Libya is a small oil producing developing economy in the Middle East and a member of OPEC. This chapter uses data from various local, regional and international sources over the last four decades to analyze the impact of fluctuations in oil prices on the structure and performance of the Libyan economy.

Libya has been depending on its citizens as well as on expatriates to conduct its economic activities. However, most Libyan expatriates are males. The distortion in the labor market is another dimension of the imbalance in the population mix. The Libyan government's efforts to increase the population base had an important impact on the fertility rate in Libya.

The Libyan economy seems to depend heavily on the production and exportation of oil. Oil production provides a greater contribution to GDP than other economic activities. The Libyan gross domestic product by economic activity and the Libyan expenditure on gross domestic product seem to have changed significantly during periods of fluctuations in oil prices.

Libya trades mostly with advanced countries. Most of Libyan expenditures on imports are related to machinery and transport equipment; manufactured goods classified by material and food and live animals.

Libya seems to invest most of its balance of payments surplus overseas. This has helped the country during periods of recession in oil exports through receiving high returns on overseas investment.

The Chapter is divided into five sections. Section two analyzes the composition of the Libyan population, labor force, and basic social indicators. Section three



examines the structure of Libyan aggregate supply by economic sectors and the structure of Libyan aggregate demand by type of expenditure. Section four examines the composition of Libyan foreign trade and its balance of payments. Finally, section five summarizes the main conclusions.

### **3.2: Population, Labor Force, and Social indicators**

Table 3.1 gives data on the composition of the Libyan population over the specified periods. These data reveal that Libyan total population in 2005 was more than 6.1 millions compared with only 2.15 million persons in 1972. The data in this table also reveal that Libyan's dependence on expatriates to conduct its economic activities has declined sharply over the last four decades. This is due to the fact that the Libyan fertility rate is among the highest in the world.

The rise in oil prices has encouraged the attraction of expatriates. During the eight years of the oil boom (1973 to 1981) the number of expatriates living in Libya has increased by approximately 50 thousand persons per annum. On the other hand, during the 16 years (1982-1998) of depreciation in oil revenue, the number of expatriates living in Libya has declined by approximately five thousand persons per annum. Despite the rise in oil prices since 1999, the number of Libyan expatriates continued to decline (by approximately 20 thousand persons per annum) due to the devaluation of the Libyan local currency (from over three US dollar to less than one US dollar per Libyan Dinar).

Table 3.2 reveals that while the percentage of national Libyan males is equivalent to that of national females, the percentage of female expatriates is approximately 10 percent of male expatriates. This suggests that Libya attracts more

males for working purposes. Actually, most Libyan expatriates are not permitted to bring members of their family to share their living in Libya.

**Table 3.1: Libyan Population  
(Thousand persons)**

Please see print copy for figure 3.1

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Note: figures between parentheses are percentages out of total population.

Sources: 1. Libya: Annual Statistical Abstract (various issues)  
2. Libya: National Authority for Information and Documentation (various issues)  
3. Libya: Ministry of planning, economic and social indicator 1970-1994.  
4. Arab League: Statistical Abstract For Arab Countries (various issues)  
5. IMF: International Financial Statistics (various issues)

**Table: 3. 2: Total Libyan Population According to Sex and Nationality  
(Thousand persons)**

Please see print copy for figure 3.2

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**Sources:** 1. Libya: National Authority for Information and Documentation (various issues)  
2. Libya: Ministry of planning, economic and social indicator 1970-1994.  
3. Central Bank of Libya, *Quarterly Statistical Bulletin*, Various Issues, Libya  
4. Arab League: Statistical Abstract For Arab Countries (various issues)

Table 3.3 shows the allocation of the labor force in Libya according to economic sectors. The data in this table suggest that:

1. Employment in the agricultural and fishing sector has declined over the last four decades. It went down from 13.4 percent of the total labor force in 1972 to less than 8.6 percent in 2004.

**Table 3.3: Libyan Labor Force by Economic Sector**

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Please see print copy for figure 3.3

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Sources: 1.Libya: Annual Statistical Abstract (various issues)  
2. Libya: National Authority for Information and Documentation (various issues)  
3. Libya: Ministry of planning, economic and social indicator 1970-1994.  
4. Central Bank of Libya, *Quarterly Statistical Bulletin*, Various Issues, Libya  
5. Arab League: Statistical Abstract for Arab Countries (various issues)

2. The petroleum and mining sectors employed less than 1.5 percent of the total labor force during the period 1972 to 2004. The percentage of employment in this sector has increased during the oil boom period.
3. The percentage of total labor force employed in the manufacturing sector has increased during the oil boom but became stationary at approximately 6 percent since the end of this boom until 2004.
4. The percentage of total labor force employed in the construction sector and in the transportation and communication sector enjoyed a slight increase over the last four decades.
5. The highest proportion of employment in the Libyan economy is in the other services sectors, (wholesale and retail trade, finance and real estate and community, social and personal services). The proportion of employment in these sectors has increased from 57.3 percent of total labor force in 1972 to 61.8 per cent in 2004

Table 3.4 summarizes the main social indicators in the State of Libya. It can be seen that the life expectancy rate is above the world average in 2004. However, the infant mortality rate is far below the world average. The number of persons per physician is very low. The fertility rate in Libya is among the highest in the world. This was largely due to the government's efforts to increase the population base. Generous family allowances are paid to Libyan citizens. Spending on education contributed directly to the decline in the illiteracy rate.

**Table 3.4: Libyan Social and Development Indicators**

Please see print copy for table 3.4
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Sources: 1. Social Indicators of Development, World Bank (various issues)  
2. UN Development Program, Human Development Report, (various issues)

### **3.3: Structure and Performance of the Libyan Economy**

The Libyan economy seems to depend heavily on the production and exportation of oil. All its economic sectors revolve around revenues generated by oil exports. It can be said that economic development in Libya has passed through two stages. The first stage of development, from early 1970s to early 1980s, utilized the huge oil revenues to build up the basic infrastructure (physical and human). The second stage started from the mid 1980s. This stage witnessed the participation of the private sector in the process of economic development. The focus was to establish new industries that use modern technologies and managerial skills and result in a diversification of income. However, rigidity in the political system (bureaucracy) and lack of appropriate managerial skills and leadership are major obstacles. Although the infrastructure in the Libyan economy has been partially developed to a stage similar to

that of the developed world, the political decisions and policies are conducted in a different manner (Haddad, 1993).

Libya plays an important role as a member of OPEC in the supply of oil to the world market (Adelman, 1995). The geological factors such as: the location of the onshore oil fields close to Europe; the flow of the oil toward the sea, and the effortlessness of drilling helped the Libyan oil to be produced relatively cheaper than many other oil producers. The central geographical location of Libya between the developed economies in the West and growing economies of North Africa has reduced transport costs and increased the significance of the Libyan oil market (World Bank, 1994).

The Libyan production of oil in 2005 was approximately 1.5 million barrels per day. This amounts to around 8.5 percent of oil production of all OPEC members. Libyan oil reserves were evaluated at approximately 45 billion barrels (7 percent of total OPEC members' reserves) at the end of 2004.

Table 3.5 classifies Gross Domestic Product (GDP) of the Libyan economy by type of economic activity. It can be seen from the table that the petroleum and mining sector forms the mainstay of the economy in Libya. Oil production makes a greater contribution to GDP than other economic activities. However, the percentage of the oil contribution to GDP differed in various periods due to fluctuations in oil prices.

The second most important sector is the service sector representing wholesale and retail trade, transport and communications, finance and insurance and real estate and other services. This sector contributed 22.4 per cent of GDP in 2004. The

percentage contribution of these services to GDP was much higher (approximately 50 percent) during the period that suffered a sharp reduction in oil prices (1998).

**Table 3.5: Libyan Gross Domestic Product by Economic Activity (million US\$)**

Please see print copy for table 3.5
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Sources: 1. Libya: National Authority for Information and Documentation (various issues)  
2. Libya: Ministry of planning, economic and social indicator 1970-1994.  
3. Central Bank of Libya, *Quarterly Statistical Bulletin*, Various Issues, Libya  
4. Arab League: Statistical Abstract For Arab Countries (various issues)  
5. World Bank 'World Tables, various issues, Washington D.C., World Bank

The manufacturing sector plays a very small role in the Libyan economy. This sector contributed to less than 3 percent of GDP during most periods. Its contribution has increased substantially during the periods of sharp decline in oil prices. In 1998, the manufacturing sector contributed 6.4 percent of GDP compared with only 2.6 percent of GDP in 1980 and 2004.

The contribution of the agricultural sector to GDP was also subject to substantial changes due to fluctuations in oil prices. This contribution increased from 1.6 percent in 1980 to 11.5 percent in 1998 and was reduced to 3.4 percent in 2004.

The percentage contribution of the construction sector to GDP in the Libyan economy has declined continuously over the past four decades. Table 3.6 presents Libyan Expenditure on Gross Domestic Product over the last four decades. It can be seen that the proportion of total expenditure on exports and imports constituted a significant proportion of GDP. These proportions were the highest during the periods of high oil prices (1980 and 2004). Expenditure on oil exports contributed 60.2 percent of GDP in the year 2004, while expenditure on imports in the same year was approximately half this percentage. The downturn in oil prices resulted in a drastic reduction in the percentage of Libyan imports to its GDP.

Expenditure on private consumption in Libya is not as high as in advanced countries. The proportion of total expenditure on private consumption reached its highest level (63.9 percent) in 1998 compared with 27.1 percent in 1980 and 41.2 percent in 2004. The percentage of gross capital formation to total GDP in the Libyan economy has declined sharply since the end of oil boom in 1981. It amounted to only 14.2 percent in 2004 compared with 25.1 percent in 1972 and 24.3 percent in 1980. This may be due to an increase in foreign investment in the Libyan economy.

Spending on public consumption in the Libyan economy as a proportion of total GDP has been reduced significantly in recent years. This percentage was 15.3 percent in 2004 compared with 22.2 percent in 1980 and 26.4 percent in 1998.



**Table 3.6: The Libyan Expenditure on Gross Domestic Product (million US\$)**

Please see print copy for table 3.6

Note: Figures in parentheses are percentages of total GDP.

Sources: 1. National Authority for Information and Documentation (various issues)

2. Central Bank of Libya, *Quarterly Statistical Bulletin*, Various Issues, Libya

3. Arab League: Statistical Abstract for Arab Countries (various issues)

4. IMF, *International Financial Statistics Yearbook*, Various Issues, Washington, D.C.,

5. World Bank 'World Tables, various issues, Washington D.C., World Bank

### **3.4: Structure of Libyan foreign trade and its balance of payments.**

Libya's relationship with the rest of the world is highly significant in terms of exports, imports and foreign investment. Table 3.7 shows that most of Libyan expenditure on imports are related to machinery ,transport equipment and manufactured goods classified by material and food and live animals. Libyan imports of machinery and transport equipment amounted to 48 percent of total imports in 2004 compared with 38 percent in 1980 and around 30 percent during periods of stagnation (1972 and 1998). However, the percentage of imports of manufactured goods classified by material and manufactured articles did not change much over the last four decades (amounting to approximately 20 percent of GDP).

**Table 3.7: Libyan composition of external trade**

Please see print copy for table 3.7

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**Sources:**

1. Libya: National Authority for Information and Documentation (2000)
2. Arab League, *Statistical Abstract for Arab Countries*, Various Editions, Cairo, Egypt

The percentage of Libyan imports of food and live animals was higher during normal periods than during the oil boom. This percentage amounted to 14.1 percent in 2004 compared with 19.3 percent in 1972 and 21.8 percent in 1998.

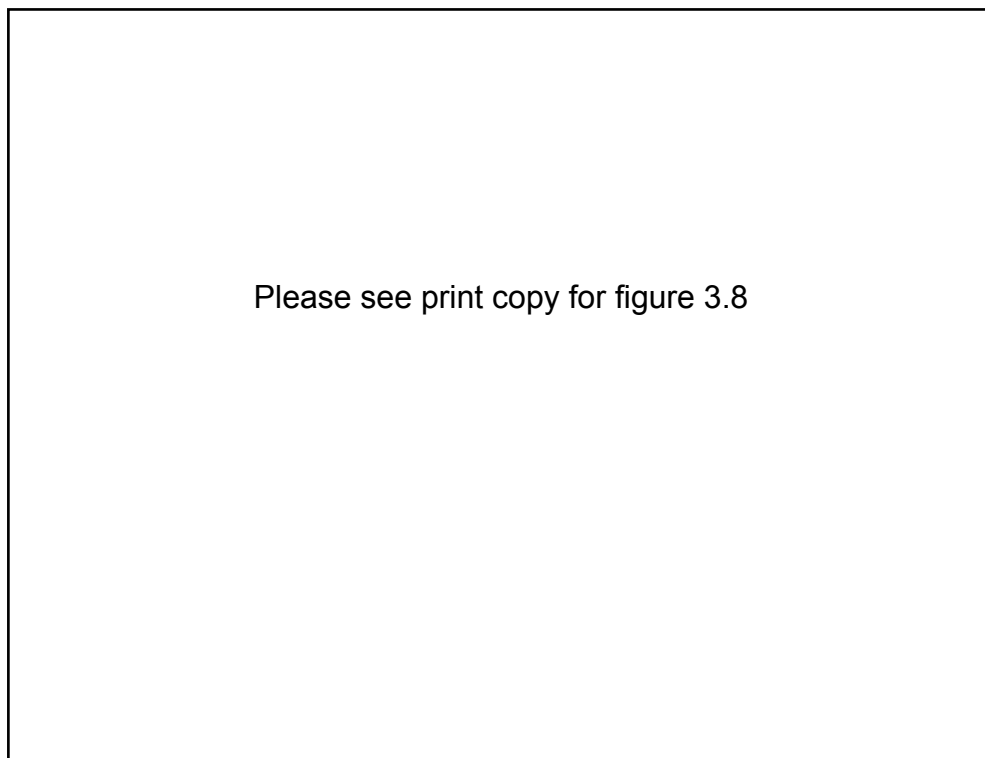
Table 3.7 also reveals that over 95 percent of total Libyan exports are crude oil since 1970 until now. The percentage of non oil exports has increased to 8.0 percent in 1998 but was reduced to 4.3 percent in 2004

Table 3.8 shows that over 80 percent of Libyan exports in 2004 were exported to the industrial countries and approximately two-thirds of Libyan exports in that year were exported to three countries, namely: Italy (37%); Germany (17%) and Spain (12%). The percentage of Libyan exports to the Arab world in 2004 was less than 5 percent of total Libyan exports. However, the percentage of Libyan exports to Turkey in 2004 exceeded 7 percent of total Libyan exports.

Table 3.8 also shows that less than 60 percent of Libyan imports in 2004 were imported from the industrial countries and over 40 percent of Libyan imports were imported from developing countries.

Table 3.8 shows that Libya's highest imports from industrialized countries in 2004 were imported mainly from Italy (25.5%), Germany (11.0%), UK (4.1%), France (3.8%) and Japan (3.2%). On the other hand, the highest proportion of Libyan imports from developing countries in 2004 was imported from Tunisia (6.1%), Turkey (4.6%), Greece (3.9%) and China (3.2%). The percentage of Libyan imports from the Arab world was approximately 8.5 percent of total Libyan imports in 2004.

**Table 3.8 Libya, Direction of Foreign Trade in 2004 (in Millions US\$)**



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**Source:** IMF, Direction of Trade Statistics Yearbook, (2005), Washington, D.C

Libya has not been trading much with USA due to economic sanctions. Its exports to that country in 2004 amounted to only 1.6 percent of Libyan total exports, while Libyan imports from USA in the same year amounted to only 0.53 percent of total Libyan imports.

The data in Table 3.9 would seem to support the research conclusions that oil exporters enjoy better balance of payments during rise in oil prices (Baryun, 1980 and Buzakuk 1988).

Table 3.9 gives information about the Libyan balance of payments in various years that are distinguished by fluctuations in oil prices, over the last four decades. The table shows that the Libyan trade balance; balance on goods and services and the balance of current account were much higher during the periods of rises in oil prices (1980 and 2004) than during the periods of reduction in oil prices (1972 and 1998). The table also reveals that Libya had invested most of its balance of payments surplus overseas. This has helped the country during periods of recession in oil exports through receiving high returns on overseas investment.

**Table 3.9: Libya Balance of Payments (Million US\$)**

Please see print copy for table 3.9

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**Source:** IMF, *Balance of Payments Statistics Yearbook*, Washington, D.C.,

### **3.5: Conclusions**

The main findings of this chapter may be summarized in the following:

1. Libyan's dependence on expatriates to conduct its economic activities has declined sharply over the four decades examined. This is due to the fact that

the Libyan fertility rate is among the highest in the world and also due to stagnation in oil exports since 1982 and due to the reduction in the value of the Libyan domestic currency since 1999.

2. The services sector (wholesale and retail trade, transportation and communication, finance and real estate and Community, social and personal services) absorbs over three-quarters of the Libyan labor force.
3. The petroleum and mining sector forms the mainstay of the economy in Libya. The second most important sector is the service sector representing wholesale and retail trade, transportation and communication, finance and insurance and real estate.
4. The contribution of the manufacturing sector to Libyan GDP is very small and the contribution of the agricultural sector is declining.
5. The proportion of Libyan expenditure on exports and imports to total Libyan GDP is higher than all other expenditure proportions. Expenditure on private consumption in Libya is not as high as in advanced countries.
6. Most of Libyan expenditure on imports are related to machinery and transport equipment; manufactured goods classified by material and food and live animals
7. Libya seems to invest most of its balance of payments surplus overseas.

## CHAPTER FOUR

### Impact of Fluctuations in Oil Prices on Libyan Economic Growth

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*(A paper related to this chapter entitled “The Impact of Fluctuations in Oil Prices on Libyan Economic Growth”, has been published in **the Middle East Business and Economic Review**, Vol. 19., No. 1, June 2007, pp.39-55).*

#### Abstract

This Chapter tries to examine the impact of fluctuations in Libyan oil prices on Libyan economic growth. It compares the rates of growth of the Libyan oil sector and Libyan non-oil sectors over the last four decades. It also examines the relationship between exports and economic growth and the response of sectoral output expansion in oil exports. Moreover, this chapter tests if there is a long-term relationship between Libyan oil exports and non-oil GDP.

#### 4.1 Introduction

Over 50 percent of world supply of crude oil is produced by developing economies. The bulk of this production is supplied by developing countries who are members of the OPEC organization. These members are: Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, Unit Arab Emirates and Venezuela.

Libya has been exporting oil since 1960. The share of Libyan oil exports in OPEC is approximately 6 percent. Hence it would be useful to investigate the role of oil exports in the process of Libyan development.

Table 4.1 reveals the significance of oil exports in Libya over the past four decades. In 1963 oil exports amounted to about 99.7 percent of total commodity

exports and 97.9 percent of total exports of goods and services. These percentages were reduced slightly over the following 42 years. They amounted to 95.8 percent and 94.4 percent in 1981 and to 92.3 percent and 90.6 percent in 2004.

Table 4.1 also shows that in 1963 oil exports were responsible for over 47 percent of GDP. This percentage changed significantly over the following four decades due to changes in oil prices. Thus, in 1974, following the oil embargo, the percentage of oil exports to GDP increased to approximately 63 percent. At the end of the oil boom in 1981, the percentage of oil exports to GDP was reduced to the same level as before the boom. The share of oil exports to GDP went to its lowest level (20.6 percent) in 1998, when oil prices were very low (less than US\$10 per barrel). The sharp rise in oil prices in 2004 pushed this percentage to its highest level (65 percent). Finally, Table 4.1 shows that oil exports per capita was the highest in 1974 and the lowest in 1998.

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**Table 4.1: Significance of Oil Exports in the Libyan Economy**

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Please see print copy for table 4.1
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**Sources:** OPEC (2004&2005), Annual Statistics Bulletin and IMF, International Financial Statistics, Year Book (various issues).

Actually, if per capita income was to be used as the yardstick of economic development, then Libya, in 1974, would have been considered as a developed country. Its per capita GDP in that year was greater than that of the United Kingdom and was



more than twice the average for all developing market economies. However, the situation in 1998 was completely the opposite of that in 1974.

This chapter is divided into six sections. Section two compares the rates of growth of Libyan oil sector and Libyan non-oil sectors over the last four decades. Section three examines the relationship between exports and economic growth in the Libyan economy. The response of sectoral output to expansion in oil exports is examined in section four. Section five tests if there is a long-term relationship between Libyan oil exports and non-oil GDP. Section six summarizes the main findings of the study.

## **4.2 Rates of Growth of Libyan Oil Exports and Non-oil Sectors**

The remarkable increase in Libyan GDP has taken place after the oil embargo in 1973 and the consequent export price rises. It is therefore, attributable to the performance of the export sector and especially to the increasing oil prices.

Table 4.2 represents estimates of the (constant proportional) rates of growth over the four periods that experienced fluctuations in oil prices since 1963. Four periods were distinguished:

1963 – 1973

1974 – 1981

1982- 1998

1999 - 2004

The first and third periods represent the years of relative stagnation in oil prices while the second and fourth periods represent substantial increases in oil prices. The growth rates were calculated using the regression model:

$$\text{Log}_e Y_{it} = b_0 + b_1 t + \mu_t \quad (1)$$

Where  $Y_{i,t}$  represents the output of the  $i$ th sector in period  $t$  and  $t$  represents time. The coefficient  $b_1$  represents the proportional (constant) rate of growth i.e.

$$b_1 = [(d y / d t) / y] \quad (2)$$

The data in Table 4.2 show that the rates of growth of output of Libyan oil exports and output of non-oil sectors (*assessed in current values and measured in US dollars.*) were greater (in most cases during the period 1963-1973 when oil prices were very low (less than US\$3 per barrel) ) than during other periods. This may be due to the fact that the initial values were too small. The data in Table 2 also suggest that growth rates of all Libyan sectors were much higher during the period of oil boom (1974-1981) than during the period of oil recession (1982-1998).

**Table 4.2 Rates of Growth of Libyan Sectoral Output (Percentages)**

Sector	1963-73	1974-81	1982-98	1999-2004	1963-2004
Oil Exports	20.6	13.6	- 2.65	13.4	5.44
Total Non-Oil Output	18.5	17.4	1.85	-20.0	7.99
Agriculture, hunting & fishing	11.7	16.1	9.07	-13.0	10.5
Manufacturing	13.6	20.6	4.66	-13.8	10.5
Construction	28.1	14.1	-4.96	-9.78	6.47
Wholesale & Retail Trade	21.1	17.5	5.36	-13.4	9.38
Transport & Communication	32.1	14.6	4.75	-13.2	9.79
Other activities	18.4	15.3	0.00	-13.8	7.81

Because the Libyan Dinar was highly devalued against the US dollar since 1999, the values of sectoral output, measured in US dollars, had declined significantly over the period 1999- 2004. As a result, the growth rates of all sectors were negative during that period, despite the fact that oil exports (measured in US dollars) during the same period, enjoyed a very high rate of growth. When measured in local prices, all Libyan non-oil sectors, with the exception of agriculture and trade, had a zero rate of growth.

This suggests that the Libyan economy did not benefit from the growth in its oil exports during the last few years

### **4.3: Relationship between Exports and Economic Growth**

The mechanism by which exports could act as an ‘engine of growth’ (or leading sector) and the determinants of the overall impact of an export stimulation on the economy have been well discussed in the literature (Baldwin, 1965; Bhagwati et al., 1971; Chambers and Gordon, 1966, Esfahani, 1991; Erazy, 1967; Frankel, and Romer, 1996; Lee , 1989, Metwally, and Tamaschke, 1980, Metwally and Abdel-Rahman, 1985; Metwally, 2004; Ram, 1987; Riedel,1984; Severn, 1968; Srinivasan, 2001, Syron. and Wassu, 1968, Tamachke, 1979 and.Watkins, 1977). Exports contribute to economic growth directly (through direct contributions to GDP) and indirectly through contributions to GDP per medium of spread (or carry-over) effects. The indirect contribution to growth holds Hirschman-type linkages and can broadly be considered as a sequence of multiplier-accelerator mechanisms (Hirschman, 1958). It is also claimed that the instability of commodity prices has an important impact on economic growth (Cashin, and Mc Dermott, 2002; Ghosh, and Ostry, 1994; Love, 1986, Massel,, 1990 and Salvatore, 1998).The postulated relationship between export growth and GDP over time is central to the ‘exports as an engine of growth’ model; theoretically exports can contribute to the growth of GDP directly and indirectly per medium of spread effects, which taken time.

It is important to note even at this early stage, that apart from the *notion* that the growth of the export sector and GDP are related over time (per medium of a sequence of multiplier-accelerator mechanisms), the model says little or nothing about what

length of time might *actually* be involved, This shortcoming is obviously not confined to the 'exports as an engine of growth' model alone and seems to be common to *all* economic theory postulating lagged time relationships between variables, The question of determining time lags between export growth and economic growth must therefore be central to econometric investigations of trade and growth. As Metwally and Tamaschke (1980) argued, this aspect has in fact been sadly neglected in the existing econometric literature in the area. With this in mind the central tool used in the analysis to follow, is the dynamic (or lagged) regression relationship utilizing annual data, which is the form taken by most of the important available series. When preliminary investigations suggested that the current period provided the most important weight, geometrically declining weights were imposed from the current period (that is a Koyck distributed lag scheme, Koyck, 1954). For statistical reasons, discrete lags were used in other cases. The equations were calculated from variables in natural logarithmic first difference form (that is:  $\log_e X_t - \log_e X_{t-1}$ ), which is virtually a percentage change. There are a number of theoretical reasons for this. First, because spread effects include acceleration effects, proper specification suggests that the equations incorporate some concept of change. Second, since we do not necessarily expect a constant impact on the economy over time of an export stimulus of given intensity (for instance because of diversification of the economy, import substitution and technological change) simple linear relationships would seem to be inappropriate (Metwally and Tamaschke (1980)). Hence, natural log differences have been used in an attempt to deal with these problems. The equations were tested for multicollinearity along the lines suggested by Farrar and Glauber (1967) and give no undue cause for concern. Inspection of the residuals in the

series (that are too short to test the assumption of homoscedasticity amongst the residuals about the fitted equations), suggested that there is no cause for concern in this respect. Autocorrelation tests, using Durbin “h” statistics, suggested by Durbin (1970) were not used in small periods.

Table 4.3 provides the econometric results of the investigations into the relationship between export growth and GDP (in current prices) for the four periods that exhibit variations in oil prices. The following regression model was used:

$$\ln ( Y_t / Y_{t-1} ) = b_0 + b_1 \ln ( X_t / X_{t-1} ) + b_2 \ln ( Y_{t-1} / Y_{t-2} ) + u_t \quad (3)$$

Where: Y = GDP

X = Oil exports.

**Table 4.3: Libyan Oil Exports and Gross Domestic Product (Current Price)**

The Model:  $\ln ( Y_t / Y_{t-1} ) = \hat{b}_0 + \hat{b}_1 \ln ( X_t / X_{t-1} ) + \hat{b}_2 \ln ( Y_{t-1} / Y_{t-2} ) + u_t$

Period	N	$\hat{b}_0$	$\hat{b}_1$	$\hat{b}_2$	$\overline{R}^2$	F	“h”
1963-1973	11	0.014 (0.307)	0.622 (5.706)*	0.311 (1.681)	0.755	16.4	1.6
1974-1981	8	0.039 (2.084)**	0.641 (21.0)	0.149 (2.589)**	0.987	260.3	
1982-1998	17	0.005 (0.630)	0.136 (3.811)*	0.111 (1.427)	0.536	8.079	1.02
1999-2004	6	-.174 (-1.81)	0.721 (3.903)*	0.102 (2.897)**	0.914	15.7	
1963-2004	42	0.137 (0.787)	0.544 (9.641)*	0.261 (3.129)*	0.718	53.3	1.16

Note: \* denotes 1 percent level of significance and \*\* denotes 5 percent level of significance

The regression results suggest that the current period export coefficient is highly significant in all periods. By way of contrast, however, the lagged GDP variable (representing all lagged exports via the Koyck geometrically declining weight

assumption Koyck, 1954) is significant at least at the 5% level only in the periods that enjoyed high oil prices (1974-1981 and 1999-2004). As this part of the results could be explained as representing the spread effects, the results clearly imply that the Libyan GDP has benefited from opportunities generated by increase in oil exports. However, the lagged effects are outweighed by the current period contributions, which could suggest that the investment opportunities generated, are not fully exploited.

Two important points can be raised against the econometric results in Table 4.3: (i) These results were computed from data valued at current prices and thus may show strong inflationary impacts; (ii) The result of the coefficients of the variable  $\ln (X_t/X_{t-1})$ , may be a expression of the simple fact that exports are an element of GDP. To exclude the inflationary effects the relationship between oil export and GDP was re-estimated in constant prices. As Metwally and Tamaschke (1980) argued, that deflating exports by an index of import prices and not by an index of export prices should be more acceptable. Therefore, both GDP and oil exports were deflated by an index of import prices. Given that, an increase in the price of exports relative to that of imports (i.e. an improvement in the terms of trade) reflects a true gain to the economy.

The following model was tested:

$$\ln (Y_t^- / Y_{t-1}^-) = b_0 + b_1 \ln (X_t^- / X_{t-1}^-) + b_2 \ln (Y_{t-1}^- / Y_{t-2}^-) + u_t \quad (4)$$

Where:  $Y^-$  = GDP valued at constant import prices (1963=100)

$X^-$  = Oil exports valued at constant import prices (1963=100)

The econometric results obtained using this method of deflation is shown in Table 4.4.

These results conform partially with those in Table 4.3 (where variables are valued at current prices). The regression results indicate that the export coefficient is

highly significant in all periods. In contrast, the lagged GDP variable was not significant at any period. Therefore, the improvement in terms of trade, show that the oil sector in Libya is smaller when valued at constant import prices and that spread effects in this country depend more on export prices rather than on export quantities. It would be, of course, absurd to disregard the price effect of oil exports when the rest of the world is expressing great concern about the continuous rise in these prices and when a real export price rise (*i.e.* relative to the price of imports) represents a rise in real income and theoretically could generate its own sequence of spread effects.

**Table 4.4: Libyan Oil Exports and Gross Domestic Product (Deflated by import Price)**

The Model:  $\ln (Y_t / Y_{t-1}) = \hat{b}_0 + \hat{b}_1 \ln (X_t / X_{t-1}) + \hat{b}_2 \ln (Y_{t-1} / Y_{t-2}) + e_t$

Period	N	$\hat{b}_0$	$\hat{b}_1$	$\hat{b}_2$	$\bar{R}^2$	F	“h”
1963-1973	11	0.283 (1.264)	0.706 (6.227)*	0.012 (0.071)	0.800	21.1	
1974-1981	8	0.188 (0.662)	0.560 (4.994)*	0.256 (1.358)	0.821	17.0	
1982-1998	17	0.361 (1.901)**	0.393 (4.124)	0.429 (1.445)	0.531	10.0	1.044
1999-2004	6	0.291 (0.727)	0.820 (4.658)*	0.031 (0.377)	0.706	9.603	
1963-2004	42	0.363	0.549 (9.018)*	0.089 (0.984)	0.660	40.8	0.974

Note: \* denotes 1 percent level of significance and \*\* denotes 5 percent level of significance

To suppress the component effect the contribution of the oil (*i.e.* mining) sector from GDP has been excluded and the changes in the output of the remaining sectors (*i.e.* GDP minus oil) were regressed on changes in oil exports. To suppress both the component and the inflationary effects (*i.e.* the rise in prices which does not represent a rise in real incomes) the deflated value of total non-oil output (*i.e.* the domestic product

of industries other than mining) was regressed on the deflated value of exports (using an import price index with 1963 =100). The following model was tested:

$$\ln(Y_{\text{non-oil},t} / Y_{\text{non-oil},t-1}) = b_0 + b_1 \ln(X_t / X_{t-1}) + b_2 \ln(Y_{\text{non-oil},t-1} / Y_{\text{non-oil},t-2}) + u_t \quad (5)$$

Where:

$Y_{\text{non-oil}}$  = (GDP – Oil) valued at constant import prices

$X$  = Oil exports valued at constant import prices

The regression results are given in Table 4.5. These results show that when both the component and the inflationary effects are excluded there is no evidence of spread effects of oil exports to the rest of the economy (non-Oil GDP).

**Table 4.5: Libyan Oil Exports and Non-oil GDP (Deflated by Import Price)**

The Model:  $\ln(Y_{\text{non-oil},t} / Y_{\text{non-oil},t-1}) = \hat{b}_0 + \hat{b}_1 \ln(X_t / X_{t-1}) + \hat{b}_2 \ln(Y_{\text{non-oil},t-1} / Y_{\text{non-oil},t-2}) + e_t$

Period	N	$\hat{b}_0$	$\hat{b}_1$	$\hat{b}_2$	$\overline{R}^2$	F	“h”
1963-1973	11	0.542 (1.245)	0.542 (1.804)	0.059 (0.210)	0.214	2.515	
1974-1981	8	1.540 (2.832)	0.249 (0.969)	0.264 (0.362)	- 0.159	0.521	
1982-1998	17	0.530 (1.919)	0.194 (1.354)	0.279 (1.193)	0.69	1.594	1.002
1999-2004	6	0.147 (0.282)	0.306 (2.090)	0.227 (0.619)	0.322	2.187	
1963-2004	42	0.566 (2.938)	0.317 (2.071)	0.119 (0.815)	0.229	3.146	1.652

Note: \* denotes 1 percent level of significance and \*\* denotes 5 percent level of significance



#### 4.4 Response of Sectors' Output to Expansion in Oil Exports

It is argued that various sectors in any economy respond to fluctuation in the income of a major source of income, such as oil exports in the oil producing economies (Lucas, 1988, Barro, 1991, Mankiw, Romer and Weil 1992; Salvatore, 1996). Available data were disaggregated to investigate the relationship between sectoral output and exports. The responsiveness of the output of six main sectors to changes in exports was examined. A priori it is expected that the growth in exports would stimulate the output of these sectors, through backward, forward and final demand linkages as well as through less direct spread effects.

The response of sector's output to expansion in oil exports for the period 1963-2004 can be tested using the following regression model:

$$\ln(Y_{it}/Y_{it-1}) = b_0 + b_1 \ln(X_{it}/X_{it-1}) + b_2 \ln(Y_{it-1}/Y_{it-2}) + b_3 D_t + u_t \quad (6)$$

Where:

$Y_i$  = Real output of the  $i$ th sector

$X$  = Oil exports valued at constant import prices

$D_t$  = A dummy variable where:  $D=0$ : 1963-1973; 1982-1998

$D=1$ : 1974-1981; 1999 – 2004

A dummy variable is used to assess the impact of fluctuations in oil prices during the period of 1963-2004.

The econometric results of this analysis are shown in Table 4.6. Once the inflationary effect is excluded and real output is regressed against real exports, (again deflated by an import price index (1963=100) to follow real gains), the econometric results of the sectoral analysis support, largely, those of Table 4.5.

The “t” values of the coefficient  $b_1$  in Table 4.6, suggests that in Libya, real output of all sectors, with the exception of the trade sector (wholesale and retail trade) and other economic activities (finance, insurance and other services) has not responded to growth in exports. Since a dummy variable is used to assess the impact of fluctuations in oil prices, if the dummy variables in all cases are not statistically significant, the intercept of real output did not increase during periods of rise in export prices.

The most important result from the sectoral analysis is that manufacturing output in the Libyan economy does not seem to have responded to changes in oil exports. This indicates weak linkages. The statistically significant intercept term for this sector in the Libyan economy clearly suggests that a good part of manufacturing output in grows independently of the expansion in exports. This may indicate that this sector engages primarily in the production of import substitutes for which there is a ready demand. It may also indicate that the expansion in oil exports is not fully exploited in stimulating manufacturing output. In other words, the Libyan economy may be finding problems in trying to maximize the rate of growth of what might be considered the only alternative if it was to lessen its dependence on oil. Perhaps one basic problem is that of market limitations (Metwally, 1979).

**Table 4.6: Oil Exports and Output of Various Libyan Sectors**

The model :  $\ln (Y_{it} / Y_{i,t-1}) = b_0 + b_1 \ln (X_{it} / X_{i,t-1}) + b_2 \ln (Y_{i,t-1} / Y_{i,t-2}) + b_3 D_t + u_i$

Sector	$b_0$	$b_1$	$b_2$	$b_3$	$\bar{R}^2$	F	“h”
Agriculture, hunting & fishing	0.786 (4.126)*	0.0035 (0.029)	0.3224 (1.427)	-0.024 (0.253)	-0.022	0.708	1.783
Manufacturing	0.424 (2.510)**	0.616 (1.677)	0.236 (0.157)	-0.016 (0.992)	0.140	3.009	1.752
Construction	0.371 (1.745)	0.382 (1.798)	0.259 (1.961)	-0.0067 (0.468)	0.134	3.110	1.665
Wholesale & Retail Trade	0.511 (2.099)**	0.407 (2.910)*	0.918 (0.639)	-0.020 (1.478)	0.312	6.535	1.651
Transport & Communication.	1.162 (1.013)	0.219 (0.191)	0.309 (1.910)**	-0.076 (0.841)	0.032	1.452	1.643
Other Economic Activities	0.456 (2.438)*	0.369 (3.440)*	0.181 (1.292)	-0.0140 (1.647)**	0.325	6.859	1.322

Note: \* denotes 1 percent level of significance and \*\* denotes 5 percent level of significance

It is not surprising therefore, that most of the increase in oil revenue finds its way to investment overseas, imports of goods and services and to the pile up of reserves and that only a small fraction of oil export proceeds are ploughed back into the economy to build its productive capacity.

#### **4.5: Long-Term Relationship between Libyan GDP and its Oil Exports**

The aim of this section is to test if there is a long-term relationship between Libyan oil exports and its GDP. If such a relationship exists, this would suggest that the two variables do not drift too far apart from each other over time. In other words, there is evidence of cointegration between the two variables. This would imply that growth in GDP in Libya is simply a reflection of growth in its oil exports. However if there is no

evidence of cointegration, the relative magnitude of Libyan GDP may be increasing or decreasing over-time, compared with its oil exports (Romer, 1986).

This section uses the cointegration technique to examine the long-term relationship between Libyan GDP and oil exports. If a long-run relationship exists, the two variables must form a unique cointegrating vector. In order to test for cointegration, and in particular to investigate whether a unique cointegrating vector can be identified, we have employed the maximum likelihood estimation technique developed by Johansen (1988) and Johansen and Juselius (1990). This approach can be used in a multivariate setting to establish the numbers of distinct cointegrating vectors (Ng and Perron, 1997).

The first step in applying this technique is to test for the order of integration of each variable included in the model. It is a common practice to use the Augmented Dickey – Fuller Test (ADF) given by the following equation for variable Z.

$$Z_t = \alpha + \beta Z_{t-1} + \sum_{i=1}^k \tau_i \Delta Z_{t-1} + \omega_t \quad (7)$$

Where,  $\omega_t$  is an error term (Dickey and Fuller 1979, Dickey and Rossana, 1994).

The cumulative distribution of the ADF test statistic is provided by Mackinnon (1991). If the calculated (absolute) statistic is greater than its critical value, then Z is said to be stationary or I(0). Table 4.7 represents the results of the Augmented Dickey – Fuller test. The estimation is based on a total of 42 observations for the period 1963 to 2004. The Augmented Dickey-Fuller regressions include an intercept and a linear trend.

It is clear that the calculated (absolute) statistics are greater than the critical value for the variables representing Libyan GDP and Libyan oil exports only for the differenced variables. This indicates non-stationarity of these variables at the level and

that the variables have achieved stationarity after being differenced once. Thus, the variables are integrated of order one,  $I(1)$ . This fact enables us to conduct the cointegration analysis. (Johansen, 1988). This technique suggests a maximum likelihood estimation procedure that provides two test statistics for determining the number of cointegrating vectors that could exist among a set of variables.

The trended case, with a trend in GDP, which has higher critical values, was considered in this analysis (Wickens, 1996 and Wooldridge, 2006). The first step is to specify a lag length for the VAR, which, on the basis of the likelihood ratio test, was set at four periods. Table 4.8 give the cointegration results for the long-term relationship between Libyan GDP and Libyan total exports.

**Table 4.7: Unit Root Tests of Libyan GDP and Libyan Oil Exports**

Variables	ADF stat for log	ADF stat for $\Delta$ log
Libyan GDP	-2.0112	-5.3661
Libyan Oil Exports	-1.9933	-5.2264

Note: 95% critical value for the augmented Dickey-Fuller statistic = -2.9 for the log values and = -3.6 for  $\Delta$ log values

The results in Table 4.8 show that the LR tests based on maximal eigenvalue of the stochastic matrix and the trace of the stochastic matrix suggest that the null hypothesis of no cointegration cannot be rejected for Libyan GDP with its oil exports. Thus, there is no evidence of long-term relationship between Libyan Gross Domestic Product and its oil exports.

**Table 4.8**  
**Results of Cointegration Analysis for Libyan GDP and Oil Exports**  
*Cointegration with unrestricted intercepts and unrestricted trends in the VAR*

1. Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

38 observations from: 5 to 42. Order of VAR = 4.

List of variables included in the cointegrating vector:

Log Exports              Log GDP

List of eigenvalues in descending order:

.25293    .041384

\*\*\*\*\*

Null	Alternative	Statistic	95% Critical Value	90%Critical Value
r = 0	r = 1	11.0808	18.3300	16.2800
r ≤ 1	r = 2	1.6061	11.5400	9.7500

\*\*\*\*\*

2. Cointegration LR Test Based on Trace of the Stochastic Matrix

\*\*\*\*\*

38 observations: from 5 to 42. Order of VAR = 4.

List of variables included in the cointegrating vector:

Log Exports              Log GDP

List of eigenvalues in descending order:

.25293    .041384

\*\*\*\*\*

Null	Alternative	Statistic	95% Critical Value	90%Critical Value
r = 0	r ≥ 1	12.6869	23.8300	21.2300
r ≤ 1	r = 2	1.6061	11.5400	9.7500

\*\*\*\*\*

Choice of the Number of Cointegrating Relations Using Model Selection Criteria

\*\*\*\*\*

38 observations from 5 to 42. Order of VAR = 4.

List of variables included in the cointegrating vector:

Log Exports              Log GDP

List of eigenvalues in descending order:

.25293    .041384

\*\*\*\*\*

Rank	Maximized LL	AIC	SBC	HQC
r = 0	32.8753	16.8753	3.7746	12.2141
r = 1	38.4157	19.4157	3.8586	13.8806
r = 2	39.2187	19.2187	2.8429	13.3923

\*\*\*\*\*

Note: AIC = Akaike Information Criterion    SBC = Schwarz Bayesian Criterion  
HQC = Hannan-Quinn Criterion

#### **4.6: Conclusions:**

The main conclusions of this chapter are:

1. The growth rates of all Libyan sectors were much higher during the periods of rises in oil prices than during the period of oil recession. However, economic growth of all Libyan sectors (with the exception of agriculture and wholesale retail trade) did not benefit from the growth in its oil exports during the last few years which may suggest lack of investment opportunities in recent years.

2. Libyan GDP has benefited from opportunities generated by increase in oil exports. However, the lagged effects are outweighed by the current period contributions that could suggest that the investment opportunities generated are not fully exploited.

3. The relationship between exports and GDP in constant prices, but allowing for improvements in the terms of trade, suggest that the export coefficient is highly significant in all periods. However, the lagged GDP variable (representing all lagged exports via the Koyck geometrically declining weight assumption) was not significant in any period which may suggest a lack of investment opportunities in all periods.

4. When both the component and the inflationary effects are excluded there is no evidence of spread effects of oil exports to the rest of the economy.

5. Real output of all Libyan sectors, with the exception of the trade sector (wholesale and retail trade) and other economic activities (including finance, insurance and other services) has not responded to growth in exports, if anything the growth in the manufacturing sector has been in the opposite direction to that of oil exports over the last four decades.

6. The null hypothesis of no cointegration cannot be rejected for Libyan GDP with its oil exports. Thus, there is no evidence of long-term relationship between Libyan Gross Domestic Product and Libyan oil exports.



## **CHAPTER FIVE**

### **Impact of Fluctuations in Oil Prices on Investment in the Libyan Economy**

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*(A paper related to this chapter entitled “The Impact of Fluctuations in Oil Prices on Investment in the Libyan Economy “, has been published in **Global Review of Business and Economic Research**, Vol.3, no.1, January-June 2007, pp. 1-12).*

#### **Abstract**

This Chapter examines the behavior of investment in the Libyan economy, based on a number of models, and attempts to assess the impact of fluctuations in oil prices on investment. The chapter also uses co-integration analysis to determine if there is a long-term relationship between investment and other components of aggregate demand (private consumption plus public consumption plus net exports) in the Libyan economy.

#### **5.1: Introduction**

Investment plays a significant role in any economy. Being a component of aggregate demand, investment is an important determinant of the general level of economic activity. Also, the considerable volatility of investment expenditure is a prime contributor to aggregate fluctuations. That new investment may generate learning externalities or be the leading channel through which innovations stimulate growth has led to much interest in public policies encouraging fixed capital formation (Chirinko, 1993). Investment spending provides the basis for economic growth and improves national capacity and productivity (Dornbusch and Fischer, 1996).

The Chapter is divided into six sections. Section 5-2 briefly reviews the literature on the determinants of the investment function. Section three examines the behavior of investment in the Libyan economy. Section four empirically tests the investment function in Libya. Section five uses cointegration analysis to test long-term relationships between investment and other components of aggregate demand in the Libyan economy. Finally, section six summarizes the main conclusions of the chapter.

## **5.2: A Brief Review of Literature**

The Classical economists believed that investment is determined mainly by two factors: the cost of capital that is measured by the interest rate and the value of output, which is increased by a unit of new capital investment. Alfred Marshall (1920) maintains that the demand for capital goods continues as long as the return on capital exceeds the market interest rate. The predominant role given to the rate of interest in investment determination was clear in the writings of other classical economists such as Adam Smith, Ricardo and Peterson (Castle, 1991). Keynes (1936) believed that there is more to investment determination than changes in the rate of interest. He believed that the most important factor in changing investment demand was the expectations of producers about the future. According to his theory, the rate of investment is determined by the gap between the marginal efficiency of capital and the rate of interest.

The Neo-classical theory of investment was introduced by Irving Fisher (1930) and developed by Witte (1963) who argued that the demand for capital goods is based on profit maximization and on the lag or lags of capital stock. The most influential

neoclassical approach to investment theory is presented by Jorgenson (1967 and 1971). He presented a theory of capital accumulation. According to him, optimal capital accumulation is achieved by maximizing the utility of a stream of income. A similar argument was given by Eisner, and Ishaq (1968),

Chirinko (1993) divided total investment into net and replacement components. Net Investment ( $I_t^n$ ) is determined by a distributed lag on new orders, which equal in a given period the change in the desired capital stock ( $K^*$ ).

$$I_t^n = \sum_{j=0}^J \beta_j \Delta K_{t-j}^* \quad (1)$$

Where, the  $\beta$ 's represent the delivery lag contribution extending for  $J+1$  period. Capital is assumed to depreciate geometrically at a constant mechanistic rate ( $\delta$ ). Replacement investment ( $I_t^r$ ) is proportional to the capital stock available at the beginning of the period and, in contrast to  $I_t^n$ , adjusts instantaneously.

$$I_t^r = \delta K_{t-1} \quad (2)$$

The relation between the desired stock of capital, the level of output ( $Y$ ) and the user cost (or rental price) of capital ( $C_t$ ) can be expressed as

$$K_t^* = \alpha Y C_t^{-\sigma} \quad (3)$$

Where,  $\sigma$  is the elasticity of substitution between capital and factor inputs, assumed to be constant. Combining the last three equations and appending a stochastic error ( $\mu_t$ ),

Chirinko obtained the following Neo-classical Model of investment:

$$I_t = I_t^r + I_t^n = \delta K_{t-1} + \sum_{j=0}^J \alpha \beta_j \Delta (Y_{t-j} C_{t-j}^{-\sigma}) + \mu_t \quad (4)$$

$\sigma$  was always assumed to be unity in Jorgenson's work, though alternative values are also consistent with the Neo-classical framework (Eisner and Ishaq, 1968) when  $\sigma = 0$ , equation (4) reduces to the flexible accelerator (Chenery, 1952), and if delivery lags are absent, the simple accelerator (Clark, 1917).

Tobin (1969) tried to develop Keynes' investment (1936) approach by explaining investment behavior through the gap between the desired capital stock and actual stock of capital in each period by a ratio that is known as Tobin's "q". Ott et.al. (1975) also argued that investment will be made when the actual stock of capital differs from the desired capital stock. They concluded that gross fixed investment ( $I$ ) is a function of the real cost of capital ( $C/P$ ), output ( $Y$ ), the rate of change of output ( $dY$ ) and the existing stock of capital ( $K$ ).

$$I = Y \left[ \left( d \frac{AP}{C} \right) \right] + \left( \frac{AP}{C} \right) dY + \delta K \quad (5)$$

Where, ( $\delta$ ) is the rate of depreciation, and ( $A$ ) is a constant. They conclude that gross investment is positively influenced by output, change in output and the existing stock of capital and negatively influenced by the real cost of capital (Ott et.al, 1975).

Haines (1978) introduced a number of accelerator models of desired capital stock. He concluded that gross investment ( $I$ ) is related to the lag of output ( $Y$ ), capital stock and the interest rate ( $I$ ). He used British annual data for 1955-70 to estimate the following investment function.

$$I_t = a_0 + a_1 I_{t-1} + a_2 \Delta Y_{t-1} + a_3 \Delta Y_{t-2} + a_4 \Delta I_{t-1} + a_5 i_{t-2} + u_t \quad (6)$$

Wallis (1979) developed the Jorgenson Theory of investment. He suggests an accumulation of capital model based on the firm's actions to maximize its net wealth

that is the present value of all future net cash flows. In this respect, gross investment is modified as:

$$I_t = \alpha_1 P_t^* + a_2 Y_t^* + \gamma I_{t-1} \quad (7)$$

Where  $P^*$  and  $Y^*$  are components of current and lagged prices and output as follows:

$$P_t^* = P_t - (1 - \delta)P_{t-1} \quad (8)$$

And

$$Y_t^* = Y_t - (a - \delta)Y_{t-1} \quad (9)$$

Thus, investment expenditure is affected by the present and lagged values of prices and output and also the lag of investment expenditure.

Wai and Wong (1982) defined an empirical flexible accelerator theory of investment related to five developing countries (Greece, Korea, Malaysia, Mexico and Thailand) based on data during the 1960s up to the middle of the 1970s, using the following model:

$$I_t = a_0 + a_1 Y_t + a_2 \Delta(BC)_t + a_3 M_t + a_4 K_{t-1} + u_{1t} \quad (10)$$

where, I, Y, and K are investment, output and capital stock respectively.  $\Delta(BC)$  is the change in bank credit and M is net capital inflow.

Greene and Delane (1990, 1991) argued that the Neo-classical flexible-accelerator model that has been widely accepted as a general theory of investment for industrialized countries is by and large hard to test in developing countries. They claim that the main assumptions of this theory, such as perfect capital markets and little or no government economic intervention are not applicable in these countries. Also, data and certain variables such as capital stock, real wage, real financing rate for debt and equity are unavailable or inadequate.

Metwally (1989) compared the impact of interest rates on the investment function in a number of Islamic and non-Islamic countries. He concluded that the rate of interest does not have any significant role in determining the demand for investment in the Islamic countries studied.

### **5.3: Behavior of Investment in the Libyan Economy**

The Libyan government carries out a large percentage of investment. Public investment has been concentrated mainly in infrastructure and the oil sector, including petrochemical industries. Private fixed capital formation, on the other hand, was directed mainly to the construction sector and the (modest) manufacturing sector. Public investment is, to a great extent, autonomous of changes in demand and interest rates and is financed from government oil revenue. Private investment depends heavily on growth in private consumption, which is affected greatly by growth in government expenditure. This suggests that total (public and private) investment in the Libyan economy depends on oil revenue, with some lag(s). The point is highlighted from the data in Table 5-1. It is clear that more resources were devoted to Gross Fixed Capital Formation (GFCF) during the boom years (1974-1981) than during the stagnant periods (1963 -1973 and 1982 -1998). This may support the argument put forward by Love (1989), and Khan and Reinhart (1990) that oil exports determine investment directly in the oil-producing countries.

**Table 5.1: Gross Fixed Capital Formation in the Libyan Economy (Current Prices)**

	1963-73	1974-81	1982-98	1999-2004	1963-2004
Million US dollars	782	5728	4645	3323	3650
Percentage of GDP	22.8	26.0	16.7	12.0	18.0

The fluctuations in oil revenue had a significant impact on the growth of Gross Fixed Capital Formation in the Libyan economy. The data in Table 5-2 suggest that this growth was relatively higher during the boom years than other years (1974-1983). The rate of growth was calculated using the regression model:

$$\ln I_t = b_0 + r t,$$

Where  $I$  is GFCF;  $t$  is time and  $b_0$  is a constant;  $r$  represents the rate of growth.

$$r = [(d I / d t) (1 / I)]$$

The downturn in oil prices had a serious adverse effect on investment. The rate of growth of this variable was negative during the period 1984-2004, i.e. following the downturn in oil prices. The periods of rises in oil prices witnessed significant growth in investment.

**Table 5.2: Rates of Growth of Libyan Gross Fixed Capital Formation (%)**

Period	Rate of Growth
1963-1973	11.5
1974-1983	14.8
1984-2004	-2.40
1963-2004	4.32

#### 5.4: Determination of the Investment Function in the Libyan Economy

An accelerator model of investment is used to capture investment behavior in the Libyan economy. There are many reasons for this choice:

1. The models which assume free market conditions and little or no government intervention are obviously not appropriate for the Middle East oil producing countries, where markets are imperfect and the government plays a strong role in the economy.
2. Asset and capital markets are not highly organized and the rate of interest is often kept lower than the market rate
3. Lack of data on wealth, assets, debt, nominal wages, capital stock etc. renders it very difficult to apply most investment models.

The acceleration model assumes a fixed ratio ( $\alpha$ ) between the desired capital stock ( $K^*$ ) and expected output ( $Y^*$ ):

$$K_t^* = \alpha Y_t^* \quad (11)$$

The flexible accelerator also provides a generalization in which actual net investment is a proportion of investment, required to achieve the desired capital stock

$$\Delta K_t^* = \beta(K_t^* - K_{t-1}) \quad (12)$$

$$K_t = \beta K_t^* + (1 - \beta)KL_t \quad (13)$$

Where,  $K$  and  $KL$  are capital stock and its lag respectively. Gross investment ( $I$ ) is equal to net investment plus replacement investment ( $D$ ):

$$I_t = \Delta K_t + D_t \quad (14)$$



It is usually assumed that replacement investment or depreciation is a proportion of existing capital stock. Therefore, it can be assumed that:

$$\begin{aligned}
 I_t &= \Delta k_t - \delta k_{t-1} \\
 &= k_t - (1 - \delta)k_{t-1} \\
 &= k_t - (1 - \delta)kL_t \\
 &= [1 - (1 - \delta)]k_t
 \end{aligned} \tag{15}$$

or

$$K_t = \frac{I_t}{[1 - (1 - \delta)L]} \tag{16}$$

The stock of capital for the last period becomes:

$$K_{t-1} = \frac{I_{t-1}}{[1 - (1 - \delta)L]} \tag{17}$$

where, ( $\delta$ ) is the rate of depreciation of capital goods. If the capital stock and its lag from equations (16) and (17) are substituted in equation (13) we obtain:

$$\frac{I_t}{[1 - (1 - \delta)L]} = \beta K_t^* + (1 - \beta) \frac{I_{t-1}}{[1 - (1 - \delta)L]} \tag{18}$$

Or,

$$I_t = [1 - (1 - \delta)L] \beta K_t^* + (1 - \beta) I_{t-1} \tag{19}$$

If the expected capital stock in equation (11) is substituted into equation (19) we obtain:

$$I_t = [1 - (1 - \delta)L] \beta \alpha Y_t^* + (1 - \beta) I_{t-1} \tag{20}$$

The last equation can be simplified as

$$I_t = f(Y_t^*, I_{t-1}) \tag{21}$$

Equation (21) defines gross investment as a function of expected output and the lag of gross investment. If we assume that expected output is a proportion of actual output, we obtain

$$I_t = f(Y_t, I_{t-1}) \quad (22)$$

Since

$$Y_t = C_t + G_t + I_t + (X - M)_t$$

Equation (22) can be written as:

$$I_t = f(C_t, G_t, (X - M)_t, I_{t-1}) \quad (23)$$

where,  $C$ ,  $G$  and  $X-M$  are private consumption, government consumption and net exports respectively.

If we assume a gestation period in the investment behavior, the accelerator model may take the form

$$I_t = g[(Y_t - Y_{t-1}, I_{t-1})] \quad (24)$$

Based on equations (23) and (24), the following two models were developed and empirically tested:

$$(1) \quad \log_e I_t = a_0 + a_1 \log_e [C + G + X - M]_t + a_2 \log_e I_{t-1} + u_t \quad (25)$$

$$(2) \quad I_t = b_0 + b_1(Y_t - Y_{t-1}) + b_2 I_{t-1} + v_t \quad (26)$$

The above two models were tested for the Libyan economy during four periods that are distinguished in terms of fluctuations in oil prices. Recall that the period (1963-73) had a stable *low* oil prices (less than \$2.50 per barrel). The period 1974-1981

represents a boom in revenue of oil exports (where oil prices went up from approximately \$12 per barrel in late 1973 to more than \$36.00 per barrel in 1981). Oil prices went down to less than \$12 per barrel during the period 1982-1998 and started rising again from 1999. On the assumption of a gestation period in the investment behavior of two years, the following periods were distinguished:

1963-1973

1974-1983

1984-2004

The whole period 1963-2004 was also considered.

The regression results for the two models are given in Tables 5.3 and 5.4.

The data in Table 5.3 would seem to suggest that:

1. The first model is a good fit as evident from the values of  $R^2$  and the “t” statistics (shown in parentheses under each coefficient). The Durbin “h” statistic measured in periods of more than 30 observations. (Gujarati, 2004 and Wooldridge, 2006). During the period 1963-2004) the h statistic does not suggest any problem of serial correlation at the 5 per cent level of significance.
2. All coefficients carry the correct sign and the coefficient of the variable  $I_{t-1}$  lies between zero and one in all cases.
3. The coefficient of the variable  $(C+G+X-M)$  that represents non-capital expenditure was not statistically significant at the 5% level during the period 1984-2004, which suffered a significant reduction in oil prices, suggesting that the demand for investment is strongly influenced by other components of aggregate demand during periods of expansion in value of oil exports.

**Table 5.3: Regression Results of Model 1**

Period	N	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	$\overline{R}^2$	F	h
1963 -1973	11	2.238 (1.762)**	0.624 (4.108)*	0.080 (0.280)	0.764	17.2	
1974-1983	10	-0.372 (1.174)	0.570 (2.453)**	0.399 (2.577)	0.954	94.9	
1984-2004	21	-0.281 (-0.113)	0.337 (1.569)	0.614 (5.492)*	0.591	15.4	
1963-2004	42	0.337 (1.082)	0.207 (2.589)**	0.712 (7.393)*	0.936	302.6	1.84

Note: \* and \*\* denote to 1 and 5 percent level of significance respectively.

4. The significance of the lagged investment variable suggests the existence of a partial adjustment mechanism only during the period of rise in oil prices and during the combined last four decades. However, the relatively high adjustment coefficient during the period 1963-2004 suggests the existence of some bottlenecks. The bottlenecks may be due to the concentration of Libyan public investment on infrastructure and the concentration of the Libyan private investment on the construction sector. Such a concentration depends on oil revenue, which was subject, to great fluctuations during the period 1963-2004.

The regression results of Table 5.4 suggest that:

1. The demand for investment in the Libyan economy was not growth-driven during the stagnation period (1984-2004). The coefficient of the growth variables  $(Y_t - Y_{t-1})$  was not statistically significant at 5 percent. This suggests that most investment in Libya during that period was autonomous, i.e. public investment.

2. The adjustment in the demand for investment to growth in aggregate demand has been subject to severe bottlenecks during the oil export boom years and during the last four decades. Some of these bottlenecks relate to the inadequacy of infrastructure.
3. By pooling the data and using dummy variables it was discovered that there is no evidence of structural shift in the demand for investment that is not growth-driving

The results in Table 5.3 were used to derive the elasticities of investment expenditure with respect to expenditure on other components of aggregate demand. These elasticities are given in Table 5.5. The estimated coefficient  $\hat{a}_1$  represents the short-run elasticity, while the long-run elasticity is given by  $\hat{a}_1/(1-\hat{a}_2)$ . The results in Table 5.5 suggest that the long-run elasticity was higher than the short-run elasticities during the period of boom of oil exports.

**Table 5.4: Regression Results of Model 2**

Period	N	$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	$\overline{R}^2$	F	h
1963 -1973	11	158.4 (1.385)	0.243 (2.245)**	0.713 (3.260)*	0.854	30.3	
1974-1983	10	-522.8 (-0.828)	0.054 (4.728)*	0.909 (12.0)	0.941	72.2	
1984-2004	21	1328.3 (3.324)*	0.038 (0.857)	0.615 (16.649)*	0.694	23.7	
1963-2004	42	-5.010 (-0.260)	0.186 (5.499)*	0.981 (22.9)*	0.928	265.0	1.789

Note: \* and \*\* denote to 1 and 5 percent level of significance respectively

**Table 5.5: Investment Elasticities with Respect to Non-Capital Expenditure in the Libyan Economy**

Period	Short-Term Elasticities	Long-Term Elasticities
1963-1974	0.624	@
1974-1983	0.570	0.948
1984-2004	@	@
1963-2004	0.207	0.719

Notes: @ = statistically not significant at the 5% level

### **5.5: Long–Term Relationships between Capital and Non-Capital Expenditure in the Libyan Economy**

This section attempts to answer the question: Is there a long-term relationship between investment and other components of aggregate demand (private consumption + public consumption + net exports) in the Libyan Economy? The answer to this question could throw some light on the absorptive capacity of the Libyan economy.

The cointegration technique was used to examine the long-term relationship between Libyan investment and other components of aggregate demand. If a long-run relationship exists, the two variables must form a unique cointegrating vector. In order to test for cointegration, and in particular to investigate whether a unique cointegrating vector can be identified, the maximum likelihood estimation technique developed by Johansen (1988) and Johansen and Juselius (1990) was employed. This approach does not have the now well-documented drawbacks of the Engle and Granger (1987) approach to cointegration and can be used in a multivariate setting to establish the numbers of distinct cointegrating vectors (Ng and Perron, 1997).

The Johansen's cointegration technique was applied to data related to the two variables. The Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979) equations were estimated as follows

$$\Delta x_t = \alpha_t + \beta_t x_{t-1} + \sum_{i=1}^n \rho \Delta x_{t-i} + \delta time_t + e_t \quad (27)$$

The equations were then tested to establish the order of cointegration. The unit root tests given in Table 5.6 suggest that the series representing investment (I) and other components of aggregate demand (Z) are both I(1). Hence the Johansen's maximum likelihood method was applied to test for cointegration between investment and other components of aggregate demand.

The trended case with no trend in DGP of the Johansen's procedure was considered in the present analysis. Since the data are annual, the method was applied using one, two and three VAR lags (Dickey, and Rossana, 1994, Mackinnon, 1991, Sanso, and Montanes, 2002 and Wickens, 1996). The two lags gave the best results which are shown in Table 5.7.

It can be seen that the estimated statistics are lower than their critical values at both the 90% and the 95% levels. The LR tests based on maximal eigenvalue and trace of the stochastic matrix suggest that the null hypothesis of zero cointegrating vector cannot be rejected (Ng, and Perron, 1997). Thus the results suggest that a long-term relationship does not exist between capital and non-capital expenditure in the Libyan economy.

**Table 5-6**  
**Unit Root Test of Various Components of Aggregate Demand in the Libyan Economy**

1. Unit root tests for variable *I*

The Dickey-Fuller regressions include an intercept and a linear trend  
 \*\*\*\*\*  
 40 observations used in the estimation of all ADF regressions.  
 Sample period from 3 to 42  
 \*\*\*\*\*  

	Test Statistic	LL	AIC	SBC	HQC
DF	-1.1897	-323.7762	-326.7762	-329.3095	-327.6921
ADF(1)	-1.7782	-319.7923	-323.7923	-327.1701	-325.0136

 \*\*\*\*\*  
 95% critical value for the augmented Dickey-Fuller statistic = -3.5247  
 LL = Maximized log-likelihood      AIC = Akaike Information Criterion  
 SBC = Schwarz Bayesian Criterion      HQC = Hannan-Quinn Criterion

2. Unit root tests for variable  $\Delta I$

The Dickey-Fuller regressions include an intercept and a linear trend  
 \*\*\*\*\*  
 40 observations used in the estimation of all ADF regressions.  
 Sample period from 3 to 42  
 \*\*\*\*\*  

	Test Statistic	LL	AIC	SBC	HQC
DF	-4.0446	-324.4542	-327.4542	-329.9875	-328.3702
ADF(1)	-3.5405	-324.3642	-328.3642	-331.7420	-329.5855

 \*\*\*\*\*  
 95% critical value for the augmented Dickey-Fuller statistic = -3.5247  
 LL = Maximized log-likelihood      AIC = Akaike Information Criterion  
 SBC = Schwarz Bayesian Criterion      HQC = Hannan-Quinn Criterion

3. Unit root tests for variable *Z*

The Dickey-Fuller regressions include an intercept and a linear trend  
 \*\*\*\*\*  
 40 observations used in the estimation of all ADF regressions.  
 Sample period from 3 to 42  
 \*\*\*\*\*  

	Test Statistic	LL	AIC	SBC	HQC
DF	-1.8179	-381.8536	-384.8536	-387.3869	-385.7696
ADF(1)	-2.2717	-380.5376	-384.5376	-387.9154	-385.7589

 \*\*\*\*\*  
 95% critical value for the augmented Dickey-Fuller statistic = -3.5247  
 LL = Maximized log-likelihood      AIC = Akaike Information Criterion  
 SBC = Schwarz Bayesian Criterion      HQC = Hannan-Quinn Criterion

4. Unit root tests for variable  $\Delta Z$

The Dickey-Fuller regressions include an intercept and a linear trend  
 \*\*\*\*\*  
 40 observations used in the estimation of all ADF regressions.  
 Sample period from 3 to 42  
 \*\*\*\*\*  

	Test Statistic	LL	AIC	SBC	HQC
DF	-5.0060	-383.2169	-386.2169	-388.7502	-387.1329
ADF(1)	-4.7871	-381.9446	-385.9446	-389.3224	-387.1659

 \*\*\*\*\*  
 95% critical value for the augmented Dickey-Fuller statistic = -3.5247  
 LL = Maximized log-likelihood      AIC = Akaike Information Criterion  
 SBC = Schwarz Bayesian Criterion      HQC = Hannan-Quinn Criterion



**Table 5.7: Results of cointegration Analysis for long-term relationship between investment and other components of aggregate demand in the Libyan Economy**

Cointegration with unrestricted intercepts and unrestricted trends in the VAR

Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

\*\*\*\*\*

40 observations from 3 to 42. Order of VAR = 2.

List of variables included in the cointegrating vector:

X1 X3

List of eigenvalues in descending order:

.28303 .082821

\*\*\*\*\*

Null	Alternative	Statistic	95% Critical Value	90% Critical Value
------	-------------	-----------	--------------------	--------------------

r = 0	r = 1	13.3088	18.3300	16.2800
-------	-------	---------	---------	---------

r <= 1	r = 2	3.4581	11.5400	9.7500
--------	-------	--------	---------	--------

\*\*\*\*\*

Cointegration with unrestricted intercepts and unrestricted trends in the VAR Cointegration LR Test Based on Trace of the Stochastic Matrix

\*\*\*\*\*

40 observations from 3 to 42. Order of VAR = 2.

List of variables included in the cointegrating vector:

X1 X3

List of eigenvalues in descending order:

.28303 .082821

\*\*\*\*\*

Null	Alternative	Statistic	95% Critical Value	90% Critical Value
------	-------------	-----------	--------------------	--------------------

r = 0	r >= 1	16.7669	23.8300	21.2300
-------	--------	---------	---------	---------

r <= 1	r = 2	3.4581	11.5400	9.7500
--------	-------	--------	---------	--------

\*\*\*\*\*

Cointegration with unrestricted intercepts and unrestricted trends in the VAR

Choice of the Number of Cointegrating Relations Using Model Selection Criteria

\*\*\*\*\*

40 observations from 3 to 42. Order of VAR = 2.

List of variables included in the cointegrating vector:

X1 X3

List of eigenvalues in descending order:

.28303 .082821

\*\*\*\*\*

Rank	Maximized LL	AIC	SBC	HQC
------	--------------	-----	-----	-----

r = 0	-698.9100	-706.9100	-713.6655	-709.3526
-------	-----------	-----------	-----------	-----------

r = 1	-692.2556	-703.2556	-712.5444	-706.6141
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r = 2	-690.5265	-702.5265	-712.6598	-706.1904
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\*\*\*\*\*

AIC = Akaike Information Criterion SBC = Schwarz Bayesian Criterion

HQC = Hannan-Quinn Criterion

## **5.6: CONCLUSIONS**

The main conclusions of this Chapter may be summarized in the following:

1. The Libyan government carries out a large percentage of investment. Public investment has been concentrated mainly in infrastructure and the oil sector, including petrochemical industries. Private fixed capital formation, on the other hand, was directed mainly to the construction sector and the (small) manufacturing sector.
2. The Libyan capital formation is strongly influenced by spending on components of aggregate demand other than investment. More resources were devoted to GFCF during periods of increase in oil exports.
3. The fluctuations in oil revenue had a significant impact on the growth of Gross Fixed Capital Formation in the Libyan economy. The downturn in oil prices had a serious adverse effect on investment. The rate of growth was negative during the downturn in oil prices. Thus, the rise in oil prices encouraged the Libyan governments to invest in infrastructure and in building up the economic capacity.
4. The significance of the lagged investment variable suggests the existence of a partial adjustment mechanism only during the period of rise in oil prices and during the combined last four decades. However, the relatively high adjustment coefficient during the period 1963-2004 suggests the existence of some bottlenecks
5. Growth in aggregate demand, as distinct from the level of that demand, did not seem to have a significant effect on the process of capital formation in the Libyan economy during periods of stagnation in oil exports. This suggests that investment in Libya was mainly autonomous public investment in infrastructure. The limited

absorptive capacity of the Libyan economy may explain the lack of induced investment in this country.

6. The adjustment in the demand for investment to growth in aggregate demand has been subject to severe bottlenecks in the Libyan economy during the boom years and during the last four decades, as a whole. Some of these bottlenecks relate to the inadequacy of infrastructure.

7. The long-run elasticity of investment expenditure in the Libyan economy with respect to Libyan expenditure on other components of aggregate demand was higher than the short-run elasticities during the period of boom of oil exports.

8. There is no evidence of long-term relationships between investment and other components of aggregate demand in the Libyan economy.

## CHAPTER SIX

### **Impact of Fluctuations in Oil Prices on Libyan Trade Relationship with its Major Trading Partners**

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*(A paper related to this chapter entitled “Trade Relationship between Libya and its Major Trading Partners ” has been accepted for publication in the **Journal of World Economic Review** and is scheduled to be published in, Vol. 2. No.1, June, 2008.)*

(A paper related to this chapter entitled “impact of fluctuation in oil prices on Libyan trade with its major trading partners “, **has been presented at Monash university, Malaysian Conference entitled “Business, Environment, International Competitiveness and sustainable Development of the Asia Pacific Economies “** held on 3-4 December 2007).

#### **Abstract**

This chapter examines the trade relationship between Libya and its major trading partners using a simultaneous-equations model. The model is estimated using the 2SLS method of estimation. The analysis emphasises the role played by the interaction of international trade and the degree of feedback. The hypothesis tested in this chapter is that an increase in Libyan’s exports to a major trading partner contributes to growth in Libyan GDP. The increase in Libyan income expands its imports from its major trading partners. This in turn contributed to growth in the income of the trade partners.

The level of Libyan imports from its major trading partners does not seem to have any significant effect on the level of the GDP of its major trading partners except Greece, Turkey and Tunisia.

## 6.1 Introduction

The Libyan economy is a developing small oil-producing economy that depends heavily on international trade. This dependence suggests the existence of an interaction between the Libyan economy and the rest of the world. This interaction could be observed in two different ways. First, an increase in Libyan exports will increase its income, which in turn causes imports to rise. The increase in Libyan imports will raise the income of the exporters to Libya, which in turn results in an increase in their imports from Libya. On the other hand, the rise in *oil prices* will result in an increase in oil revenue. However, this rise in oil prices increases the cost of production in importing countries which may result in lower growth in their income and hence their imports from oil-producing countries.

The Libyan economy was severely affected by fluctuations in oil prices because of its great dependence on oil revenues. This chapter will test the export-led growth model within the framework of international trade interdependence. Thus, the structure and performance of trade between Libya and its ten major trading partners (Italy, Germany, Spain, Turkey, France, Switzerland, Tunisia, Greece, UK and China) during the period 1975-2005 will be analyzed.

The literature on feedback effects of foreign trade has intensified during the past two decades (Metwally & Tamaschke, 1980; Metwally 1988; Lee, 1989; Esfahani, 1991; Metwally & Vadlamudi 1992; Sprout & Weaver, 1993; Metwally, 1993; Perdikis & Asseery, 1994; Metwally & Tamaschke 2001).

The Chapter is divided into five sections. After this introduction, section two examines the magnitude of trade between Libya and its major trading partners. Section

three develops a simultaneous equations model to test the interaction of international trade and the degree of feedback between Libya and its major trading partners. Section four gives the regression results of the simultaneous equation models for ten trading partners. Finally, the main conclusions are summarized in section five.

## **6.2: The Magnitude of Trade between Libya and its Major Trading Partners**

Libya trades mostly with the industrialized countries. More than 50 percent of Libyan imports are supplied by industrialized countries. Libya imports over two-thirds of its supplies from Italy and Germany. In addition, Libya exports almost 50 percent of its total exports to these two countries.

The data in Table 6.1 suggest that Italy is the largest trade partner with Libya. More than one-third of Libyan exports during the last five years were directed to Italy and more than one-quarter of Libyan imports during the same period were obtained from Italy. The second largest trading-partner with Libya is Germany. Libyan exports to Germany over the last five years were more than 14 percent of Libyan total exports and Libyan imports from Germany were more approximately 10 percent of Libyan total imports during that period.

The data in Table 6.1 also suggest that a large proportion of Libyan exports (more than 11 percent) had been directed to Spain over the last five years. On the other hand, Libyan imports from Spain were less than 2 percent of total Libyan imports during that period. An opposite trade relationship seems to hold in Libyan

trade with UK. Libyan trade with France and Greece seems to be equal for both exports and imports.

**Table 6.1: Libyan Trade with its Major Trading Partners (Average 2000-2005)**

Please see print copy for table 6.1
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**Sources:** IMF, International Financial Yearbook, Various issues, Washington DC.  
IMF, Direction of Trade Statistics Yearbook. Various issues. Washington. DC.  
Central Bank of Libya. Annual report. Various issues. Tripoli: Jamahiriya publisher.

### **6.3: Simultaneous-equations Model**

To examine the impact of fluctuation in oil prices on Libyan trade relationship with its major trading partners, a simultaneous equations model similar to that developed by Metwally (1993) in his study of the interdependence of trade and economic development in Asian economies will be utilized to test the feedback effects.

The following simultaneous relationships, known as structural equations, have been developed to test for feedback effects in the trade relationships between the Libya and its main trading partners.

***Structural Equations:***

$$Y_{L,t} = \alpha_0 + \alpha_1 X_{L-\text{partner } i, t} + \alpha_2 X_{L0,t} + \alpha_3 Y_{L,t-1} + e_{1t}$$

$$X_{L-\text{partner } i, t} = \beta_0 + \beta_1 P_{\text{oil}, t} + \beta_2 Y_{\text{partner } i, t} + e_{2t}$$

$$Y_{\text{partner } i, t} = \gamma_0 + \gamma_1 X_{\text{partner } i0, t} + \gamma_2 M_{L-\text{partner } i, t} + Y_{\text{partner } i, t-1} + e_{3t}$$

$$M_{L-\text{partner } i, t} = \delta_0 + \delta_1 Y_{L,t} + \delta_2 M_{L-\text{partner } i, t-1} + e_{4t}$$

***Endogenous variables:***

$$Y_{L,t} = \text{Libyan GDP in period } t$$

$$X_{L-\text{partner } i, t} = \text{Libyan exports to the } i\text{th trading partner in Period } t$$

$$Y_{\text{partner } i, t} = \text{GDP of the } i\text{th partner in period } t$$

$$M_{L-\text{partner } i, t} = \text{Libyan imports from the } i\text{th trading partner in Period } t$$

**Predetermined (Exogenous) variables:**

$$X_{L0,t} = \text{Libyan exports to countries other than the } i\text{th partner in period } t$$

$$Y_{L,t-1} = \text{Libyan GDP in period } t-1$$

$$P_{\text{oil}, t} = \text{Oil prices in period } t$$

$$X_{\text{partner } i0, t} = \text{Exports of the } i\text{th trading partner to countries other than Libya in period } t$$

$$M_{L-\text{partner } i, t-1} = \text{Libyan imports from the } i\text{th trading partner in period } t-1$$

$$Y_{\text{partner } i, t-1} = \text{GDP of the } i\text{th partner in period } t-1$$

The first equation tests the relationship between income of Libya and its exports to its major trading partners. It is assumed that Libyan income depends on these exports. It is also assumed that there is a partial adjustment mechanism in the income-export



relationship. The lagged dependent variable gives the equation a dynamic character, allowing for partial adjustment (or lagged effects) following a Koyck geometrically declining weight scheme (Ramanathan, 1992; Griffiths, Hill & Judge, 1993; Studenmund, 2000).

The second equation examines the relationship between Libyan exports to each partner and the level of the partner's GDP. It is expected that the growth in the partner's economy, would result in an increase in its imports from Libya. It is also assumed that Libyan exports depend on the price of oil. It is expected that an increase in oil prices leads to an increase in the export proceeds of the Libyan economy, given the quantities exported.

The third equation examines the interaction between the Libyan economy and its major trading partners. It is assumed that the level of GDP of each trading partner depends on its exports to Libya and to the rest of the world. This equation is also dynamic. If there is a significant feedback effect, we would expect the coefficients  $\gamma_2$  to be statistically significant. For only then, would we be able to say that increasing imports from Libya, results in an increase in the GDP of its trading partner. (Metwally, 1993).

The fourth Equation examines the relationship between Libyan imports and its GDP within a process of a partial adjustment mechanism. Libyan imports from various trading partners are assumed to depend on Libyan income with a partial adjustment mechanism.

The above system is mathematically complete in that it contains as many equations as it has endogenous variables (Theil, 1970). Applying the order and rank

conditions of identification to the four simultaneous equations, it can be verified that both conditions hold and each equation is over-identified. It follows that the method of Two Stage Least Squares (2SLS) is appropriate to estimate the equations of the model.

The 2SLS results for the four equations of the model are presented in Tables 6.2 to 6.11. The data used for the estimations are for the period 1975 to 2005. They were obtained from the IMF publications, OPEC publication and Central Bank of Libya. The (adjusted)  $R^2$  and F statistics of the fitted equations suggest that the model is a good fit. Also the estimated Durbin Watson (DW) and Durbin's h statistics support the view that the residuals about the fitted equations were independent (Maddala, 2000; Studenmund, 2000 & Gujarati, 2003).

The values of  $R^2$ , t, F, DW and Durbin's h statistics in Tables 6.2 to 6.11 are given for what they are worth. In addition to the test for serial correlation, inspection of the residuals about the fitted equations did not suggest any obvious violations of the homoscedasticity of error terms assumption. The equations were also analyzed for multicollinearity and these tests gave no undue cause for concern; this is further confirmed by a comparison of the t statistics with the F statistics of the fitted equations. For further discussion, including the robustness of Least Squares methods in the presence of minor violations of the error term assumptions (Davidson, 2000 ; Mittelhammer, Judge & Miller, 2000 & Patterson, 2000).

#### **6.4: Results of the Simultaneous-equations Model**

These results are given in Tables 6.2 to 6.11. The regression results for Italy are given in Table 6.2. These results suggest:

- i. Libyan income is strongly influenced by Libyan oil exports to Italy and to the rest of the world. The “t” value of the coefficient of the variable “ $X_{L-Italy, it}$ ”, which represents Libyan exports to Italy, is significant at the 5 percent level of significance. The short-run elasticity of Libyan income with respect to its exports to Italy is approximately 0.18, while the long-term elasticity is approximately 0.36. This suggests that an increase in Libyan exports to Italy by 10 percent results in an increase in Libyan income by approximately 1.8 percent in the short run and by 3.6 per cent in the long run. Inspection of the coefficient ( $Y_{L, t-1}$ ) further suggests the existence of significant spread effects.
- ii. The results of the second equation suggest that Libyan exports to Italy are strongly influenced by oil prices and the level of Italian GDP. Italian income is a major determinant of Libyan exports to that country. A rise in Italian income by US\$1 results in an increase in Libyan exports to Italy by approximately US\$ 0.0021. Oil prices have a slightly greater effect on Libyan exports to Italy than the Italian income.
- iii. The results of the Italian GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from Italy is a very small proportion of total Italian exports.
- iv. The regression results in the fourth equation suggest that Libyan imports from Italy are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from Italy is approximately .11 in the short-run and .15 in the long-run. This suggests that an increase in Libyan income by US\$1 results in an increase in Libyan imports from Italy by 11 US cents in the short-run and by approximately 15 US cents in the long-run. The short-term elasticity of Libyan

imports from Italy with respect to Libyan income is approximately 2.16, while its long-run counterpart is approximately 3.04. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from Italy by approximately 2.2% in the short-run and by 3% in the long run. The value of the coefficient of the variable  $M_{L-Italy, t-1}$  (0.288) suggests that approximately 0.712 of the gap between the desired level of spending on imports from Italy and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately a year and half.

**Table 6.2: Regression Results of the Simultaneous Equations Model of Libyan Trade with Italy**

$$Y_{Libya, t} = 8485.8 + 1.144 X_{L-Italy, t} + 0.236 X_{Libya, t} + 0.480 Y_{Libya, t-1} \\ (3.003) \quad (2.625)^* \quad (2.117)^* \quad (3.725)^{**} \\ \bar{R}^2 = .720 \quad F = 25.8 \quad h = 1.030$$

$$X_{Libya-Italy, t} = -304.5 + 96.4 P_{oil, t} + 0.0021 Y_{Italy, t} \\ (-0.626) \quad (5.576)^{**} \quad (5.313)^{**} \\ \bar{R}^2 = 0.704 \quad F = 35.4 \quad DW = 1.404$$

$$Y_{Italy, t} = 64117.1 + 1.990 X_{Italy, t} + 6.760 M_{Libya-Italy, t} + 0.552 Y_{Italy, t-1} \\ (1.114) \quad (3.553)^{**} \quad (0.201) \quad (4.400)^{**} \\ \bar{R}^2 = 0.929 \quad F = 122.9 \quad h = 0.825$$

$$M_{Libya-Italy, t} = -2092.0 + .111 Y_{Libya, t} + .288 M_{Libya-Italy, t-1} \\ (-3.492) \quad (4.856)^{**} \quad (2.089)^* \\ \bar{R}^2 = 0.591 \quad F = 21.9 \quad h = 0.968$$

Note: \*\* and \* denote to 1 and 5 percent level of significance respectively

The regression results for Germany are given in Table 6.3. These results suggest:

- i. Libyan income is strongly influenced by Libyan oil exports to Germany and to the rest of the world. The “t” value of the coefficient of the variable “ $X_{L-Germany, t}$ ”, which represents Libyan exports to Germany, is significant at the 1 percent level of

significance. The short-run elasticity of Libyan income with respect to its exports to Germany is approximately 0.21, while the long-term elasticity is approximately 0.30. This suggests that an increase in Libyan exports to Germany by 10 percent results in an increase in Libyan income by approximately 2.1 percent in the short run and by 3.0 per cent in the long run. Inspection of the coefficient ( $Y_{L,t-1}$ ) further suggests the existence of significant spread effects.

ii. The results of the second equation suggest that Libyan exports to Germany are strongly influenced by oil prices and the level of Germany GDP. The Germany income is a major determinant of Libyan exports to that country. A rise in Germany income by US\$1 results in an increase in Libyan exports to Germany by approximately US\$ 0.0004. Oil prices have a greater effect on Libyan exports to Germany than Germany income.

iii. The results of the Germany GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from Germany is a very small proportion of Germany exports.

iv. The regression results in the fourth equation suggest that Libyan imports from Germany are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from Germany is approximately .009 in the short-run and .015 in the long-run. This suggests that an increase in Libyan income by US\$1 results in an increase in Libyan imports from the Germany by 1 US cents in the short-run and by approximately 1.5 US cents in the long-run. The short-term elasticity of Libyan imports from Germany with respect to Libyan income is approximately 0.4, while its long-run counterpart is approximately

0.6. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from Germany by approximately 0.4 percent in the short-run and by 0.6% in the long run. The value of the coefficient of the variable  $M_{L-Germany,t-1}$  (0.399) suggests that approximately 0.601 of the gap between the desired level of spending on imports from Germany and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately one and two-third year.

**Table 6.3: Regression Results of the Simultaneous Equations Model of Libyan Trade with Germany**

$$Y_{Libya,t} = 9753.6 + 5.369 X_{L-Germany,t} + 0.177 X_{Libya,t} + 0.249 Y_{Libya,t-1}$$

$$(5.375) \quad (3.803)** \quad (2.067)* \quad (2.233)*$$

$$\bar{R}^2 = .831 \quad F = 48.6 \quad h = 1.083$$

$$X_{Libya-Germany,t} = 611.6 + 29.9 P_{oil,t} + 0.0004 Y_{Germany,t}$$

$$(2.412) \quad (3.133)** \quad (2.593)*$$

$$\bar{R}^2 = 0.427 \quad F = 11.8 \quad DW = 1.731$$

$$Y_{Germany,t} = 237083.0 + 1.476 X_{Germany,t} + 95.7 M_{Libya-Germany,t} + 0.413 Y_{Germany,t-1}$$

$$(3.368) \quad (4.463)** \quad (1.448) \quad (3.778)**$$

$$\bar{R}^2 = 0.976 \quad F = 401.5 \quad h = 1.644$$

$$M_{Libya-Germany,t} = -440.0 + .009 Y_{Libya,t} + .399 M_{Libya-Germany,t-1}$$

$$(-1.986) \quad (3.618)** \quad (2.992)**$$

$$\bar{R}^2 = 0.572 \quad F = 20.4 \quad h = 1.607$$

Note: \*\* and \* denote to 1 and 5 percent level of significance respectively

The regression results for Spain are given in Table 6.4. These results suggest:

- i. Libyan income is strongly influenced by Libyan oil exports to Spain and to the rest of the world. The “t” value of the coefficient of the variable “ $X_{L-Spain,t}$ ”, which

represents Libyan exports to Spain, is significant at the 5 percent level of significance. The short-run elasticity of Libyan income with respect to its exports to Spain is approximately 0.13, while the long-term elasticity is approximately 0.23. This suggests that an increase in Libyan exports to Spain by 10 percent results in an increase in Libyan income by approximately 1.3 percent in the short run and by 2.3 per cent in the long run. Inspection of the coefficient ( $Y_{L, t-1}$ ) further suggests the existence of significant spread effects.

ii. The results of the second equation suggest that the amount of Libyan exports to Spain is strongly influenced by oil prices and the level of Spanish GDP. The Spanish income is a major determinant of Libyan exports to that country. A rise in Spanish income by US\$1 results in an increase in Libyan exports to Spain by approximately US\$ 0.0014. Oil prices seem to have an equivalent effect on Libyan exports to Spain as the Spanish income.

iii. The results of the Spanish GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from Spain is a very small proportion of Spanish exports.

iv. The regression results in the fourth equation suggest that Libyan imports from Spain are positively related to the Libyan GDP *without* a partial adjustment mechanism. The marginal propensity of Libyan imports from Spain is approximately .01. This suggests that an increase in Libyan income by US\$1 results in an increase in Libyan imports from the Spain by 1 US cents. The elasticity of Libyan imports from Spain with respect to Libyan income is approximately 0.42 in Libyan income by 1% results in an increase in Libyan imports from Spain by approximately 0.4 percent.

**Table 6.4: Regression Results of the Simultaneous Equations Model of Libyan Trade with Spain**

$$Y_{\text{Libya},t} = 9613.2 + 3.310 X_{\text{L-Spain},t} + 0.226 X_{\text{Libya},t} + 0.439 Y_{\text{Libya},t-1}$$

$$(3.619) \quad (2.456)^* \quad (2.14)^* \quad (3.559)^{**}$$

$$\bar{R}^2 = .775 \quad F = 30.7 \quad h = 0.711$$

$$X_{\text{Libya-Spain},t} = -233.6 + 33.4 P_{\text{oil},t} + 0.0014 Y_{\text{Spain},t}$$

$$(-1.777) \quad (7.057)^{**} \quad (7.092)^{**}$$

$$\bar{R}^2 = 0.811 \quad F = 63.1 \quad DW = 1.848$$

$$Y_{\text{Spain},t} = 24883.1 + 1.581 X_{\text{Spain},t} + 544.5 M_{\text{Libya-Spain},t} + 0.710 Y_{\text{Spain},t-1}$$

$$(2.340) \quad (2.803)^{**} \quad (1.414) \quad (6.858)^{**}$$

$$\bar{R}^2 = 0.932 \quad F = 133.5 \quad h = 1.01$$

$$M_{\text{Libya-Spain},t} = -124.7 + .009 Y_{\text{Libya},t} + .183 M_{\text{Libya-Spain},t-1}$$

$$(-1.145) \quad (2.577)^{**} \quad (0.914)^{**}$$

$$\bar{R}^2 = 0.171 \quad F = 3.994 \quad h = 1.442$$

Note: \*\* and \* denote to 1 and 5 percent level of significance respectively

The regression results for Turkey are given in Table 6.5. These results suggest:

- i. Libyan income is strongly influenced by Libyan oil exports to Turkey and to the rest of the world. The “t” value of the coefficient of the variable “ $X_{L-Turkey,t}$ ”, which represents Libyan exports to Turkey, is significant at the 5 per cent level of significance. The short-run elasticity of Libyan income with respect to its exports to Turkey is approximately 0.101, while the long-term elasticity is approximately 0.203. This suggests that an increase in Libyan exports to Turkey by 10 percent results in an increase in Libyan income by approximately 1 percent in the short run and by 2 per cent in the long run. Inspection of the coefficient ( $Y_{L,t-1}$ ) further suggests the existence of significant spread effects.
- ii. The results of the second equation suggest that Libyan exports to Turkey are strongly influenced by oil prices and the level of Turkish GDP. Turkish income is a



major determinant of Libyan exports to that country. A rise in Turkish income by US\$1 results in an increase in Libyan exports to Turkey by approximately US\$ 0.017. Oil prices would seem to have less effect on Libyan exports to Turkey than Turkish income.

iii. The coefficient of the variable  $M_{Libya-Turkey, t}$  (which represents Libyan imports from Turkey) in the third equation, is statistically significant, which suggests that Libyan imports from Turkey had a significant and positive effect on the level of Turkish GDP. This significant impact suggests the presence of feedback effects.

iv. The regression results in the fourth equation suggest that Libyan imports from Turkey are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from Turkey is approximately .015 in the short-run and .023 in the long-run. This suggests that an increase in Libyan income by US\$1 results in an increase in Libyan imports from the Turkey by 1.5 US cents in the short-run and by approximately 2.3 US cents in the long-run. The short-term elasticity of Libyan imports from Turkey with respect to Libyan income is approximately 1.915, while its long-run counterpart is approximately 4.181. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from Turkey by approximately 2 percent in the short-run and by 4% in the long run. The value of the coefficient of the variable  $M_{L-partner\ i, t-1}$  (0.345) suggests that approximately 0.655 of the gap between the desired level of spending on imports from Turkey and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately one and half years.

**Table 6.5: Regression Results of the Simultaneous Equations Model of Libyan Trade with Turkey**

$$Y_{\text{Libya}, t} = 7365.1 + 4.095 X_{L-\text{Turkey}, t} + 0.285 X_{\text{Libya}, t} + 0.548 Y_{\text{Libya}, t-1}$$

(2.95)    (2.186)\*                      (2.668)\*                      (5.094)\*\*

$\bar{R}^2 = .791$      $F = 32.9$      $h = 1.102$

$$X_{\text{Libya-Turkey}, t} = -762.5 + 9.511 P_{\text{oil}, t} + 0.017 Y_{\text{Turkey}, t}$$

(-5.985)    (3.054)\*\*                      (8.875)\*\*

$\bar{R}^2 = 0.802$      $F = 59.6$      $h = 1.772$

$$Y_{\text{Turkey}, t} = 34304.6 + 1.037 X_{\text{Turkey}, t} + 7.797 M_{\text{Libya-Turkey}, t} + 0.238 Y_{\text{Turkey}, t-1}$$

(6.789)    (6.444)\*\*                      (2.27)\*                      (2.138)\*

$\bar{R}^2 = 0.975$      $F = 334.1$      $h = 0.979$

$$M_{\text{Libya-Turkey}, t} = -354.7 + .015 Y_{\text{Libya}, t} + .345 M_{\text{Libya-Turkey}, t-1}$$

(-2.463)    (2.73)\*                      (6.867)\*\*

$\bar{R}^2 = 0.749$      $F = 44.3$      $h = 1.232$

Note: \*\* and \* denote to 1 and 5 percent level of significance respectively

The regression results for France are given in Table 6.6. These results suggest:

- i. Libyan income is strongly influenced by Libyan oil exports to France and to the rest of the world. The “t” value of the coefficient of the variable “ $X_{L-\text{France}, t}$ ”, which represents Libyan exports to France, is significant at the 5 percent level of significance. The short-run elasticity of Libyan income with respect to its exports to France is approximately 0.16, while the long-term elasticity is approximately 0.238. This suggests that an increase in Libyan exports to France by 10 percent results in an increase in Libyan income by approximately 1.6 percent in the short run and by 2.4 percent in the long run. Inspection of the coefficient ( $Y_{L, t-1}$ ) further suggests the existence of significant spread effects.
- ii. The results of the second equation suggest that Libyan exports to France are strongly influenced by oil prices and the level of France GDP. French income is a major

determinant of Libyan exports to that country. A rise in French income by US\$1 results in an increase in Libyan exports to France by approximately US\$ 0.00037. Oil prices have a stronger effect on Libyan exports to France than the French income.

iii. The results of the France GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from France is a very small proportion of total French exports.

iv. The regression results in the fourth equation suggest that Libyan imports from France are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from France is approximately .01 in the short-run and .02 in the long-run. This suggests that an increase in Libyan income by US\$1 results in an increase in Libyan imports from France by 1 US cents in the short-run and by approximately 2 US cents in the long-run. The short-term elasticity of Libyan imports from France with respect to Libyan income is approximately 0.9, while its long-run counterpart is approximately 1.89. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from France by approximately 0.9 percent in the short-run and by 1.9% in the long run. The value of the coefficient of the variable  $M_{L-France, i, t-1}$  (0.482) suggests that approximately 0.518 of the gap between the desired level of spending on imports from France and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately 2 years.

**Table 6.6: Regression Results of the Simultaneous Equations Model of Libyan Trade with France**

$$Y_{\text{Libya}, t} = 11399.9 + \frac{7.526}{(3.853)} X_{L-\text{France}, t} + \frac{0.232}{(2.160)^*} X_{\text{Libya}, t} + \frac{0.341}{(2.362)^*} Y_{\text{Libya}, t-1}$$

$$\bar{R}^2 = .742 \quad F = 28.8 \quad h = 0.986$$

$$X_{\text{Libya-France}, t} = -254.03 + 19.8 P_{\text{oil}, t} + \frac{0.00037}{(4.928)^{**}} Y_{\text{France}, t}$$

$$\bar{R}^2 = 0.667 \quad F = 30.1 \quad DW = 1.911$$

$$Y_{\text{France}, t} = 116383.8 + \frac{2.610}{(7.83)^{**}} X_{\text{France}, t} + \frac{58.8}{(0.435)} M_{\text{Libya-France}, t} + \frac{0.424}{(5.07)^{**}} Y_{\text{France}, t-1}$$

$$\bar{R}^2 = 0.973 \quad F = 346.9 \quad h = 1.254$$

$$M_{\text{Libya-France}, t} = -147.9 + \frac{.0109}{(2.327)^*} Y_{\text{Libya}, t} + \frac{.482}{(3.036)^{**}} M_{\text{Libya-France}, t-1}$$

$$\bar{R}^2 = 0.591 \quad F = 21.9 \quad h = 1.370$$

Note: \*\* and \* denote to 1 and 5 percent level of significance respectively

The regression results for Switzerland are given in Table 6.7. These results suggest:

- i. Libyan income is not significantly affected by Libyan oil exports to Switzerland. It is strongly affected by Libyan exports to the rest of the world. The “t” value of the coefficient of the variable “ $X_{L-\text{Switzerland}, t}$ ”, which represents Libyan exports to Switzerland, is not statistically significant; even at the 10 per cent level of significance. This may be due to the fact that Libyan exports to Switzerland have been a very small proportion of Libyan total exports over the last two decades. However, inspection of the coefficient ( $Y_{L, t-1}$ ) suggests the existence of significant spread effects.
- ii. The results of the second equation suggest that Libyan exports to Switzerland are strongly influenced by oil prices and the level of Swiss GDP. Swiss income is a

major determinant of Libyan exports to that country. A rise in Swiss income by \$1 results in an increase in Libyan exports to Switzerland by approximately US\$ 0.0012. Oil prices would seem to have less effect on Libyan exports to Switzerland than Switzerland income.

iii. The results of Switzerland GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from Switzerland is a very small proportion of total Switzerland exports.

iv. The regression results in the fourth equation suggest that Libyan imports from Switzerland are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from Switzerland is approximately .005 in the short-run and .007 in the long-run. This suggests that an increase in Libyan income by US\$1 results in an increase in Libyan imports from the Switzerland by 0.5 US cents in the short-run and by approximately 0.7 US cents in the long-run. The short-term elasticity of Libyan imports from Switzerland with respect to Libyan income is approximately 1.277, while its long-run counterpart is approximately 2.066. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from Switzerland by approximately 1.3 percent in the short-run and by approximately 2.1% in the long run. The value of the coefficient of the variable  $M_{L-Switzerland\ i, t-1}$  (0.382) suggests that approximately 0.618 of the gap between the desired level of spending on imports from Switzerland and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately 1.6 years.

**Table 6.7: Regression Results of the Simultaneous Equations Model of Libyan Trade with Switzerland**

$$Y_{\text{Libya}, t} = 6718.6 + 4.608 X_{\text{L-Switzerland}, t} + 0.291 X_{\text{Libya}, t} + 0.612 Y_{\text{Libya}, t-1}$$

(2.202) (1.09) (2.137)\* (5.12)\*\*

$\bar{R}^2 = .681$   $F = 21.6$   $h = 1.321$

$$X_{\text{Libya-Switzerland}, t} = -202.1 + 8.339 P_{\text{oil}, t} + 0.0012 Y_{\text{Switzerland}, t}$$

(-5.985) (3.817)\*\* (5.838)\*\*

$\bar{R}^2 = 0.676$   $F = 31.3$   $DW = 1.672$

$$Y_{\text{Switzerland}, t} = 10055. + 1.660 X_{\text{Switzerland}, t} + 25.7 M_{\text{Libya-Switzerland}, t} + 0.486 Y_{\text{Switzerland}, t-1}$$

(1.056) (5.191)\*\* (0.221) (4.841)\*\*

$\bar{R}^2 = 0.973$   $F = 351.9$   $h = 0.713$

$$M_{\text{Libya-Switzerland}, t} = -65.6 + .0046 Y_{\text{Libya}, t} + .382 M_{\text{Libya-Switzerland}, t-1}$$

(-1.068) (2.240)\* (2.202)\*

$\bar{R}^2 = 0.406$   $F = 14.8$   $h = 1.442$

Note: \*\* and \* denote to 1 and 5 percent level of significance respectively

The regression results for Tunisia are given in Table 6.8. These results suggest:

- i. Libyan income is strongly influenced by Libyan oil exports to Tunisia and to the rest of the world. The “t” value of the coefficient of the variable “ $X_{\text{L-Tunisia}, t}$ ”, which represents Libyan exports to Tunisia, is significant at the 5 per cent level of significance. The short-run elasticity of Libyan income with respect to its exports to Tunisia is approximately 0.04, while the long-term elasticity is approximately 0.088. This suggests that an increase in Libyan exports to Tunisia by 10 percent results in an increase in Libyan income by approximately 0.4 percent in the short run and by 0.9 per cent in the long run. Inspection of the coefficient ( $Y_{\text{L}, t-1}$ ) further suggests the existence of a significant spread effects.
- ii. The results of the second equation suggest that Libyan exports to Tunisia are strongly influenced by oil prices and the level of Tunisian GDP. Tunisian income is a

major determinant of Libyan exports to that country. A rise in Tunisian income by US\$1 results in an increase in Libyan exports to Tunisia by approximately US\$ 0.024. Oil prices would seem to have less effect on Libyan exports to Tunisia than Tunisian income.

iii. The coefficient of the variable  $M_{Libya-Tunisia, t}$  (which represents Libyan imports from Tunisia) in the third equation, is statistically significant, which suggests that Libyan imports from Tunisia had a significant and positive effect on the level of Tunisian GDP. This significant impact suggests the presence of feedback effects.

iv. The regression results in the forth equation suggest that Libyan imports from Tunisia are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from Tunisia is approximately .007 in the short-run and .042 in the long-run. This suggests that an increase in Libyan income by US\$1 results in an increase in Libyan imports from Tunisia by 0.7 US cents in the short-run and by approximately 4.2 US cents in the long-run. The short-term elasticity of Libyan imports from Tunisia with respect to Libyan income is approximately 1.188, while its long-run counterpart is approximately 7.11. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from Tunisia by approximately 1.2 percent in the short-run and by 7% in the long run. The value of the coefficient of the variable  $M_{Libya-Tunisia, t-1}$  (0.833) suggests that approximately 0.167 of the gap between the desired level of spending on imports from Tunisia and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately 6 years.

**Table 6.8: Regression Results of the Simultaneous Equations Model of Libyan Trade with Tunisia**

$$Y_{\text{Libya}, t} = 7616.1 + \frac{6.158}{(2.98)} X_{\text{Libya-Tunisia}, t} + \frac{0.248}{(2.372)^*} X_{\text{Libya}, t} + \frac{0.603}{(6.237)^{**}} Y_{\text{Libya}, t-1}$$

$$\bar{R}^2 = .767 \quad F = 28.5 \quad h = 1.312$$

$$X_{\text{Libya-Tunisia}, t} = -322.4 + \frac{4.876}{(-4.819)} P_{\text{oil}, t} + \frac{0.024}{(7.94)^{**}} Y_{\text{Tunisia}, t}$$

$$\bar{R}^2 = 0.706 \quad F = 35.5 \quad DW = 1.715$$

$$Y_{\text{Tunisia}, t} = 2420.8 + \frac{0.477}{(2.855)} X_{\text{Tunisia}, t} + \frac{12.983}{(2.243)^*} M_{\text{Libya-Tunisia}, t} + \frac{0.606}{(5.693)^{**}} Y_{\text{Tunisia}, t-1}$$

$$\bar{R}^2 = 0.945 \quad F = 147.8 \quad h = 1.272$$

$$M_{\text{Libya-Tunisia}, t} = -170.9 + \frac{.0071}{(-2.362)} Y_{\text{Libya}, t} + \frac{.833}{(8.13)^{**}} M_{\text{Libya-Tunisia}, t-1}$$

$$\bar{R}^2 = 0.724 \quad F = 39.3 \quad h = 0.932$$

Note: \*\* and \* denote to 1 and 5 percent level of significance respectively

The regression results for Greece are given in Table 6.9. These results suggest:

i. Libyan income is strongly influenced by Libyan oil exports to Greece and to the rest of the world. The “t” value of the coefficient of the variable “ $X_{\text{Libya-Greece}, t}$ ”, which represents Libyan exports to Greece, is significant at the 5 percent level of significance. The short-run elasticity of Libyan income with respect to its exports to Greece is approximately 0.144, while the long-term elasticity is approximately 0.211. This suggests that an increase in Libyan exports to Greece by 10 percent results in an increase in Libyan income by approximately 1.4 percent in the short run and by 2.1 percent in the long run. Inspection of the coefficient ( $Y_{\text{Libya}, t-1}$ ) further suggests the existence of significant spread effects.

ii. The results of the second equation suggest that Libyan exports to Greece are influenced by oil prices and the level of Greek GDP. Greek income is a significant



determinant of Libyan exports to that country. A rise in Greek income by US\$1 results in an increase in Libyan exports to Greece by approximately US\$ 0.003. Oil prices would seem to have greater effect on Libyan exports to Greece than Greek income.

iii. The coefficient of the variable  $M_{L, \text{Greece } i, t}$  (which represents Libyan imports from Greece) in the third equation, is statistically significant, which suggests that Libyan imports from Greece had a significant and positive effect on the level of Greek GDP. This significant impact suggests the presence of feedback effects.

iv. The regression results in the fourth equation suggest that Libyan imports from Greece are positively related to Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from Greece is approximately .004 in the short-run and .014 in the long-run. This suggests that an increase in Libyan income by US\$1 results in an increase in Libyan imports from Greece by 0.4 US cents in the short-run and by approximately 1.4 US cents in the long-run. The short-term elasticity of Libyan imports from Greece with respect to Libyan income is approximately 0.21, while its long-run counterpart is approximately 0.51. This suggests that an increase in Libyan income by 10% results in an increase in Libyan imports from Greece by approximately 2% in the short-run and by 5.1% in the long run. The value of the coefficient of the variable  $M_{L- \text{Greece } i, t-1}$  (0.686) suggests that approximately 0.314 of the gap between the desired level of spending on imports from Greece and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately three years.

**Table 6.9: Regression Results of the Simultaneous Equations Model of Libyan Trade with Greece**

$$Y_{\text{Libya}, t} = 12035.8 + 11.279 X_{\text{L-Greece}, t} + 0.286 X_{\text{Libya}, t} + 0.314 Y_{\text{Libya}, t-1}$$

(3.642) (3.32)\*\* (2.574)\* (2.156)\*

$\bar{R}^2 = .763$  F= 27.8 h= 0.992

$$X_{\text{Libya-Greece}, t} = -42.6 + 9.292 P_{\text{oil}, t} + 0.0037 Y_{\text{Greece}, t}$$

(-0.41) (2.35)\* (2.18)\*\*

$\bar{R}^2 = 0.337$  F= 8.377 D.W= 1.499

$$Y_{\text{Greece}, t} = 2542.7 + 2.314 X_{\text{Greece}, t} + 73.135 M_{\text{Libya-Greece}, t} + 0.574 Y_{\text{Greece}, t-1}$$

(0.486) (3.09)\*\* (2.876)\*\* (5.338)\*\*

$\bar{R}^2 = 0.850$  F= 55.8 h= 0.675

$$M_{\text{Libya-Greece}, t} = -73.3 + .0045 Y_{\text{Libya}, t} + .686 M_{\text{Libya-Greece}, t-1}$$

(-1.204) (2.16)\* (3.24)\*\*

$\bar{R}^2 = 0.327$  F= 8.046 h= 1.642

Note: \*\* and \* denote to 1 and 5 percent level of significance respectively

The regression results for the UK are given in Table 6.10. These results suggest:

- i. Libyan income is not significantly affected by Libyan oil exports to the UK. It is strongly affected by Libyan exports to the rest of the world. The “t” value of the coefficient of the variable “ $X_{\text{L-UK}, t}$ ”, which represents Libyan exports to the UK, is not statistically significant even at the 10 per cent level of significance. This may be due to the fact that Libyan exports to the UK have been a very small proportion of Libyan total exports over the last two decades. However, inspection of the coefficient ( $Y_{\text{L}, t-1}$ ) suggests the existence of a significant spread effects.
- ii. The results of the second equation suggest that the relatively small amount of Libyan exports to the UK is strongly influenced by oil prices and the level of the UK GDP. The UK income is a major determinant of Libyan exports to that country.

A rise in UK income by US\$1 results in an increase in Libyan exports to UK by approximately US\$ 0.00013. Oil prices have less effect on Libyan exports to UK than the UK income.

iii. The results of the UK GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from UK is a very small proportion of UK exports.

iv. The regression results in the fourth equation suggest that Libyan imports from the UK are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from the UK is approximately .01 in the short-run and .017 in the long-run. This suggests that an increase in Libyan income by US\$1 results in an increase in Libyan imports from the UK by 1 US cents in the short-run and by approximately 1.7 US cents in the long-run. The short-term elasticity of Libyan imports from the UK with respect to Libyan income is approximately 0.5, while its long-run counterpart is approximately 0.9. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from UK by approximately 0.5 percent in the short-run and by 1.2% in the long run. The value of the coefficient of the variable  $M_{L-UK, i, t-1}$  (0.426) suggests that approximately 0.574 of the gap between the desired level of spending on imports from the UK and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately 1.75 years.

**Table 6.10: Regression Results of the Simultaneous Equations Model of Libyan Trade with the UK**

$$\begin{aligned}
 Y_{\text{Libya}, t} &= 9304.6 + 17.0 X_{L-\text{UK}, t} + 0.288 X_{\text{Libya}, t} + 0.460 Y_{\text{Libya}, t-1} \\
 &\quad (2.56) \quad (1.741) \quad (2.192)^* \quad (2.83)^{**} \\
 &\quad \bar{R}^2 = .676 \quad F = 21.2 \quad h = 0.343 \\
 \\
 X_{\text{Libya-UK}, t} &= -20.3 + 2.672 P_{\text{oil}, t} + 0.0013 Y_{\text{UK}, t} \\
 &\quad (-5.98) \quad (2.113)^* \quad (6.11)^{**} \\
 &\quad \bar{R}^2 = 0.711 \quad F = 36.6 \quad DW = 1.810 \\
 \\
 Y_{\text{UK}, t} &= -235785.2 + 3.366 X_{\text{UK}, t} + 568.0 M_{\text{Libya-UK}, t} + 0.413 Y_{\text{UK}, t-1} \\
 &\quad (-1.223) \quad (3.049)^{**} \quad (1.039) \quad (2.181)^* \\
 &\quad \bar{R}^2 = 0.821 \quad F = 45.5 \quad h = 1.241 \\
 \\
 M_{\text{Libya-UK}, t} &= -75.7 + .0102 Y_{\text{Libya}, t} + .426 M_{\text{Libya-UK}, t-1} \\
 &\quad (-1.033) \quad (2.912)^{**} \quad (3.036)^{**} \\
 &\quad \bar{R}^2 = 0.669 \quad F = 30.3 \quad h = 1.067
 \end{aligned}$$

Note: \*\* and \* denote to 1 and 5 percent level of significance respectively

The regression results for China are given in Table 6.11. These results suggest:

- i. Libyan income is not significantly affected by Libyan oil exports to China. It is strongly affected by Libyan exports to the rest of the world. The “t” value of the coefficient of the variable “ $X_{L-\text{China}, t}$ ”, which represents Libyan exports to China, is not statistically significant even at the 10 per cent level of significance. This may be due to the fact that Libyan exports to China have been a very small proportion of Libyan total exports over the last two decades. However, inspection of the coefficient ( $Y_{L, t-1}$ ) further suggests the existence of a significant spread effects.
- ii. The results of the second equation suggest that the relatively small amount of Libyan exports to China is strongly influenced by oil prices and the level of Chinese GDP. The Chinese income is a major determinant of Libyan exports to that country. A rise in Chinese income by US\$1 results in an increase in Libyan exports to China by

approximately US\$ 0.0001. Oil prices would seem to have less effect on Libyan exports to China than the Chinese income.

iii. The results of the Chinese GDP function in equation 3 suggest the absence of feedback effects. This may be due to the fact that the value of Libyan imports from China is a very small proportion of Chinese exports.

iv. The regression results in the fourth equation suggest that Libyan imports from China are positively related to the Libyan GDP within a partial adjustment mechanism. The marginal propensity of Libyan imports from China is approximately .0091 in the short-run and .0244 in the long-run. This suggests that an increase in Libyan income by US\$1 results in an increase in Libyan imports from the China by 0.9 US cents in the short-run and by approximately 2.4 US cents in the long-run. The short-term elasticity of Libyan imports from China with respect to Libyan income is approximately 0.23, while its long-run counterpart is approximately 0.62. This suggests that an increase in Libyan income by 1% results in an increase in Libyan imports from China by approximately 0.2% in the short-run and by 0.6 percent in the long run. The value of the coefficient of the variable  $M_{L-Chinese\ i, t-1}$  (0.628) suggests that approximately 0.372 of the gap between the desired level of spending on imports from China and the actual level of spending will be closed in one period and the number of periods of adjustment is approximately two and half years.

**Table 6.11: Regression Results of the Simultaneous Equations Model of Libyan Trade with China**

$$Y_{\text{Libya}, t} = 5930.4 + 3.147 X_{\text{L-China}, t} + 0.399 X_{\text{Libya}, t} + 0.634 Y_{\text{Libya}, t-1}$$

$$(1.75) \quad (0.33) \quad (2.314)^* \quad (5.093)^{**}$$

$$\bar{R}^2 = .636 \quad F = 17.9 \quad h = 0.632$$

$$X_{\text{Libya-China}, t} = -102.3 + 3.978 P_{\text{oil}, t} + 0.00011 Y_{\text{China}, t}$$

$$(-5.985) \quad (2.38)^* \quad (3.123)^{**}$$

$$\bar{R}^2 = 0.458 \quad F = 13.3 \quad DW = 1.950$$

$$Y_{\text{China}, t} = 179501.2 + 2.157 X_{\text{China}, t} + 575.6 M_{\text{Libya-China}, t} + 0.359 Y_{\text{China}, t-1}$$

$$(4.442) \quad (5.777)^{**} \quad (1.014) \quad (5.146)^{**}$$

$$\bar{R}^2 = 0.975 \quad F = 164.71 \quad h = 1.090$$

$$M_{\text{Libya-China}, t} = -207.7 + .0091 Y_{\text{Libya}, t} + .628 M_{\text{Libya-China}, t-1}$$

$$(-2.06) \quad (2.405)^* \quad (3.83)^{**}$$

$$\bar{R}^2 = 0.529 \quad F = 17.9 \quad h = 0.777$$

Note: \*\* and \* denote to 1 and 5 percent level of significance respectively

## 6.5 Conclusion:

The main conclusions of this chapter may be summarized in the following:

1. Libyan exports to each member of its major trading partners had a significant positive effect on Libyan GDP. Only Libyan exports to China did not seem to have a significant effect on Libyan GDP. This may be due to the fact that these exports were too small and highly fluctuating.
2. The effects of lagged GDP on GDP are positive and significant in all cases which suggests the existence of strong spread effects from the export sector to the rest of the economy.
3. The GDP of each major trading partner of Libya is a major determinant of Libyan exports to these partners.

4. The price of oil has a significant effect on Libyan export revenues from its major trading partners.
5. The GDP of the major trading partners is strongly influenced by their exports to countries other than Libya.
6. The level of Libyan imports from its major trading partners does not seem to have any significant effect on the level of GDP of its major trading partners except **Greece, Tunisia and Turkey**. In other words, it seems that a feedback effect exerts only in the trade relation between Libya, Greece, Tunisia and Turkey.
7. Libyan income has a strong impact on its imports from its trading partners. The short-run income elasticity was highest in the case of Italy (2.16) followed by Turkey (1.91) Tunisia (1.19) and France (0.9).

## **CHAPTER SEVEN**

### **The Effect of the Fluctuations in Oil Prices on the Import Patterns of the Libyan Economy**

*(A paper related to this chapter entitled "The Effect of the Fluctuations in Oil Prices on the Import Patterns of the Libyan Economy" has been accepted for publication in the **Middle East Business and Economic Review** and is scheduled to be published in, Vol. 20. No.1, June, 2008.)*

#### **Abstract**

This Chapter conducts a disaggregated analysis of the relationship between Libyan imports of various commodity groups, and Libyan per capita income using two-digit SIT classifications. The linkages between Libyan imports of various commodity groups are examined during various periods of fluctuation in oil prices: 1973-1981, 1982-1998 and 1999-2005.

The results of the analysis revealed that the income elasticity of demand of all import groups increased following the downturn in oil prices. Some groups even changed; turning from necessities (with income elasticity less than unity) during the boom years to luxuries (with income elasticity greater than unity) in the years following the downturn in oil prices.

#### **7.1: Introduction**

Several researchers have tried to estimate the demand function for imports (Ball, and Mavwh, 1962, Khan, 1975, Murray, and Gunman, 1976, Khan and Ross, 1977, Metwally and Tamaschke 1980; Boylan, 1980, Asseery and Perdikis 1990, Asseery and



Peel 1991, Metwally, 1987, Arize, and Affifi, 1987, Metwally, 1993, Abbott, and Seddinghi, 1996 and Metwally 2004).

As was indicated before, Libya is a small oil producing developing economy in North Africa and its economy depends heavily on its oil revenue. Due to limited productive capacity, the Libyan economy imports most of its consumer and capital goods. Libya does not impose any significant import restrictions and has a low tariff. If there are no discontinuities, it is possible to have an import-income relationship embodying two properties: (a) an initial income level below which the commodity is seldom bought and (b) a saturation level which provides an upper limit to the consumption of the commodity (Prebisch, 1959 and Sanyal and Jones, 1982). These two properties imply that income elasticity gradually diminishes as income increases, possibly from values higher than unity down ultimately to a value of zero (Brown, 1953, Friedman, 1957, Houthakker and Magee, 1969 and Marquez, 1990).

The oil boom of the 1970's has resulted in accelerated consumption and hence a sharp rise of imports of the Middle-Eastern oil-producing countries. It was also found that the average propensity to consume has increased with the increase in income in these countries (Metwally, 1991). The sharp decline in the performance of the oil sector had resulted in structural changes in the import function. According to Metwally (1993a) the (average proportional) rate of growth of Middle East oil producers' imports of goods and services turned from a very high positive value during the oil boom to negative values during the recession period (1982-1989), when oil prices declined sharply.

The Chapter is divided into five sections. Following this introduction, the second section develops a number of models to test the relationship between imports and income. The method of estimation for each model is discussed in the third section. The fourth section gives data and regression results. The fifth section summarizes the main findings of the chapter.

## 7.2. The Methodology

Imports of some groups may be linearly related to income while imports of other groups may behave in a nonlinear fashion. In addition, the rate of change in imports with respect to income may be positive or negative, constant, diminishing or increasing. Furthermore, some groups may experience high growth at low income levels, followed by a slow growth when incomes reach high levels. Some other groups may have an asymptotic level, which is reached at modest levels of income.

This chapter specifies and tests five forms of relationship between imports (M) and per capita income (Y). These models are given in Table 7.1. The income elasticity of imports for each relationship is defined as:

$$\eta_M = (dM/dY) (Y/M) \quad (1)$$

Where  $\eta_M$  represents the elasticity of imports with respect to changes in income. The elasticity defines the percentage change in imports due to 1 percent change in income

We assume linear relationship between imports and income in the first model. Thus, the marginal propensity to import (MPM) will be constant, i.e.

$$MPM = \partial M / \partial Y = \alpha \quad (2)$$

Where  $\alpha$  is constant. If  $\alpha$  was, say 0.4, this means a unit change in income would lead to a change in imports equal to 0.4 of a unit, irrespective of the level of income.

$$M_j = e^{\alpha - \beta/Y}$$

**Table 7.1: Various Models of Import-Income Relationship**

Import Functions	Import elasticity
1. $M_j = \alpha + \beta Y$	$\beta(\bar{Y} / \bar{M})$
2. $M_j = e^{\alpha - \beta/Y}$	$\beta / \bar{Y}$
3. $M_j = \alpha Y^\beta$	$\beta$
4. $M_j = \alpha - \beta / Y$	$\beta / \bar{M}_j \bar{Y}$
5. $Y = M_j = e^{\alpha - \beta/Y} e^{M_j / \beta}$	$\beta / \bar{M}_j$

**Notes:** M and Y denote per capita imports of a given commodity j and income respectively.  $\alpha$ ,  $\beta$  and  $\lambda$  are parameters to be estimated.  $\alpha > 0$ ;  $\beta > 0$  and  $\lambda > 0$

The marginal propensity to import in the second relationship should to be positive. However, there is a point of inflection where  $Y = \beta/2$ . To the left of this point, MPM increases with income; to the right of it, MPM diminishes. There is also an asymptotic level of income given by  $M = e^\alpha$ .

The marginal propensity to import in the third import function is given by  $\alpha\beta Y^{\beta-1}$ . This implies that if  $\beta$  is greater than one, the MPM continuously increases as income increases, while if  $\beta$  lies between zero and one, the MPM continuously decreases. This function gives a constant import elasticity ( $\eta_m = \beta$ ).

The fourth function gives a positive but diminishing MPM. Thus, as income increases, MPM increases but at a declining rate

$$[(\partial \text{MPY} / \partial Y) = -\beta M / Y^2].$$

Also, the relationship has an asymptotic level. This model resembles the second function to the right of the point of inflection.

The fifth function can be written as  $Y = AB^M$  where

$A = e^{\alpha - \beta/Y}$  and  $B = e^{-1/\beta}$ . This is a steady growth function.

### 7.3: Methods of Estimation

The first equation was estimated by using the method of ordinary least squares. A logarithmic transformation was used to estimate the second relationship. The transformation gives:

$$\ln M_j = \alpha - \beta Y \quad (3)$$

The last square to a double-log transformation method was used to estimate the third equation, which gives:

$$\ln M_j = \alpha + \beta \ln Y, \quad (4)$$

where the import elasticity is given by:

$$d(\ln M_j) / d(\ln Y) = \beta \quad (5)$$

A reciprocal transformation was applied to income the fourth function in order to use the method of least squares. The fifth function was transformed into the following semi-log relationship:

$$\ln Y = \delta + \lambda M \quad (6)$$

Where:  $\delta = -\alpha / \beta$ , and  $\lambda = 1 / \beta$

The elasticity coefficients were computed using the estimated parameters of each model. These elasticities relate to the mean values of per capita incomes and imports. It should be noted that fitting various forms of equations to the same set of data often reveal that differences in estimates obtained from alternative equations are least at the mean-income level. Estimated levels of imports as well as income elasticity of imports deviate markedly from one function to another when one moves away from the mean level of income Metwally (1993).

#### **7.4: The Data and the Aggregate Results**

This chapter uses data covering the period of 1974-2005, which was obtained from local and international sources. In order to assess the degree of the impact of fluctuations in oil revenue on the patterns of imports of the Libyan economy, regression analysis was applied to disaggregated data using the two-digit standard international trade classification (SITC) description. These data were calculated from the Libyan foreign trade statistics bulletin during the three periods: 1974-1981, 1982-1998 and 1999-2005. These statistics classify imports into these major groups as follows:

0. Food and live animals
1. Beverages and Tobacco
2. Crude materials, inedible
3. Mineral fuels, lubricants, etc.

4. Animal and Vegetable oils and fats
5. Chemicals
6. Manufacturing goods
7. Machinery and Transport equipment
8. Miscellaneous manufacturing articles
9. Other commodities

Figure 7.1 illustrates the share of these major categories as percentage of the total of Libyan imports during the period of 1999-2005. It is clear that 50 percent of the total imports are related to the machinery and transportation equipment group while approximately 16 percent of the Libyan imports are related to manufactured goods.

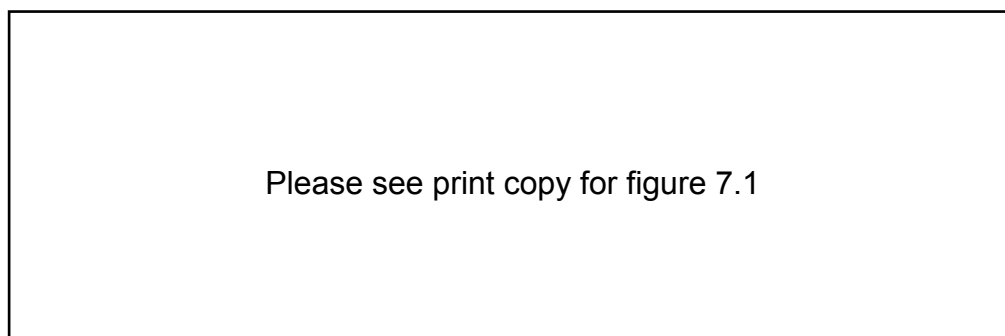


Figure 7.1: Shares of Libyan Imports during the period 1999-2005

Sources: (1) Libya: National Authority for Information and Documentation Statistics Book (various issues),  
(2) Tripoli, Libya; Central Bank, Annual Report, various issues, Tripoli  
(3) UN Yearbook of International Trade Statistics ,various issues DC

The food and live animals imports represent the third largest group of Libyan imports (12%). Only 7 percent of total imports are related to miscellaneous manufacturing articles.

Each of the above classifications is disaggregated into a two-digit classification. However, this level of disaggregation differs between the various groups. The regression analysis was applied to the above 10 groups and to 39 subgroups. Lack of symmetric data did not permit any further disaggregation.

Table 7.2 shows the best estimates for each type of imports function, while Table 7.3 gives the coefficients of elasticity for each group as calculated in the last regression model during each sub-period. The best fitting was the one that minimized the error variance:  $S^2 = \sum [(M - E(M))^2]$ , where  $E(M)$  is the expected value of M obtained from each regression.

The data in Tables 7.2 and 7.3 suggest that:

1. The marginal propensity to import of a large number of commodity groups increases as income increases during the periods of rise in oil prices (1974-1981 and 1999-2005).
2. Model 3 proved to be the best in almost 60 percent of the cases during the period 1974-1981 and in almost 75 percent of the cases during the period 1999-2005.
3. Model 5 proved to be the best fit in almost 12.5 percent of all cases during the periods of rise in oil prices.
4. The behavior of a good number of import groups during the periods of rise in oil prices was best represented by the linear import function which suggests a constant marginal propensity to import.
5. Models 3 and 5 proved to be the best fit in cases of manufacturing imports during the periods of high oil prices. Thus the exporters of these commodities

enjoyed markets with steady growth. The marginal propensity to import of a large number of food products, on the other hand, was held constant during the same period. This suggests that the sharp rise in oil revenue checked the operation of the law of diminishing returns in imports.

6. Imports of tobacco experienced a point of inflection. The marginal propensity to import of that commodity increased rapidly during the years of rises in oil prices.
7. As expected, the import-elasticity of demand for groups 6, 7 and 8 (which represent manufactured goods) were, in general, much higher than those of other import groups.
8. There seems to be a significant negative correlation between the size of the coefficient of the import elasticity and the level of per capita income. The higher the income, the lower the coefficients of elasticity for each import group. This is another “Engel’s Law”
9. The downturn in oil prices during the period 1982-1998 completely upset the pattern of the relationships between Libyan income and imports. The commodity groups which enjoyed constant or increasing marginal propensities to import during the years of high oil prices suffered diminishing marginal propensities during the period of declining of oil revenue. Model 4, which did not give a good fit to any import group during the periods of rises in oil prices, proved to be the best fit for most commodities during the recession. Thus 33 (or 77) import commodity groups followed the pattern described by model 4. This suggests that the decline in oil prices slowed down radically the demand for imports of most commodity groups. The fall in oil revenue also changed the



behavior of the import function of some import commodity groups from one of steady growth or constant elasticity to one of long-normal behavior.

The decline in oil prices has resulted in a sharp rise in the income elasticity of imports for all import groups. Many commodities, particularly manufactured goods, changed status from “necessities” to “luxuries”. This is indicated by the rise in the elasticity coefficient below the value of one

**Table 7.2: Regression results for imports during the distinguished periods**

	1974-1981		1982-1998		1999-2005	
Commodity Group	Best Model	The Equations	Best Model	The Equations	Best Model	The Equations
00 Live animals	3	$\ln M = 9.123 + .923 \ln Y$ (48.1) (9.903)* $R^2 = .933$ ; $F = 98.1$	4	$M = 155.9 - 615.5 / Y$ (21.9) (-13.6) $R^2 = .925$ ; $F = 184.7$	1	$M = 6.268 + 10.197 Y$ (-1.173) (4.885)* $R^2 = .827$ ; $F = 23.9$
01 Meat and Meat preparations	3	$\ln M = 8.165 + 1.085 \ln Y$ (68.8) (18.1)* $R^2 = .979$ ; $F = 326.5$	4	$M = 48.6 - 193.2 / Y$ (13.1) (-8.178) $R^2 = .817$ ; $F = 66.9$	3	$\ln M = 0.828 + 1.249 \ln Y$ (0.767) (10.3)* $R^2 = .955$ ; $F = 105.7$
02 Dairy Products And eggs	3	$\ln M = 9.310 + 0.814 \ln Y$ (44.7) (7.953)* $R^2 = .900$ ; $F = 63.3$	4	$M = 68.9 - 277.2 / Y$ (13.1) (-9.06)* $R^2 = .845$ ; $F = 82.1$	3	$\ln M = 0.501 + 1.312 \ln Y$ (44.7) (7.953)* $R^2 = .897$ ; $F = 43.8$
04 Cereal and cereal Preparations	1	$M = 32.0 + 12.305 Y$ (2.970) (9.830)* $R^2 = .932$ ; $F = 96.6$	4	$M = 257.5 - 868.8 / Y$ (14.9) (-7.92)* $R^2 = .807$ ; $F = 62.7$	3	$\ln M = 4.492 + 0.899 \ln Y$ (4.819) (8.570)* $R^2 = .936$ ; $F = 73.4$
05 Fruit & Vegetables	3	$\ln M = 9.553 + 0.774 \ln Y$ (74.4) (12.4)* $R^2 = .957$ ; $F = 154.8$	4	$M = 66.3 - 247.4 / Y$ (20.2) (-11.9)* $R^2 = .904$ ; $F = 141.0$	1	$M = 10.9 + 11.163 Y$ (-0.569) (4.584)* $R^2 = .808$ ; $F = 21.0$
06 sugar, sugar Preparations, honey	5	$\ln Y = 0.65 + 0.0246 M$ (6.086) (13.0)* $R^2 = .960$ ; $F = 169.3$	4	$M = 99.3 - 325.0 / Y$ (20.2) (17.2)* $R^2 = .952$ ; $F = 296.5$	3	$\ln M = 2.994 + 0.939 \ln Y$ (4.395) (12.2)* $R^2 = .968$ ; $F = 149.8$
07 Coffee, tea, coco, Spices etc.	3	$\ln M = 8.814 + 0.884 \ln Y$ (39.3) (8.013)* $R^2 = .902$ ; $F = 64.2$	2	$\ln M = 11.4 - 0.040 / Y$ (76.2) (-10.6)* $R^2 = .881$ ; $F = 111.4$	3	$\ln M = 0.399 + 1.201 \ln Y$ (0.419) (11.2)* $R^2 = .962$ ; $F = 125.6$
08 Feeding-stuff for animals	1	$M = -28.6 + 15.379 Y$ (-3.104) (14.4)* $R^2 = .967$ ; $F = 207.3$	4	$M = 227.5 - 957 / Y$ (20.2) (-8.957)* $R^2 = .842$ ; $F = 80.2$	3	$\ln M = 1.473 + 1.538 \ln Y$ (-0.903) (8.381)* $R^2 = .934$ ; $F = 70.2$
0 Total – Food and Live animals	3	$\ln M = 11.355 + 0.896 \ln Y$ (110.8) (17.8)* $R^2 = .978$ ; $F = 316.7$	4	$M = 975.4 - 36911 / Y$ (20.4) (-12.1)* $R = .908$ ; $F = 147.3$	3	$\ln M = 3.363 + 1.153 \ln Y$ (4.960) (15.1)* $R^2 = .979$ ; $F = 228.2$
11 Beverages	2	$\ln M = 9.348 - 4.719 / Y$ (245.1) (-20.2)* $R^2 = .983$ ; $F = 407.0$	2	$\ln M = 9.886 - 0.064 / Y$ (68.4) (-8.780)* $R^2 = .837$ ; $F = 77.1$	1	$M = 0.459 + 0.294 Y$ (2.693) (12.6)* $R^2 = .970$ ; $F = 159.7$
12 Tobacco etc.	2	$\ln M = 9.967 - 5.695 / Y$ (154.2) (-14.4) $R^2 = .967$ ; $F = 206.4$	2	$\ln M = 11.017 - 132 / Y$ (80.3) (-10.5)* $R^2 = .880$ ; $F = 109.6$	3	$\ln M = .765 + 0.987 \ln Y$ (0.612) (7.009) $R^2 = .908$ ; $F = 49.1$
1 Total beverages and Tobacco	2	$\ln M = 10.395 - 5.313 Y$ (240.4) (-20.0)* $R^2 = .983$ ; $F = 401.1$	2	$\ln M = 11.293 - .823 / Y$ (96.4) (-11.8)* $R^2 = .903$ ; $F = 149.4$	3	$\ln M = 1.182 + 0.959 \ln Y$ (1.110) (7.997)* $R^2 = .927$ ; $F = 63.9$
24 Wood, lumber & cork	5	$\ln Y = 1.026 + 0.0176$ (4.667) (4.702)* $R^2 = .760$ ; $F = 22.1$	4	$M = 83.0 - 349.9 / Y$ (15.5) (-10.3)* $R^2 = .875$ ; $F = 105.3$	3	$\ln M = 7.808 + .315 \ln Y$ (34.5) (11.5)* $R^2 = .965$ ; $F = 132.1$
27 Crude fertilizers & Crude materials	1	$M = -5.924 + 3.589 Y$ (-1.970) (10.3)* $R^2 = .938$ ; $F = 105.8$	2	$\ln M = 10.509 - 2.668 / Y$ (46.8) (8.874)* $R^2 = .840$ ; $F = 8.7$	3	$\ln M = 5.473 + 1.683 \ln Y$ (13.6) (8.301)* $R^2 = .966$ ; $F = 68.9$

\* = significant at 1 percent level of significance.

**Table 7.2 (Continued)**

	1974-1981		1982-1998		1999-2005	
Commodity Group	Best Model	The Equations	Best Model	The Equations	Best Model	The Equations
29 Crude animals and Vegetable materials	5	$\ln Y = .01744 + 0.0152 M$ (0.448) (11.82)* $R^2 = .522$ ; $F = 139.1$	4	$M = 14.2 - 47.7/Y$ (20.3) (-10.7)* $R^2 = .884$ ; $F = 114.7$	1	$M = 0.576 + 0.406 Y$ (1.312) (6.776)* $R^2 = .902$ ; $F = 45.9$
2 Total-Crude materials, Inedible	1	$M = 11.3 + 9.872 Y$ (0.941) (7.107)* $R^2 = .878$ ; $F = 50.5$	4	$M = 114.9 - 476.2/Y$ (16.1) (-10.5)* $R^2 = .880$ ; $F = 110.0$	1	$M = 13.049 + 7.825 Y$ (-4.043) (17.8)* $R^2 = .984$ ; $F = 315.2$
32 Coal, coke and Briquettes	3	$\ln M = 6.292 + 0.991 \ln Y$ (23.4) (7.508)* $R^2 = .890$ ; $F = 56.4$	2	$\ln M = 9.820 - 2.134/Y$ (64.8) (-12.6)* $R^2 = .914$ ; $F = 158.5$	3	$\ln M = 5.021 + 1.550 \ln Y$ (9.290) (5.677)* $R^2 = .866$ ; $F = 32.2$
33 Petroleum and Petroleum products	5	$\ln Y = .737 + 0.04092 M$ (4.238) (7.564)* $R^2 = .891$ ; $F = 57.2$	4	$M = 52.9 - 224.9/Y$ (14.6) (-9.749)* $R^2 = .864$ ; $F = 95.0$	3	$\ln M = 6.641 + 1.538 \ln Y$ (20.8) (9.551)* $R^2 = .948$ ; $F = 91.2$
3 Total – mineral fuels, Lubricants etc.	3	$\ln M = 8.684 + 0.858 \ln Y$ (30.6) (6.158)* $R^2 = .844$ ; $F = 37.9$	4	$M = 61.9 - 263.8/Y$ (14.9) (-9.996)* $R^2 = .869$ ; $F = 99.9$	3	$\ln M = 6.821 + 1.541 \ln Y$ (24.6) (11.0)* $R^2 = .960$ ; $F = 120.9$
4 Total – animals and vegetable oils and fats	5	$\ln Y = .537 + 0.02913 M$ (-4.651) (12.7)* $R^2 = .958$ ; $F = 160.9$	4	$M = 265.3 - 972.0/Y$ (15.3) (-8.824)* $R^2 = .838$ ; $F = 77.9$	1	$M = 23.5 + 23.343 Y$ (-9.10) (6.609)* $R^2 = .897$ ; $F = 43.7$
51 Chemical elements and Compounds	1	$M = 3.757 + 3.528 Y$ (1.105) (8.948)* $R^2 = .920$ ; $F = 80.0$	4	$M = 80.7 - 300.2/Y$ (16.3) (-9.583)* $R^2 = .860$ ; $F = 91.8$	3	$\ln M = 8.221 + 1.197 \ln Y$ (24.6) (11.0)* $R^2 = .843$ ; $F = 26.8$
53 Dyeing, tanning and colouring materials	3	$\ln M = 7.334 + 0.934 \ln Y$ (32.3) (8.363)* $R^2 = .909$ ; $F = 69.9$	4	$M = 65.0 - 242.9/Y$ (23.1) (-13.6)* $R^2 = .925$ ; $F = 184.3$	3	$\ln M = .822 + 1.240 \ln Y$ (19.6) (6.154)* $R^2 = .883$ ; $F = 37.9$
54 Medical and pharmaceutical products	1	$M = -1.076 + 5.791 Y$ (-2.03) (9.415)* $R^2 = .927$ ; $F = 88.7$	2	$\ln M = 12.187 - 8.293/Y$ (181.6) (-19.4)* $R^2 = .962$ ; $F = 377.9$	3	$\ln M = 8.734 + 1.176 \ln Y$ (21.4) (5.716)* $R^2 = .867$ ; $F = 32.7$
55 Oil, perfumes, cleansing Materials	3	$\ln M = 7.727 + 1.110 \ln Y$ (30.9) (9.026)* $R^2 = .921$ ; $F = 81.5$	4	$M = 84.5 - 335.7/Y$ (15.2) (-9.502)* $R^2 = .858$ ; $F = 90.3$	5	$\ln Y = 1.258 + 0.0173 M$ (9.794) (5.657)* $R^2 = .865$ ; $F = 32.0$
56 Manufactured fertilizers	3	$\ln M = 7.730 + 1.238 \ln Y$ (23.5) (7.659)* $R^2 = .893$ ; $F = 58.7$	4	$M = 31.2 - 132.3/Y$ (16.5) (-11.0)* $R^2 = .890$ ; $F = 120.8$	3	$\ln M = 7.722 + 1.522 \ln Y$ (16.5) (6.443)* $R^2 = .892$ ; $F = 41.5$
59 Chemical materials and Products	3	$\ln M = 6.829 + 1.157 \ln Y$ (20.8) (7.171)* $R^2 = .880$ ; $F = 51.4$	4	$M = 27.4 - 117.7/Y$ (14.7) (-9.960)* $R^2 = .869$ ; $F = 99.2$	3	$\ln M = 6.046 + 1.529 \ln Y$ (12.6) (6.319)* $R^2 = .889$ ; $F = 39.9$
5 Total – chemicals	3	$\ln M = 9.786 + 1.029 \ln Y$ (43.0) (9.211)* $R^2 = .924$ ; $F = 84.9$	4	$M = 417.0 - 1598.2/Y$ (30.7) (-18.5)* $R^2 = .958$ ; $F = 341.7$	3	$\ln M = 9.799 + 1.284 \ln Y$ (75.2) (19.5)* $R^2 = .987$ ; $F = 379.8$
62 Rubber manufacture	5	$\ln Y = .370 + 0.05413 M$ (-2.753) (12.4)* $R^2 = .957$ ; $F = 155.2$	4	$M = 87.6 - 354.6/Y$ (17.0) (-10.9)* $R^2 = .887$ ; $F = 117.8$	1	$M = 9.507 + 6.155 Y$ (-1.816) (8.612)* $R^2 = .902$ ; $F = 74.2$
63 Wood and cork manufacture, not furniture	3	$\ln M = 6.594 + 1.160 \ln Y$ (23.5) (7.291)* $R^2 = .884$ ; $F = 53.2$	4	$M = 66.7 - 256.8/Y$ (10.4) (-6.2909)* $R^2 = .725$ ; $F = 39.6$	3	$\ln M = 7.522 + 1.326 \ln Y$ (11.7) (4.059)* $R^2 = .767$ ; $F = 16.5$
64 paper manufactures	3	$\ln M = 7.781 + 1.065 \ln Y$ (27.1) (7.5581)* $R^2 = .891$ ; $F = 57.1$	4	$M = 67.5 - 265.7/Y$ (13.6) (-8.429)* $R^2 = .826$ ; $F = 71.0$	1	$M = 10.7 + 6.009 Y$ (-1.620) (6.641)* $R^2 = .898$ ; $F = 44.1$
65 Textiles and fabrics	3	$\ln M = 9.391 + 1.039 \ln Y$ (40.5) (9.12)* $R^2 = .922$ ; $F = 83.1$	4	$M = 188.6 - 811.8/Y$ (10.3) (-6.999)* $R^2 = .766$ ; $F = 49.0$	3	$\ln M = 7.802 + 1.414 \ln Y$ (12.4) (4.463)* $R^2 = .697$ ; $F = 19.9$
66 Non-metallic mineral	3	$\ln M = 8.889 + 1.480 \ln Y$ (20.1) (6.810)* $R^2 = .869$ ; $F = 46.4$	2	$\ln M = 14.1 - 13.636/Y$ (63.6) (-9.702)* $R^2 = .863$ ; $F = 94.1$	3	$\ln M = 8.767 + 1.815 \ln Y$ (16.4) (6.736)* $R^2 = .901$ ; $F = 45.4$

**Table 7.2 (Continued)**

Commodity Group	1974-1981		1982-1998		1999-2005	
	Best Model	The Equations	Best Model	The Equations	Best Model	The Equations
67 Iron and Steel	3	$\ln M = 8.444 + 1.764 \ln Y$ (20.1) (6.810)* $R^2 = .922$ ; $F = 83.0$	4	$M = 678.1 - 811.8 / Y$ (12.5) (-8.969)* $R^2 = .843$ ; $F = 80.4$	1	$M = -354.4 + 93.0 Y$ (-3.934) (7.563)* $R^2 = .920$ ; $F = 57.2$
68 Non-ferrous metals	3	$\ln M = 5.710 + 1.460 \ln Y$ (13.3) (6.918)* $R^2 = .872$ ; $F = 47.9$	4	$M = 12.9 - 58.6 / Y$ (12.5) (-8.875)* $R^2 = .799$ ; $F = 78.8$	3	$\ln M = 4.331 + 1.988 \ln Y$ (5.738) (5.026)* $R^2 = .835$ ; $F = 25.3$
69 Metal manufactures	3	$\ln M = 9.220 + .442 \ln Y$ (16.4) (5.206)* $R^2 = .795$ ; $F = 27.1$	4	$M = 449.6 - 2012.4 / Y$ (12.9) (-9.100)* $R^2 = .847$ ; $F = 82.8$	3	$\ln M = 8.382 + 1.905 \ln Y$ (11.3) (5.091)* $R^2 = .838$ ; $F = 25.9$
6 Total – manufactured Goods	5	$\ln Y = 1.208 + 0.001017M$ (13.0) (9.514)* $R^2 = .928$ ; $F = 90.5$	4	$M = 2085.3 - 9223.9 / Y$ (19.2) (-13.4)* $R^2 = .923$ ; $F = 179.3$	3	$\ln M = 9.962 + 1.878 \ln Y$ (24.4) (9.098)* $R^2 = .943$ ; $F = 82.7$
71 Machinery, other than Electrical	3	$\ln M = 9.010 + 1.828 \ln Y$ (17.7) (7.308)* $R^2 = .884$ ; $F = 53.4$	4	$M = 549.4 - 2617.4 / Y$ (8.527) (-6.391)* $R^2 = .731$ ; $F = 40.9$	3	$\ln M = 7.312 + 2.340 \ln Y$ (17.9) (11.3)* $R^2 = .981$ ; $F = 127.9$
72 Electrical machinery and appliances	3	$\ln M = 7.593 + 2.574 \ln Y$ (10.1) (6.939)* $R^2 = .873$ ; $F = 48.1$	2	$\ln M = 16.8 - 22.865 / Y$ (48.5) (-10.4)* $R = .878$ ; $F = 108.1$	3	$\ln M = 7.949 + 2.963 \ln Y$ (16.7) (12.3)* $R^2 = .968$ ; $F = 151.8$
73 Transport Equipment	3	$\ln M = 9.627 + 1.851 \ln Y$ (21.5) (8.397) $R^2 = .910$ ; $F = 70.5$	2	$\ln M = 16.8 - 21.391 / Y$ (72.2) (-14.5)* $R^2 = .933$ ; $F = 210.4$	3	$\ln M = 8.003 + 2.784 \ln Y$ (11.3) (7.787)* $R^2 = .924$ ; $F = 60.6$
7 Total – Machinery and Transport Equipment	3	$\ln M = 1.261 + 2.381 \ln Y$ (3.672) (13.7)* $R^2 = .974$ ; $F = 188.4$	2	$\ln M = 17.5 - 21.476 / Y$ (90.7) (-17.5)* $R^2 = .953$ ; $F = 307.3$	3	$\ln M = 8.840 + 2.837 \ln Y$ (22.13) (14.0)* $R^2 = .75$ $F = 196.8$
81 Sanitary, plumbing heating and lighting	1	$M = 19.3 + 4.588 Y$ (-.404) (8.262)* $R^2 = .907$ ; $F = 68.3$	4	$M = 57.3 - 262.2 / Y$ (16.8) (-12.1)* $R^2 = .907$ ; $F = 145.5$	3	$\ln M = 5.767 + 1.973 \ln Y$ (9.055) (6.134)* $R^2 = .883$ ; $F = 37.6$
82 Furniture	3	$\ln M = 7.502 + 1.798 \ln Y$ (20.4) (9.947)* $R^2 = .934$ ; $F = 98.9$	4	$M = 216.9 - 1039.4 / Y$ (1.9) (-8.942)* $R^2 = .842$ $F = 80.0$	3	$\ln M = 6.158 + 2.454 \ln Y$ (14.9) (11.7) $R^2 = .965$ ; $F = 137.2$
83 Travel goods, handbags, etc	3	$\ln M = 6.986 + .887 \ln Y$ (14.5) (3.634)* $R^2 = .755$ ; $F = 13.2$	4	$M = 9.193 - 37.010 / Y$ (19.4) (-12.3)* $R^2 = .909$ $F = 150.6$	3	$\ln M = 5.227 + 1.293 \ln Y$ (6.489) (3.177) $R^2 = .689$ ; $F = 10.1$
84 Apparel and clothing Accessories	3	$\ln M = 9.443 + 1.286 \ln Y$ (32.9) (8.873)* $R^2 = .940$ ; $F = 78.7$	4	$M = 259.2 - 078.8 / Y$ (16.3) (-10.7)* $R^2 = .884$ $F = 114.5$	3	$\ln M = 8.858 + 1.463 \ln Y$ (13.0) (4.281)* $R^2 = .786$ ; $F = 18.3$
85 Footwear	3	$\ln M = 8.309 + 1.129 \ln Y$ (21.59) (5.942)* $R^2 = .835$ ; $F = 35.3$	4	$M = 87.8 - 49.5 / Y$ (20.3) (-12.9) $R^2 = .915$ $F = 162.4$	1	$M = -18.0 + 8.212 Y$ (-1.067) (3.577)* $R^2 = .719$ ; $F = 12.8$
87 Scientific and photographic Equipment	3	$\ln M = 7.577 + 1.387 \ln Y$ (14.8) (5.520)* $R^2 = .813$ ; $F = 30.5$	4	$M = 71.6 - 304.5 / Y$ (17.7) (-11.8)* $R^2 = .903$ $F = 140.1$	3	$\ln M = 6.992 + 1.632 \ln Y$ (18.3) (8.435) $R^2 = .934$ ; $F = 71.2$
89 Miscellaneous manufactures articles	3	$\ln M = 8.090 + 1.525 \ln Y$ (16.2) (6.199)* $R^2 = .846$ ; $F = 38.4$	4	$M = 280.8 - 1267.0 / Y$ (10.2) (-7.271)* $R^2 = .779$ $F = 52.9$	3	$\ln M = 7.617 + 1.859 \ln Y$ (18.3) (8.435)* $R^2 = .947$ ; $F = 89.3$
1 Total- Misc. Manufactured articles	3	$\ln M = 10.9 + 1.036 \ln Y$ (71.9) (13.9)* $R^2 = .965$ ; $F = 193.5$	4	$M = 982.8 - 4338.4 / Y$ (15.8) (-10.9)* $R^2 = .889$ $F = 119.8$	3	$\ln M = 9.333 + 1.7444 \ln Y$ (33.0) (12.2)* $R^2 = .967$ ; $F = 148.7$
10. Total – all commodities	3	$\ln M = 12.1 + 1.474 \ln Y$ (49.9) (12.1)* $R^2 = .955$ ; $F = 147.5$	4	$M = 12167 - 36771.8 / Y$ (17.8) (-13.1)* $R^2 = .920$ $F = 171.4$	3	$\ln M = 11.916 + 2.071 \ln Y$ (53.9) (19.7)* $R^2 = .987$ ; $F = 389.2$

\* = significant at 1 percent level of significance.

**Table 7.3: The Coefficients of Import Elasticity in Various Periods**

	Coefficients of elasticity			Coefficients of elasticity			
Commodity Group	1974-81	1982-98	1999-2005	Commodity Group	1974-1981	1982-1998	1999-2005
00 Live animals	0.923	1.540	1.092	59 Chemical materials and products	1.157	1.960	1.529
01 Meat and Meat preparations	1.085	1.479	1.249	5 Total – chemicals	1.029	1.429	1.284
02 Dairy Products and eggs	0.814	1.619	1.312	62 Rubber manufacture	0.617	1.647	1.270
04 Cereal and cereal Preparations	0.754	1.069	0.899	63 Wood and cork manufacture, not furniture	1.160	1.448	1.322
05 Fruits and vegetables	0.774	1.340	1.155	64 paper manufactures	1.065	1.526	1.326
06 sugar, sugar Preparations, honey	0.747	1.005	0.939	65 Textiles and fabrics	1.039	1.960	1.414
07 Coffee, tea, coco, spices etc.	0.884	1.515	1.201	66 Non-metallic mineral products	1.480	2.058	1.815
08 Feeding-stuff for animals	1.304	1.842	1.538	67 Iron and Steel	1.764	2.372	2.102
0 Total – Food and live animals	0.896	1.386	1.153	68 Non-ferrous metals	1.460	2.384	1.908
11 Beverages	0.712	1.218	0.823	69 Metal manufactures	1.442	2.216	1.905
12 Tobacco etc.	0.860	1.378	0.987	6 Total – manufactured goods	1.277	2.133	1.878
1 Total beverages and Tobacco	0.802	1.332	0.959	71 Machinery, other than electrical	1.828	2.766	2.340
24 Wood, lumber and cork	1.036	1.845	1.315	72 Electrical machinery, appliances	2.574	3.451	2.963
27 Crude fertilizers and crude materials	1.261	1.912	1.683	73 Transport Equipment	1.851	3.229	2.784
29 Crude animals and vegetable materials	0.522	1.054	0.812	7 Total – Machinery and Transport Equipment	2.381	3.242	2.837
2 Total – Crude materials, inedible	0.875	1.756	1.298	81 Sanitary, plumbing heating	1.056	2.383	1.973
32 Coal, coke and briquettes	0.991	1.832	1.550	82 Furniture	1.798	2.830	2.454
33 Petroleum and petroleum products	0.797	1.887	1.538	83 Travel goods, handbags, etc	0.887	1.621	1.293
3 Total – mineral fuels, Lubricants etc.	0.858	1.901	1.541	84 Apparel and clothing accessories	1.286	1.776	1.463
4 Total –animals and vegetable oils	705	1.283	1.161	85 Footwear	1.129	1.577	1.431
51 Chemical elements and compounds	0.882	1.330	1.197	87 scientific and photographic equipment	1.387	1.894	1,632
53 Dyeing, tanning and colouring materials	0.909	1.344	1.240	89 Miscellaneous manufactures articles	1.525	2.276	1.859
54 Medical and pharmaceutical products	1.024	1.252	1.176	8 Total- Misc. Manufactured articles	1.036	2.120	1.744
55 Oil, perfumes, cleansing materials	1.110	1.565	1.397	10. Total – all commodities	1.474	2.558	2.071
56 Manufactured fertilizers	1.238	1.879	1.522				

## **7.6: Conclusions:**

The most important conclusions of this chapter may be summarized in the following:

1. The reduction in oil revenues of the Libyan economy following the oil slump in 1982 completely upset the import-income relationship which was developed during the boom years 1974-1981.
2. The rise in oil prices since 1999 has improved the Libyan income-import relationship.
3. The marginal propensity to import of most, if not all, import groups diminished during the period 1982-1998. This is in contrast to an increasing or constant marginal propensity to import during the years of rise in oil prices (1974-1981 and 1999-2005)
4. The income elasticity of demand of all import groups increased following the downturn in oil prices. Some groups even changed “baskets”, turning from necessities (with income elasticity less than unity) during the boom years to luxuries (with income elasticity greater than unity) in the years following the downturn in oil prices.
5. The impact of the oil recession on the import patterns was particularly stronger in cases of manufactured imports.
6. The changes in patterns of imports of the Libyan economy are mainly due to substantial reductions in incomes and operation of Engel’s Law rather than to import restrictions or changes in tastes

## **CHAPTER EIGHT**

### **Impact of fluctuations in Oil prices on Libyan Balance of Payments**

*(A paper related to this chapter entitled "Impact of fluctuations in Oil prices on Libyan Balance of Payments " has been published in the **International Journal of Applied Business and Economic Research**, Vol.5. No.2, December 2007)*

#### **Abstract**

The aim of this Chapter is to analyze the impact of fluctuations in oil prices on the main components of the balance of payments of the Libyan economy. This chapter also forecasts the future behavior of the Libyan balance of payments under various scenarios.

Single and simultaneous-equations models are developed and tested to examine the impact of the external and internal forces on Libyan balance of payments. The results are used in forecasting the future behavior of this balance under various scenarios.

The analysis indicates that the ratio of trade balance to GDP has fluctuated sharply with changes in the world price of oil. The decline in oil exports combined with deficit in the services balance and net current transfers depleted the gains from trade surplus in the Libyan economy. This resulted in a continuous decline in the current account surplus.

#### **8.1: Introduction**

It was demonstrated in previous chapters that Libya is an open economy which depends heavily on the outside world. Its percentage of exports to GDP ranges between

30 and 50 per cent. Oil exports contribute well over 90 per cent of these exports. Also, imports contribute 20-35 per cent of GDP. Libya imports most of its needs of consumer and capital goods. Moreover, due to the small domestic absorptive capacity, a significant proportion of the Libyans' surplus is invested overseas. The behavior of most economic variables revolves around the oil export sector. Since the oil embargo in late 1973, oil prices fluctuated sharply with serious impact on Libyan balances of payments.

The chapter is divided into seven sections. Section two examines the performance of Libyan balance of payments during the period 1973-2005. The analysis will cover the balance of trade, the balance of current account, and the financial account. Section three examines the affect of fluctuations in oil prices on the main components of the balance of payments. Section four examines a single equation model of the resource balance, while section five examines a simultaneous equation model. Section six forecasts the future behavior of Libyan balance of payments under various scenarios. Finally, the main conclusions of this chapter are summarized in section seven.

## **8.2: Performance of Libyan Balance of Payments during the Period 1973-2005**

The oil boom which began following the embargo in late 1973 did not last very long. The year 1982 brought the OPEC to the brink. It has been demonstrated that oil exports of all members of the Middle Eastern oil producers have declined significantly and continuously since 1983. The decline in oil exports resulted in



substantial decline of imports. However the rates of decline of imports were much less than those of exports (Metwally, 1993). As a consequence the surplus in the trade balance was reduced sharply in each of these economies. Also, as a result of the slump in oil exports, the ratio of imports of goods and services to exports of goods and services rose sharply in each member state. As a consequence, the surplus in the resource balance declined substantially, and even became negative, a phenomenon not known to these economies before 1983 (Metwally and Tamaschke, 1980)

As has been shown before, oil prices increased substantially during the period 1973-1981, then reduced to very low levels during the period 1982-1998 and started rising to high levels since 1999. Since oil prices have fluctuated significantly in three periods, to show the long-term effect of fluctuations in oil prices on the components of the balance of payment, four different years within the period 1972-2005 were selected at random. These years are 1974, 1981, 1990 and 2005. Table 8.1 presents the Libyan balance of payments. The data in this table suggest the following:

1. The proportion of oil exports out of merchandise exports has declined during the period of falling in oil prices (1982-1998). In 1974 this ratio was 92.1 percent. In 1998, this ratio declined to 19.2 per cent. However, this proportion increased during the period of rise in oil prices (1999-2006). In 2005 this ratio was 91.7 percent

2. The proportion of merchandise exports out of GDP has also declined from around 63 per cent in 1974 to around 16 per cent in 1998 and increased to 56.3 percent in 2005.
3. The ratio of merchandise imports to exports was subject to a high degree of fluctuation during the period 1973-2005. The ratio varied from less than 34 percent during 1980 and 2005 (periods of rise in oil prices) to over 92 per cent in 1998 (the period of the greatest fall in oil prices).
4. The ratio of the trade balance to GDP has fluctuated sharply with changes in the world price of oil. This ratio has declined from 49.1 per cent in 1974 to less than 1.5 per cent in 1998 and increased to almost 23 percent in 2005.
5. Libya experienced a continuous deficit in the resource balance (imports and exports of services) throughout the period 1974-2005. The outflows in services declined during the period 1982-1998, but rose sharply after 1999. The main reason for this reduction is the decline in investment expenditure due to the sharp decline in oil revenues. The ratio of the resource balance to GDP declined from around 26 per cent in 1974 to less than one per cent in 1998.
6. The ratio of net investment income to GDP in declined sharply from 12 per cent in 1982 to 2 per cent in 1999. This ratio has increased in 2005 to 5 per cent
7. The net current transfers constituted a very small negative part of the GDP (less than one per cent) during the period 1974-2005.
8. The ratio of current account to GDP has varied extremely during the period 1974-2005. This ratio averaged around 18 per cent during the period 1974-1980 and was reduced to less than one percent during the periods of decline in oil prices.

**Table 8.1: Libyan Balance of Payments in Selected Years (million US\$)**

Please see print copy for table 8.1

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Sources: International Financial Statistics Yearbooks (IMF, different issues); IMF, Balance of Payments Statistics (IMF, different issues).

This ratio was almost a negative one percent in 1998 and increased to over 10 percent in 2005.

9. The Libyan overall balance has been significantly affected by fluctuations in oil prices. In 1974, this balance was more than 10 percent of GDP. It increased to over 18 percent in 1980 when oil price has gone up sharply. The overall balance was reduced to a negative proportion of .015 percent in 1998 when oil prices went down sharply. In 2005, when oil prices increased sharply again, the proportion of Libyan overall balance went up to 16 percent of GDP.

### **8.3: The Impact of Fluctuations in Oil Prices on the Performance of the Balance of Payments in Libya**

Table 8.2 presents the growth rates of merchandise exports and imports and the average surplus or deficit in the trade balance and current account for the Libyan economy during the three sub-periods that experienced fluctuations in oil prices. It can be seen that Libya enjoyed high growth rates in merchandise exports and imports during the periods of rises in oil prices i.e. during the periods 1973-1982 and 1999-2005. The growth rates during the period 1983-1998 were negative but not statistically significant. The average surplus in the trade balance and current account increased significantly during the periods of rises in oil prices: 1973-1982 and 1999-2005. This surplus declined sharply during the period 1983-1998.

The analysis of Libyan balance of payments indicates clearly that fluctuations in oil prices had adversely affected the different components of the balance of payments.

In a nutshell, structural reform programs to stabilize the balance of payments against fluctuations in oil prices are needed. Some of these programs will have a negative effect in the short run, but the economy will be better off in the long-run.

**Table 8.2: The Growth Rate and Economic Indicators of the Components of Libyan Balance of Payments (1973-2005)**

	<b>1973-1982</b>	<b>1983-1998</b>	<b>1999-2005</b>
Goods Export	13.5	- 2.1*	15.4
Goods Import	22.0	- 1.2*	14.6
Average Surplus/Deficit in Trade Balance (US \$M)	3653	1890	6762
Average Surplus/Deficit in Current Account ((US \$M)	1806	66	2180

\* Not statistically significant at the 5 percent level

The two main objectives of the adjustment process are: i) economic stability to achieve an acceptable level of the balance of payments with low inflation rates in the short-run; ii) economic growth to achieve high growth while ensuring stability in the long-run. The aggregate demand management policies are the center of any adjustment reform strategy. The instruments within these policies include; public expenditure, taxation, money supply, interest and exchange rates. It is important to notice that the Libyan rate of exchange has dropped significantly since 1992. Also the levels of taxation and interest are very low. It may not be easy to adjust or change these levels in the short-run. This may need structural reform policies include liberalization of trade and financial markets, privatization, and institutional reform.

#### 8.4: A Single Equation Model of the Resource Balance

The resource balance is defined as exports of goods and non-factor services minus imports of goods and non-factor services. Economic theory suggests that the resource balance ( $X - M$ ) varies inversely with GDP. This is based on the assumption that exports are determined by factors outside the domestic economy whereas imports are a function of income level within the domestic economy (Whitman, 1970, Ott et al, 1975, Parkin and R. Bade, 1982, Obstfeld and Rogoff, 1996, and McTagg, Frindlay and Parkin, 2007). It must be realized, however, that Libyan GDP is dominated by oil revenue, which is owned by the government and is not automatically available for domestic expenditure. Because of the limited capacity to absorb oil revenues in the Libyan economy, an increase in total GDP, basically reflecting increases in oil exports, would automatically add to the overall surplus. Hence, it is possible to get a positive relationship between GDP and the external surplus, contrary to the postulates of economic theory (Metwally, 1987). This hypothesis was tested using the regression model:

$$S_t = a_0 + a_1 Y_t + a_2 C_t + u_t$$

Where:

$S_t$  = Libyan resource balance in period t  
 $Y_t$  = Libyan GDP in period t  
 $C_t$  = Growth in world consumption of oil in period t  
 $u_t$  = Error term

All data are in current price and the following results were obtained:

$$S_t = -0.548 - 0.035 Y_t + 2.715 C_t$$

(-0.932)    (-1.551)    (24.6)

$$R^2 = 0.975 \quad F = 362.5 \quad D.W = 1.527 \quad N = 32$$

These results do not seem to support economic theory that  $X-M$  varies inversely with GDP. The results show that the resource balance is not significantly correlated with GDP. The t-statistic of the  $Y$  coefficient is not statistically significant at the 5% level of significance. This result suggests that the conventional balance of payments function may not have much meaning in the Libyan economy. The Libyan total GDP is dominated by oil revenue which is owned by the government and not automatically available for domestic expenditure. Because of the limited capacity to absorb oil revenue in the Libyan economy, an increase in total GDP (basically reflecting increase in oil exports) would automatically add to the overall surplus. Hence, it is no surprise that the test shows no significant negative correlation between GDP and the external surplus.

Since the surplus should be related to a measure of domestic absorption, i.e. a measure of domestic ability to spend on imports, the relevant relationship, in the case of the Libyan economy, is that between the resource balance and *non-oil income* rather than GDP. And since the export content of the resource balance is a function of external forces (Metwally and Tamaschke, 1994), we may assume that growth in the world economy would have some impact on the performance of the export sector of Libya. Hence, it is reasonable to test the following regression model:

$$S_t = b_0 + b_1 Q_{it} + b_2 C_t + v_t$$

Where:

$Q_{it}$  = Libyan Non-oil income in period  $t$   
 $S_t$  and  $C_t$  as before  
 $v_t$  = Error term

All data are in current price and the following results were obtained:

$$S = -0.241 - 0.135 Q_t + 2.7305 C_t$$

$$(-0.918) \quad (-5.336) \quad (34.9)$$

$$\bar{R}^2 = 0.975 \quad F = 608.8 \quad D.W = 1.524$$

It is clear that when non-oil income is used a significant correlation is obtained between income and the external surplus. The t-value of the Q coefficient is significant at 0.000 % level of significance. The regression results also suggest that there is a highly significant positive correlation between Libya's external surplus and the growth in world consumption of oil. These results were not revealed when total GDP (rather than non-oil income) was used as an explanatory variable.

The above single-regression results suggest that non-oil income and not total GDP should be the relevant variable in determining the external surplus of the Libyan economy.

### **8.5: A Simultaneous Equation Model**

The above single-equation model does not take into account the interaction between the Libyan domestic economy and the rest of the world. The interaction can be explained in two ways. First, an increase in Libyan exports results in an increase in Libyan income. As this income rises there will be an increase in Libyan demand for imports. This increase in imports results in an increase in the incomes of those countries which exports the goods and services to the Libyan economy. The rise in income of the rest of the world will in turn stimulate demand for oil and this will result in an increase in the income of the oil producers. Secondly, a rise in oil prices would increase costs of



production of the oil importers. This may slow their rates of growth and hence their demand for oil. If, in the meantime, the growth of the imports of the oil producers is kept at high levels to maintain the standards of living and the process of development, the external surplus would be reduced ( Phaup, 1981, Warner and Kreinin, 1983, Bhamani-Oskooce, 1986 Metwally and Arab, 1987, Asseery and Perdakis, 1990 and Yergin, 1992). Moreover, experience shows that the sharp and erratic increases in oil prices would force the oil importers to adopt policies that would result in severe fluctuations in oil imports with a sharp drop in oil demand for some years. This, given the steady growth of demand for imports by oil producing countries, would contribute towards the instability and reduction of their external surplus. The increase in growth in world consumption of oil results in an increase in the demand for oil. This results in an increase in Libyan income which in turn stimulates its demand for imports. However, sudden and sharp rises in oil prices, as happened in the mid seventies, increase costs of production of the oil importers which may slow their rates of growth and hence their demand for oil.

It follows that the relationship between external surplus and income should be examined by a simultaneous equation model where the interaction process between the relevant variables is explicitly taken into account. The following simultaneous relationships, known as structural equations, have been developed similar to that which was used by Metwally (1993):

***Structural equations:***

$$S_t = a_0 + a_1 Q_t + a_2 C_t + u_1$$

$$Q_t = b_0 + b_1 X_t + b_2 G_t + b_3 Q_{t-1} + u_2$$

$$X_t = c_0 + c_1 P_t + c_2 E_t + c_3 M_t + u_3$$

$$M_t = d_0 + d_1 Q_t + d_2 M_{t-1} + u_4$$

***Endogenous Variables:***

$S_t$  = Resource balance of the Libyan economy in period t (in current price)

$Q_t$  = Non-oil income of the Libyan economy in period t (in current price)

$X_t$  = Exports of goods and services of the Libyan Economy in period t (in current price)

$M_t$  = Imports of goods and services of the Libyan economy in period t (in current price)

***Predetermined Variables:***

$C_t$  = Growth in world consumption of oil in period t (in current price)

$P_t$  = Oil prices in period t (in current price)

$G$  = Government expenditure in period t (in current price)

$E$  = Ratio of OPEC exports of oil to total exports of oil in period t (in current price)

$M_{t-1}$  = Libyan imports of goods and services in period t-1

$Q_{t-1}$  = Libyan non-oil income in period t-1

The first equation is the same as the single-equation model discussed above. It examines the relationship between Libyan external surplus, Libyan non-oil income and

the growth in world consumption of oil. It is expected that the coefficient  $a_1$  carries a negative sign and the coefficient  $a_2$  carries a positive sign.

The second equation in the system investigates the relationship between non-oil income, exports and government expenditure on consumption and investment. The variable representing government expenditure is important, since it is considered the most vital, if not the sole, control variable. Actually, changes in Libyan government spending are the vehicles through which oil revenue is translated into domestic income. Even during the years of recession, The Libyan government maintained a high level of spending to boost the internal economy. This was financed mainly by drawing on accumulated reserves. The introduction of the lagged dependent variable as an explanatory variable gives the equation a dynamic character. The coefficients,  $b_1$  and  $b_2$  are expected to be positive and the coefficient  $b_3$  is expected to lie between zero and one.

The third equation tests the hypothesis that oil exports are determined by the forces of demand for and supply of oil and the constraint of the Libyan economy as a member of OPEC. The variable  $E$  measures the ratio of OPEC production to the total world consumption of oil. The higher this ratio, the lower the volume of supply of non-OPEC members and hence the greater the demand for oil produced by Libya (and other members of OPEC). It should be noted that up to 1981 OPEC did not have problems in preserving a particular price structure. It is only since 1982 that the concern for maintaining oil prices has become OPEC's main objective. Oil prices are assumed to be the main predictors (Metwally and Tamaschke, 1995). It is expected that an increase in oil prices leads to an increase in export proceeds of the Libyan economy, given the quantities exported. It is also expected that a rise in the ratio of OPEC production leads

to an increase in demand for oil of OPEC members, given the price of oil (Schneider, 1983 and Adelman, 1995). Thus the two coefficients,  $c_1$  and  $c_2$ , are expected to carry a positive sign. To test if there is any feedback effect, Libyan imports of goods and services are introduced as explanatory variables in the export equation. If there is a significant feedback effect, the coefficient  $c_3$  would be statistically significant.

The fourth equation shows that the demand for imports is a function of non-oil income, which is an appropriate measure of domestic ability to spend on imports. However, there is some degree of rigidity in imports adjustment to variations in oil income. It is reasonable to assume that there is a partial adjustment mechanism in the response of the demand for imports to changes in oil exports.

The above system of structural equations is mathematically complete in the sense that it contains as many equations as endogenous variables. Applying the order and rank conditions of identification, it is seen that each equation is over-identified. It is logical, therefore, to use the method of two-stage least squares to estimate the parameters of the equations. The regression results are given in Table 8.3

The regression results, suggest that the model is a good fit as indicated by the values of (adjusted)  $\bar{R}^2$  and F statistics. Also, the estimated D-W and h statistics suggests that there is no serious problem of serial correlation. The various test statistics are given for what they are worth since their precise meaning in small sample simultaneous models is arguable.

The simultaneous-equations model results suggest that:

1. The simultaneous equation model gives slightly better results than the single-equation model. This is evident from comparing the t-value,  $\bar{R}^2$  and F in the first equation. Also, world growth of consumption of oil exerts a significant positive effect on the resource balance of Libya. The simultaneous regression result, therefore support the single equation model result that there is a negative significant correlation between the external surplus and non-oil income. This model seems to give better statistical results (judged by the “t” values) than the single-equation model.

**Table 8.3: Simultaneous Equations Regression Results**

$$S_t = -0.177 - 0.142Q_t + 2.734 C_t$$

$$(-0.638) \quad (-5.424) \quad (34.8)$$

$$\bar{R}^2 = 0.976 \quad F = 609.3 \quad D.W = 1.733 \quad N = 32$$

$$Q_t = -3.726 + 0.167 X_t + 1.662 G_t + 0.331 Q_{t-1}$$

$$(-3.097) \quad (2.480)** \quad (7.501)* \quad (3.856)*$$

$$\bar{R}^2 = 0.800 \quad F = 42.4 \quad h = 0.328 \quad N = 32$$

$$X_t = -16.5 + 0.331 P_t + 0.965 E_t - 0.480 M_t$$

$$(-5.393) \quad (4.841)* \quad (5.673)* \quad (-1.760)**$$

$$\bar{R}^2 = 0.855 \quad F = 77.6 \quad D.W = 1.696 \quad N = 32$$

$$M_t = 1.916 + 0.596 Q_t + 0.209 M_{t-1}$$

$$(2.784) \quad (7.501)* \quad (2.193)**$$

$$\bar{R}^2 = 0.832 \quad F = 77.6 \quad h = -0.267 \quad N = 32$$

Note: \* and \*\* denote to 1 and 5 percent level of significance respectively

2. There is a significant effect of oil exports on non-oil income (equation 2). The coefficient of the variable  $X$  is significant at the 2% level. The effect of government consumption is quite strong. The coefficient of the variable  $G$  is significant at .0000 level. Also the Koyck coefficient is statistically significant. However, the value of this coefficient is not too much which suggests adequate infrastructure and no existence of administrative problems.
3. There is a significant positive relationship between exports and each of oil prices and the ratio of OPEC exports of oil to total world exports (equation 3). Changes in oil prices seem to exert a strong influence on Libyan exports of goods and services. The coefficient of the price variable is significant at the .0000 percent level. However, the effect of increasing oil prices may very well offset the effect of income growth on the demand for oil. The Libyan economy thus makes its gains through the rise in prices and not as much through expanding the quantities exported. The sudden and sharp rise in oil prices could have a negative growth effect on the income of oil importers, and may result in a decline in the demand for oil. The variable  $E$  which represents the OPEC share in world oil supply is also significant at the same level. This suggests that changes in these shares are strong determinants of Libyan oil exports. Imports do not seem to be an important factor in determining exports. The  $t$ -value of the import coefficient is not statistically significant at a 5% level. This suggests the absence of feedback effects. This is not surprising given the fact that Libyan imports amount to a very small fraction of total world exports. Furthermore, the income elasticity of demand for oil is relatively low.

4. Non-oil income is a major determinant of spending on imports in the Libyan economy (equation 4). Moreover, a partial adjustment process seems to exist with respect to Libyan imports. This result suggests that the Libyan economy may be falling into an “import trap”. The oil boom has changed Libyan patterns of consumption and imports.

### **8.6: Scenarios of Future Impact of Fluctuations in Oil Prices on the Libyan Balance of Payments.**

The future impact of the fluctuations in oil prices, rate of growth of world consumption of oil, Libyan government expenditure and the ratio of OPEC exports of oil to total world exports of oil on the Libyan resource balance is examined under three scenarios. These scenarios have different assumptions regarding these variables. It is assumed that the oil price may remain constant, increase or decrease, combined with changes in the rate of growth of world consumption of oil, Libyan government expenditure and the ratio of OPEC exports of oil to total world exports.

#### ***Scenario I:***

This scenario assumes a continuation of the 2005 price of oil (US\$53.35 per barrel); an annual increase in the 2005 Libyan government expenditure by 5 percent, an annual increase in the 2005 ratio of OPEC exports of oil to total world exports by 0.2 percent each year and an annual rate of growth world consumption of oil of 4 percent.

**Scenario II:**

This scenario assumes a rise in the 2005 oil price by 5 percent per annum, an annual increase in the 2005 Libyan government expenditure by 7.5 percent, an annual increase in the 2005 ratio of OPEC exports of oil to total world exports by 0.2 percent each year and an annual increase in the 2005 rate of growth world consumption by 0.025 percent.

**Scenario III:**

This scenario assumes a reduction in the 2005 oil price oil by 10 percent per annum; an annual increase in the 2005 Libyan government expenditure by 2 percent; the same ratio of OPEC exports of oil to total world exports as in 2005 and a reduction in 2005 rate of growth world consumption by half a percent.

Applying the econometric models of simultaneous equations and the assumptions made above about the future behavior of oil prices, rate of growth of world consumption of oil, Libyan government expenditure and the ratio of OPEC exports of oil to total world exports, the forecasting results are given in Table 8.4. These results would seem to suggest that:

1. The surplus in the Libyan resource balance will decline continuously over the next five years according to Scenario 1. The surplus in the resource balance in the year 2010 will be approximately 65 percent of its level in the year 2005. The decline in the surplus is due to the pressure exerted on the balance of payments by the growth in domestic absorption as a result of the assumed 5 percent growth in government expenditure. The increase in this expenditure promotes growth in non-oil income. This



in turn results in an increase in imports of goods and services. Imports increase by approximately 33 percent while exports increase by only 22 percent, given the assumption of relative stability in oil prices and constant quotas.

2. An improvement in the oil market conditions combined with growth in the world consumption of oil and the ratio of OPEC exports of oil to total world exports of oil, according to Scenario II, result in substantial increases in the surplus in the Libyan resource balance. If the price of oil increased *steadily* from its 2005 level of US\$53.35 per barrel by 5 percent per annum to reach US\$68.09 per barrel in the year 2010, the growth in world consumption of oil increased from its level of 4 percent in 2005 by half a percent each year; the growth in the ratio of OPEC exports of oil to total world exports by .02 percent each year and the increase in government expenditure by 7.5 percent each year since 2005 result in a continuous increase in Libyan resource balance between 2005 and 2010.

3. According to Scenario III, the Libyan balance of payments would experience serious deterioration if oil prices were reduced steadily and the growth in world consumption was reduced. Thus, a reduction in oil price from its level in 2005 from US\$53.35 per barrel to US\$31.50 per barrel would turn the surpluses enjoyed by the Libyan economy into huge deficits. The Libyan resource balance will turn from a surplus over 12.647 billion US dollars in 2005 to only 4.634 billions in 2010.

**Table 8.4: Scenarios of Future Behavior of the Resource Balance of the Libyan Economy (US\$)**

Year	Non-oil Income	Exports	Imports	Resource balance
2005:	12.4	28.85	13.00	12.647
<b>Scenario 1</b>				
2006	15.33	32.71	13.77	8.759
2007	15.85	33.33	14.83	8.543
2008	17.16	33.98	15.72	8.499
2009	18.96	34.64	16.50	8.244
2010	19.93	35.30	17.24	8.106
<b>Scenario II</b>				
2006	15.65	33.28	13.96	12.136
2007	18.53	35.14	15.88	12.412
2008	20.58	36.76	17.61	12.805
2009	22.49	38.77	19.00	13.216
2010	24.32	40.18	20.38	13.634
<b>Scenario III</b>				
2006	14.65	30.32	13.37	10.222
2007	15.30	28.73	13.83	8.263
2008	15.47	27.30	14.03	7.372
2009	15.49	26.02	14.08	6.002
2010	15.50	24.86	14.10	4.634

## **8.7: Conclusions**

The main conclusions of this chapter may be summarized in the following:

1. The reduction in oil prices has resulted in a reduction in the proportion of Libyan oil exports relative to its merchandise exports and its GDP. Also the reduction in oil prices has resulted in an increase in ratio of Libyan merchandise imports to exports.
2. The Libyan ratio of trade balance to GDP has fluctuated sharply with changes in the world price of oil. Libya experienced a reduction in the service balance (import and export of services) throughout the periods of falling oil prices.
3. Libya has experienced a negative deficit in net current transfers during the period 1974-2005. The decline in oil exports combined with deficit in the services balance
4. The simultaneous-equations model results suggest that the Libyan resource balance is negatively correlated with non-oil income and positively correlated with growth in world consumption of oil.
5. The simultaneous-equations model results indicate that non-oil income is a major determinant of Libyan spending on imports. The results also indicate that changes in imports resulting from changes in non-oil income are subject to a partial adjustment mechanism.
6. Stabilization in oil prices would not leave the Libyan balance of payments intact. Growth in domestic absorption will result in greater increases in imports of goods and services. This will result in a continuous reduction in the surplus of the resource balance. The pressure on this balance can be alleviated through

introduction of economic policies which balance the growth in domestic absorption with the modest growth in exports of goods and services.

7. The regression results reveal that changes in OPEC share in world oil supply are strong determinants of Libyan oil exports.
8. The simultaneous-equations model results suggest that there is no significant feedback effect between imports and exports, owing mainly to the small contribution of Libyan imports to world incomes.
9. An improvement in the oil market conditions combined with increase in the growth in world consumption of oil and ratio of OPEC exports of oil to total world exports result in an increase in the surplus in the resource balance of the Libyan economy. Libya would increase its surplus in a period of years, if since 2005, oil price increased steadily by 5 percent per annum, growth in world consumption increases by half a percent per annum, and the ratio of OPEC exports of oil to total world exports increased by 0.2 percent per annum
10. A reduction in oil prices, combined with slow growth in the world consumption of oil and no change in the ratio of OPEC exports of oil to total world exports would result in a severe deterioration in the resource balance of the Libyan economy, even if Libya rationalizes its domestic expenditure.

## **CHAPTER NINE**

### **Conclusions and Recommendations**

#### **9.1: Conclusions:**

This thesis has reached very important conclusions regarding the impact of fluctuations in oil prices on the performance of the Libyan economy. The main conclusions are:

1. The petroleum and mining sector forms the mainstay of the economy in Libya. The growth rates of all Libyan sectors were much higher during the periods of rising oil prices than during the period of oil recession. However, economic growth of all Libyan sectors (with the exception of agriculture and wholesale retail trade) did not benefit from the growth in its oil exports during the last few years which may suggest lack of investment opportunities in the recent years.
2. The Libyan GDP has benefited from opportunities generated by increases in oil exports. However, the lagged effects are outweighed by the current period contributions that could suggest that the investment opportunities generated are not being fully exploited.
3. Real output of all Libyan sectors, with the exception of the trade sector (wholesale and retail trade) and other economic activities (including finance, insurance and other services) have not responded to growth in exports, if anything the growth in the manufacturing sector has been in the opposite direction to that of oil exports over the last four decades.

4. There is no evidence of a long-term relationship between Libyan GDP and Libyan oil exports.
5. The fluctuations in oil revenue had a significant impact on the growth of Gross Fixed Capital Formation in the Libyan economy. The downturn in oil prices had a serious adverse effect on investment. The rate of growth of the variable was negative during the downturn in oil prices. Thus, the rise in oil prices encouraged the Libyan government to invest in infrastructure and in building up the economic capacity.
6. Growth in aggregate demand, as distinct from the level of that demand, did not seem to have a significant effect on the process of capital formation in the Libyan economy during periods of stagnation in oil exports. This suggests that investment in Libya was mainly autonomous public investment in infrastructure. The limited absorptive capacity of the Libyan economy may explain the lack of induced investment in this country. The adjustment in the demand for investment to growth in aggregate demand has been subject to severe bottlenecks in the Libyan economy during the boom years and during the last four decades. Some of these bottlenecks relate to the inadequacy of infrastructure.
7. The long-run elasticity of investment expenditure in the Libyan economy with respect to Libyan expenditure on other components of aggregate demand was higher than the short-run elasticities during the period of boom in oil exports.
8. There is no evidence of long-term relationships between investment and other components of aggregate demand in the Libyan economy.

9. Libyan exports to each member of its major trading partners had a significant positive effect on Libyan GDP. The effects of lagged GDP on GDP are positive and significant in all cases which suggest the existence of strong spread effects from the export sector to the rest of the economy. The GDP of each major trading partner of Libya is a major determinant of Libyan exports to these partners.
10. The price of oil has a significant effect on Libyan export revenues from its major trading partners. The GDP of the major trading partners is strongly influenced by their exports to countries other than Libya.
11. The level of Libyan imports from its major trading partners does not seem to have any significant effect on the level of GDP of its major trading partners .A feedback effect is evident only in trade relation between Libya, Greece, Tunisia and Turkey.
12. The reduction in oil revenues of the Libyan economy following the oil slump in 1982 completely upset the import-income relationship which was developed during the boom years 1974-1981.The rise in oil prices since 1999 has improved the Libyan income-import relationship.
13. The marginal propensity to import of most, if not all, import groups diminished during the period 1982-1998. This in contrast to an increasing or constant marginal propensity to import during the years of rise in oil prices (1974-1981 and 1999-2005).
14. The impact of the oil recession on the import patterns was particularly stronger in cases of manufactured imports. The changes in patterns of imports of the Libyan

economy are mainly due to substantial reductions in incomes and operation of Engel's Law rather than to import restrictions or changes in tastes.

15. The reduction in oil prices resulted in a reduction in the proportion of Libyan oil exports relative to its merchandise exports and its GDP. Also the reduction in oil prices has resulted in an increase in the ratio of Libyan merchandise imports to exports.
16. The Libyan ratio of trade balance to GDP has fluctuated sharply with changes in the world price of oil. Libya experienced a reduction in the service balance throughout the periods of falling oil prices. Libya has also experienced a negative deficit in net current transfers during the period 1974-2005. The decline in oil exports combined with the deficit in the services balance.
17. The Libyan resource balance is negatively correlated with non-oil income and positively correlated with the growth in world consumption of oil. Non-oil income is a major determinant of Libyan spending on imports. Changes in imports resulting from changes in non-oil income are subject to a partial adjustment mechanism.
18. Stabilization in oil prices would not leave the Libyan balance of payments intact. Growth in domestic absorption will result in greater increases in imports of goods and services. This will result in a continuous reduction in the surplus of the resource balance. The pressure on this balance can be alleviated through introduction of economic policies which balance the growth in domestic absorption with the modest growth in exports of goods and services.



19. Changes in OPEC share in world oil supply are strong determinants of Libyan oil exports. There is no significant feedback effect between imports and exports, owing mainly to the small contribution of Libyan imports to world incomes.
20. An improvement in the oil market conditions combined with increased world consumption of oil and ratio of OPEC exports of oil to total world exports results in an increase in the surplus in the resource balance of the Libyan economy. Libya would increase its surplus in a period of years, if oil prices increased steadily; growth in world consumption increases and total world exports increases.
21. A reduction in oil prices, combined with slow growth in the world consumption of oil and no change in the ratio of OPEC exports of oil to total world exports would result in a severe deterioration in the resource balance of the Libyan economy, even if Libya rationalizes its domestic expenditure.

## **9.2: Problems facing the Libyan Economy**

Despite the fact that Libya is a major oil producing country, it is not highly developed. It has not reached a stage of “take off into self-sustained economic growth” if to such a concept one can give a practical meaning. The real problem facing Libya, and other oil producers, is the dependence on oil exports and the fluctuations in oil prices. The rate of net productive investment to GDP has been far below 10 percent per annum in the oil-producing countries during the period of low oil prices.

Being an oil producer, Libya, sells its assets without seeking to establish viable alternatives. This can be seen by comparing the contributions of different sectors to

GDP and total active labor force. The development strategy of selling one's assets and piling up reserves has dangerous consequences:

1. Libya relies only on exports of petroleum and hardly exports any other products or services
2. Petroleum is an exhaustible resource.
3. There is a threat raised by the development of new technology which could result in the creation of competitive substitute in the not too distant future.
4. There is the question of the adequacy of the reserves and the forms in which they could be held in the future
5. Libyan oil reserves would not last for long. Hence Libya cannot rely forever only on oil exports.
6. Fluctuations in oil prices, makes it very difficult for Libya to achieve stable economic growth
7. Libyan imports and government expenditure depends mainly on its oil exports.
8. Libya invests most of its balance surplus, which results from the rise in oil prices, in advanced countries. This may create risks. The country may lose its external balance when there are disagreements with those countries in which the surplus was invested.
9. Libya is not able to use its balance surplus in creating non-oil outputs to replace oil exports.

10. It may not be possible to persuade over 90 percent of the Libyan labor force to move into what may still be labeled as “the service sector” or even to ask them to retire at an early stage financing this by returns from reserves.

The above suggests that industrialization is the best hope for achieving self-sustained economic growth in the Libyan economy. However, in its effort to industrialize, Libya is likely to face a problem of market limitation. This problem arises from the empirical observation that the efficient scale of producing manufacturing products is not very much smaller in less industrialized countries than it is in industrialized countries whose markets for the same products are much wider than the markets of the underdeveloped countries. In spite of the huge differences between the two types of economies, the same size of plant tends to prevail in the same industries. Technical factors determining the size of plant in manufacturing industries tend to play more or less the same role in industrialized and less-industrialized countries. In the latter, however, indivisibilities and/or discontinuities in the production process exert a stronger influence in determining the “optimal” size of plant than in the more industrialized countries. This has resulted in most of the less industrialized countries (as Libya) being unable to establish even one plant to produce those items for which technical factors put a lower limit on plant size and the minimum economic scale of production is so large that one plant can easily meet the whole national market.

### **9.3: Recommendations**

Libyan industrialization is the best hope for achieving self-sustained economic growth. However, the policy of industrialization through “build-and-wait”, based on the

assumption that as development proceeds and the level of income rises, plants which are not justified at lower income levels may become justified, may not prove effective for Libya whose present size of market is much too small.

*The only avenue left seems to be co-operation with neighbors in North-African Arab countries.* It is recommended that Libya creates co-operation with: Egypt, Tunisia, Algeria, Morocco and Sudan. The total market of these neighboring countries is much bigger than the Libyan market. Also, all each of these countries has a larger population than Libya and most of them have larger GDPs than Libya. Egypt has a population over 75 millions and a GDP of approximately 95 billion US dollars. Tunisia has a population over 10 millions and a GDP of approximately 18 billion US dollars, Algeria has a population over 33 millions and a GDP of approximately 80 billion US dollars, Morocco has a population over 32 millions and a GDP of approximately 50 billion US dollars, and the Sudan has a population over 37 millions and a GDP of approximately 30 billion US dollars. On the other hand Libya has a population over 6 million and a GDP of approximately 37 billion US dollars.

In a large number of cases, manufacturing is not possible within the Libyan market, but in the mentioned North-African Arab market, operating at optimal scheme is feasible. Thus for North-African Arab Countries, the argument for an aggregation of markets to provide an outlet for the product of at least one efficient, modern manufacturing plant is extremely powerful.

It is highly recommended that Libya creates an economic integration with the mentioned five neighboring countries. Economic integration between the North-African Arab Countries will permit them to obtain important scale economies. Although the creation of the North-African Arab Common Market (NAACM) has to be judged primarily in terms of its effectiveness in promoting new investment and the establishment of new industries, its short-run impact on productive efficiency should not be overlooked. One of the paradoxes of less industrialized countries is that, while they obviously need many more factories and industries, they may not fully utilize the industrial capacity they already have.

The domestic market of members of NAACM may widen sufficiently in the near future to justify economic production of those articles that can not be produced efficiently at present. Income and prices are the main factors that might be expected to produce variations in the observed patterns. Other factors such as family size, geographical location, and social class seem to be reasonable for member of NAACM.

My recommendation of creating the North-African Arab Common Market (NAACM) will improve that this market in the future would be large enough to justify economic production of certain luxuries as well as other manufacturing articles. It is expected that by 2020 NAACM demand for commodities such as passenger cars, washing machines, domestic refrigerators, vacuum cleaners, typewriters, ball and roller bearings, aluminum and other manufacturing products will be large enough to justify the establishment of plants of economic size.

The creation of NACCM would encourage appreciably the development of large-scale manufactures as well as food, clothing and agricultural products. This would hasten growth. So too would the intensification of competition to increase the efficiency of operation of existing industries and hence to initiate a higher sustained growth of productivity. As a result Libya would not be forced to depend only on oil exports and would not be highly affected by fluctuations in oil prices.

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