PETROLEUM RESOURCES, LINKAGES AND DEVELOPMENT: THE CASE OF OMAN

Said Al-Saqri

Submitted for the degree of Doctor of Philosophy

Centre for Strategic Economic Studies
Faculties of Business and Law
Victoria University
Melbourne, Australia

2010

ACKNOWLEDGEMENTS

I would like to thank my principal supervisor, Professor Peter J. Sheehan for his help and encouragement in the course of writing this thesis. Professor Sheehan helped me to see clearly what I wanted see, and to see the challenges associated with what I see, and to link what I see with everything around it. My thanks also go to my co-supervisor Dr Ahmed Abdullahi, particularly for his enthusiasm for the topic of my research and contribution to my proficiency in the use of econometrics and econometrics software tools.

I would like to acknowledge H.E. Mohammed Al-Zubair, the Advisor to H.M. the Sultan for Economic Planning Affairs and the Ministry of Higher Education, for giving me the opportunity to do this research.

I wish to thank my friend and PhD colleague, Helena Grunfeld. Her advice and support and revision of my work were instrumental in leading me to the successful completion of this work.

I would like to express my sincere appreciation to staff and students at the Centre for Strategic Economic Studies for their advice and assistance, in particular to Margarita Kumnick, who helped me edit my thesis, Michelle Motton, Steven Parker, Professor Sardar M.N. Islam, Dr Bruce Rasmussen, Syurkani I.K., Dr Kashif Rashid, Sonia Mussawir, and Jason Nielsen.

I am most indebted to my wife and children, my brothers, Ibrahim in particular, and Mohammed Aba-Bulgu and his wife Seada for their encouragement, support and understanding. Last but not least, I would like to dedicate this thesis to my loving mother who taught me the love of learning.

DECLARATION

I, Said Mohammed Al-Saqri, declare that the PhD thesis entitled *Petroleum Resources, Linkages and Development: The Case of Oman* is no more than 100,000 words in length, including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

[redacted]

Signature

Date 6/11/2010

ABSTRACT

After four decades of oil resource utilization, Oman is faced with the challenge of reducing its dependency on oil income and adjusting to becoming a non-oil economy within twenty years. The overall objective of this thesis is to contribute to the discussion of how this transformation can take place. The specific aims of the study are to examine: (1) linkages between oil resource extraction activities and economic development in Oman; (2) linkages between government expenditure and non-oil GDP growth; (3) economic efficiency and the changing dynamics of factor inputs and their contribution to GDP growth; and (4) the underlying issues associated with fiscal sustainability when oil income ceases.

The VAR and cointegration methodologies were used to test for long and short-term relationships between the oil and the non-oil sectors, including government expenditure and its impact on the non-oil sector. The results were then tested, using the Granger causality approach, to look for the direction of causality in the various sectors of the economy. In addition, the research applied growth accounting techniques to investigate economic efficiency and the contribution of total factor productivity to output growth. Friedman's permanent income hypothesis (PIH) was used to identify an optimal fiscal policy, taking into account present spending levels and the rate of depletion of oil resources.

The results showed that, overall, the oil sector boom has had a positive impact on the development and output growth of Oman. The oil sector boom did not result in de-industrialization of the manufacturing sector, and government expenditure funded by oil revenue has a significant role in inducing non-oil GDP growth. The factor input analysis showed different patterns over time in the contribution of technological change and economic efficiency to GDP growth, but that in recent years it has been quite strong. Based on the permanent income model (PIM), the thesis examined optimal paths for government expenditure in the light of emerging oil depletion. It is clear that, if the interests of future generations of Omanis are to be protected, the Government needs to embark on such a path immediately. The model developed could be used to guide further definition of the best fiscal path for the country.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ADF	Augmented Dickey-Fuller Test
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
AR	Auto Regressive
BOT	Build Operate Transfer
CTR	Constant Returns Scale
DGP	Data Generating Process
DP	Development Council
DP	Development Plan
DPA	Direct Productive Activities
DRT	Decreasing Returns to Scale
ECT	Error Correction Term
FPE	Final Prediction Error
GCC	Gulf Cooperation Countries
GDP	Gross Domestic Product
HQ	Hannan-Quinn Information Criterion
IMF	International Monetary Fund
IRT	Increasing Returns to Scale
LDC	Less Developed Countries
LNG	Liquefied Natural Gas
MENA	Middle East and North Africa
ML	Johansen Maximum Likelihood
MPK	Marginal Product of Capital
MPL	Marginal Product of Labour
OAPEC	Organization of Arab Petroleum Exporting Countries
OLS	Ordinary Least Square Regression
OPEC	Organization of Petroleum Exporting Countries
PDO	Petroleum Development Oman
PFLO	Popular Front for the Liberation of Oman
PIH	Permanent Income Hypothesis
PIM	Permanent Income Model

RBI	Resource Based Industrialization
RO	Rial Omani
SA	Saudi Arabia
SIC	Schwarz Information Criterion
SGRF	State General Reserve Fund
SOC	Social Overhead Capital
TFP	Total Factor Productivity
UAE	United Arab Emirates
USD	United States Dollar
VAR	Vector Auto Regression
VECM	Vector Error Correction Model
WB	World Bank
WTO	World Trade Organization

EXECUTIVE SUMMARY

After four decades of oil-dependence, Oman faces the challenge of transforming itself into a non-oil economy within 20 years. The overall objective of this thesis was to examine linkages between oil resource extraction activities and economic development in Oman for the purpose of contributing to the discussion of how Oman can diversify its sources of income. There were four specific aims for this study.

The first aim was to examine linkages between the oil and the non-oil sectors by focusing on sectoral linkages and interdependencies between the oil and the non-oil sectors. The results would show the level of economic dependency running from the oil sector to the non-oil sectors and the extent to which different sectors benefited from the oil export boom.

In examining the linkages between the sectors as part of the first objective, the thesis also examined the Dutch disease, an ailment supposedly arising from a natural resource sector boom, and its possible effects on the economy. According to the Dutch disease theory, countries with abundant natural resources, minerals in particular, suffer from four major symptoms; first, exchange rate appreciation; second, a decline in the manufacturing sector; third, a boom in the service sector; and fourth, a labour shift from the manufacturing sector to the service sector and the booming resource extraction sector. The prominent role and size of the service sector coupled with a decline in the size of the agriculture and fisheries sector and the small contribution of the manufacturing sector to the economy may suggest that Oman's economy has been suffering from the Dutch disease.

In meeting the first objective, the VAR and cointegration methodologies were used to test for long and short-term relationships between the oil and the non-oil economies, including government expenditure and its impact on the non-oil sector. The results were then tested, using the Granger causality approach to look for the direction of causality in the various sectors of the economy.

With respect to the first study objective, the overall results showed that the resource export boom has had a positive impact on the overall development and GDP growth in Oman. The empirical test results suggested that the oil sector boom has been positively associated with growth in the manufacturing and service sectors. Both of these sectors benefited equally from the oil sector boom and experienced parallel growth during 1967-2007. The agriculture and fishing sector, the main pre-oil economic activity, did not seem to have been affected by oil resource activities. The booming mineral sector in Oman, unlike that of the Netherlands, United Kingdom, or Australia did not lead to de-industrialization.

In addition, the research found that the oil sector boom did not have a negative impact on the growth of non-oil sectors. The boom did not result in exchange rate appreciation, a decline in the manufacturing sector, or a labour shift from the manufacturing sector to the service sector or to the booming resource extraction sector. The prominent size of the service sector, compared to the manufacturing sector, was expected, given government expenditure and investment in social overhead capital and fiscal expansion to promote development.

The second objective of this thesis was to examine linkages between government expenditure and non-oil GDP growth. Since the oil windfall has accrued directly to the government, fiscal policy in Oman has had greater influence on the domestic economy than is usually the case in less resource dependent economies. Using the VAR and cointegration methodologies, the research examined the effects of government expenditure on the manufacturing, agriculture and fisheries, and service sectors.

The results of our empirical tests suggest three relationships. First, government expenditure, in the long run, had a positive and significant impact on the growth of the manufacturing and service sectors. Second, in terms of the casual impact of government expenditure, an analysis of the lag structure indicated that government fiscal capacity influenced future non-oil GDP growth. Third, the agriculture and fisheries sector growth was not affected by government expenditure.

The third aim of this study was to examine economic efficiency and the changing dynamics of factor inputs and their contribution to GDP growth. Such analyses are very

critical to assess Oman's ability to withstand the eventual depletion of oil resources. Using growth accounting techniques, applied to aggregate and specific periods between 1967-2007, the aim was to show the sources of growth in the Omani economy and the extent to which GDP growth in Oman has been a function of capital and labour accumulation and/or whether it could also be attributed to increasing efficiency in the use of factor inputs and to technological progress.

The research found that improving economic efficiency and technological change has contributed to output growth in Oman, particularly during the 2002-2007 period. Unlike the past oil export boom (1974-1984), the oil sector boom during this period did not decrease the efficiency of the economy. On the contrary, the TFP contribution to GDP growth in 2002-2007 was 48%. The results support the proposition that data aggregation masked important information about the development of factor inputs. This could mean, for resource rich economies with very low initial level of development, that the TFP interpretation require further decomposition of data.

The fourth objective of this study was to examine the underlying issues associated with fiscal sustainability when oil income ceases. Policy makers are faced with the challenge of finding an optimal government expenditure level that takes into account the expected reduced oil income stream and the eventual depletion of oil revenues. We applied Friedman's permanent income model (PIM) to identify an optimal fiscal policy, taking into account the 2007 expenditure levels and the rate of depletion of oil resources.

As to the fourth and last objective, the research found that the government cannot sustain the current trend in expenditure in the light of the depletion of the oil reserves. The government needs to constrain its expenditure to maintain a viable level of expenditure when these reserves are depleted, so as to protect the position of future generations. Based on the PIM, the research developed an expenditure and savings model that could be used by the government to develop viable expenditure options that would protect the position of future generations beyond 2050, when Oman will be a non-oil economy. The final chapter also touches briefly on other policies that will need to be considered if Oman is to successfully make the transition to a prosperous and growing non-oil economy.

CHAPTER 1.
INTRODUCTION

I will proceed as quickly as possible to transform your life into a prosperous one with a bright future. Every one of you must play his part towards this goal. Our country in the past was famous and strong. If we work in unity and co-operation, we will regenerate that glorious past and we will take a respectable place in the world.
Sultan Qaboos bin Said AlSaid on the day of his accession in 1970 (Ministry of Information 2001)

1.1 INTRODUCTION

Oman's real gross domestic product (GDP) grew at an annual rate of 10% between 1967-2007, rising to 38 billion USD in constant 2000 prices. Per capita GDP grew at 5% a year, reaching 10,820 USD (see Figure 1.1). Literacy rates increased from less than 30% in 1967 to 81% in 2007, and life expectancy increased from 47 years in 1967 to 76 years in 2007. Oman's economic achievements were hailed by the World Bank Commission on Growth and Development as an economic miracle and according to the report, only 13 countries, including Oman, achieved growth rates of such magnitude in the post war (The World Bank 2008).[1]

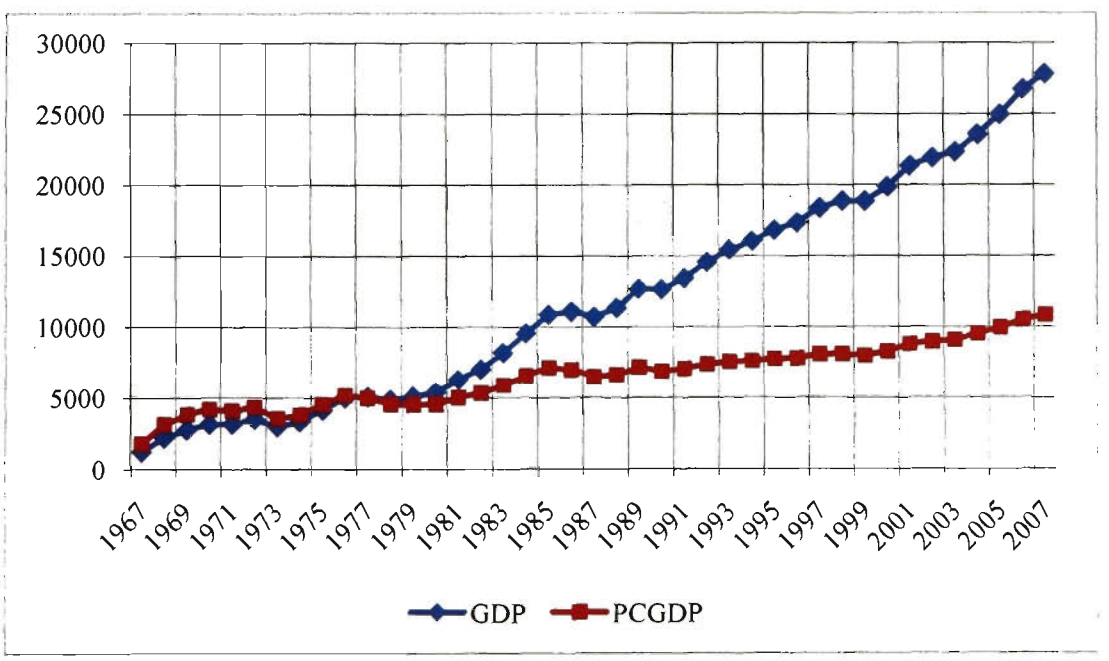
Oman has made other significant achievements. Since the 1960s, Oman has transformed itself from a traditional tribal system to a modern state, governed by a Cabinet of Ministers headed by the Sultan of Oman, His Majesty Sultan Qaboos Said Al-Said. In the course of developing the administration, a State Consultative Council was established in 1981 to give Omanis greater participation in decision making in the planning and development of the country's economy and social services. The Council had 56 representatives from the Government, regional and private sectors, and members were appointed by the government for a term of two years. The Council was superseded

[1] The other countries include: Botswana, Brazil, China, Hong Kong, Indonesia, Japan, Republic of Korea, Malaysia, Malta, Singapore, Taiwan and Thailand.

in November 1991 by the Majlis al-shūrā (مجلس الشورى ; meaning "Consultative Council") to which members are elected. Omani women are eligible to stand as candidates.[2] The formation of the Majlis was seen as a major development, aimed at making the government more democratic, transparent and representative of the people. The Majlis al-shūrā has no legislative power, but can give recommendations to the government and members can question Ministers about their respective programs and plans.

Oman was able to achieve such unprecedented levels of growth compared to its historical economic development because of oil discovery in 1964 in general, and the oil export boom that started with the 1973 international oil price increase in particular. Oil revenues raised the level of wealth and purchasing power, and enabled the country to import consumer and capital goods. Oil export earnings grew at 5% a year between 1970 and 2007 and accounted for 48% of GDP, earning the country 12 billion USD of foreign exchange in 2007. During the oil export boom in 1974-1985, GDP grew at 12% a year and GDP per capita income increased by 6% a year, at constant 2000 prices.

Figure 1.1: GDP (million USD) and per capita GDP (USD), 1967-2007



Notes: PCGDP is per capita GDP.

Sources: *Statistical Year Book*, Oman, various issues, and *World Development Indicators*, World Bank.

[2] For the translation from Arabic to English I have used International journal of Middle East Studies guidelines.

The impressive growth rates came about despite uncertainties surrounding the future of the economy. The uncertainty stemmed from the inability to predict future income because of the volatile nature of the international oil price, and because it was expected that oil production would start to decline by 1977. Indeed, the First Five-year Development Plan (DP) of 1976-1980 estimated that by 1977, oil production would decline gradually and by 1987 Oman would have exhausted most of its oil. The plan stated the following:

> Projected estimates anticipate a gradual decline in oil production with the effect from 1977. Since oil is the main source of Oman's national income, the decline of oil revenues will inevitably be reflected in reductions in the gross national product unless measures are taken in the Development Plan to increase the value added in other sectors of the economy. (Development Council 1976)

Therefore, from the outset, policy planners in Oman recognized that oil resources were limited and ultimately would be depleted and that Oman needed to diversify its sources of income away from oil by investing in other sectors of the economy, such as manufacturing, non-oil mining, agriculture and fisheries and by converting some of the oil income into productive human and physical capital.

1.2 DEVELOPMENT COUNCIL

In order to promote economic development and social well being, a Development Council (DC) was established in 1974 by a royal decree (Official Gazette 1974). The DC specified a number of policy development objectives for the country. The number one objective stressed two important policy priorities. The first is the rightful share of current and future generations to oil resources. Oil wealth accruing from the exploitation of oil minerals should benefit current and future Omanis equally. The second policy priority emphasised the importance of efficient exploitation of the limited quantities of oil resources available.

To be able to use oil wealth efficiently, the council's third objective called for giving priority to building basic infrastructure and providing utilities and services to promote non-oil sector growth and economic development. Efficient use of oil resources also entailed a free competitive market economy, and therefore, the fourth policy objective

called for using market principles, not only to induce efficient use of oil wealth, but also to promote and enhance the growth non-oil sector activities including the private sector.

And in order to diversify sources of income and decrease dependence on oil income, the fifth strategic policy objective called for investing in direct productive activities (DPA), including exploring other natural resources. The DC also realized that its development objectives would be futile without building human resources and capital. So the council called for the introduction of education and training programmes for all communities and population centres.

1.3 STATEMENT OF THE PROBLEM

Since the late 1960s, economic growth has been totally driven by oil revenues, despite the government's stated policies to diversify the sources of income through the development of other sectors of the economy, such as agriculture and industry. Despite a number of important milestones achieved in the development of all aspects of Omani life, the basic economic structure of Oman since oil was first exported in 1967, has remained unchanged. Revenues from the manufacturing and agricultural sectors are still far too low and weak to sustain the current standard of living, let alone replace oil. Oil, which has sustained the standard of living, is running out (reaching its peak in 2000 and has been declining since then). It is expected that with the current rate of production and proven reserves, Oman will run out of oil by the 2027. What does the future prophesize for Oman?

To achieve its stated targets and aims, government policy focused on increasing the national output through fiscal expansion policy, oil resources extraction, and the provision of social services and basic infrastructure. The policy of building basic infrastructure and providing social services was seen as an important pre-requisite for inducing and stimulating the necessary linkages for any industrial and agricultural sector growth, and ultimately economic development. Furthermore, such a strategy was justified by previously inadequate physical and social infrastructure. However, the huge and fast growth of government expenditure on social overhead capital (SOC) produced several undesirable consequences, some of which contradicted the initial intended strategy. The agricultural share in GDP continued to decrease. Its ability to attract

employment became increasingly more difficult and expensive. The industrial sector value added was comparatively small and could not replace the oil sector. The service sector was dependent on oil sector activities. In addition, the ease with which it was possible to employ cheap and unskilled expatriates in the service sector and the open policy towards the import of consumer and other merchant goods, made it very difficult for the agricultural and industrial sectors to compete. So instead of inducing and fostering agricultural and industrial linkages, government strategy weakened the linkages that were already in place and made it very difficult to induce new linkages for agricultural and industrial production.

The past policies served Oman well in delivering economic growth and improving the standard of living. However, the policies are not sustainable because of their strain on the country's financial assets and the way in which they compromise future generations' resources. According to the Brundtland Report commissioned by the United Nations General Assembly in 1983, sustainable development should "meet the needs of the present without compromising the ability of future generations to meet their own needs" (The Commission For The Future 1987, p79). It also requires "an economic system that is able to generate surpluses and technical knowledge on a self-reliant and sustained basis" (The Commission For The Future 1987, p81). Hence, sustainable development requires firstly, allocation of enough resources for today's need and secondly, enough savings for future generations.

Government policy did not diversify the sources of income or provide sustainability for the following reasons:

- The policy did not foster the necessary linkages to stimulate the growth of the non-oil sectors. The national output was still dominated by the oil and services sector, which together constituted 85% of GDP in 2007.
- Fiscal policy determines the size and the overall demand of the domestic market and government expenditure has a significant impact on non-oil GDP growth.
- Insufficient savings for an economy that depends on depletable resources. "It is now widely understood that in countries where the mainstay of the economy is depletable resource base (oil), the oil extraction – and hence current national income – reduces future national income" (Elbadawi and Majd 1993,1).

The initial policies of investing in SOC and providing job opportunities were necessary and well justified. Basic infrastructure, such as building roads, providing basic health and education services, and reducing the illiteracy rates are very important parts of any economic development plan. However, it is necessary to evaluate and assess that policy, taking into account the continuous reliance on oil as a source of income and the dominance of the oil and service sectors over all other sectors throughout the four decades of development planning. The stated goals throughout the five-year development plans were to diversify the sources of income in order to achieve sustainable development and reduce dependency on oil. The agricultural sector has not responded to the government's strategy so far and the industrial contribution to GDP is small and dwarfed by the oil and service sectors. In other words, the stated goals and aims have not been achieved and government policies on imports and foreign labour have been inconsistent in achieving the planning goals, resulting in a marginalized agricultural sector and a small manufacturing sector.

To examine and assess the past development experience for the purpose of formulating strategies for a sustainable future, two major questions should be asked. First, why did the policy of investing in SOC fail to induce significant linkages to other sectors of the economy? Second, what is the best policy alternative that could induce such linkages? Or, rather, what policies should the Omani government pursue to make best use of the remaining oil resources to diversify the sources of income and achieve economic growth that is sustainable?

With respect to the first question, from the above discussion, the priority given to fiscal expansion and the deployment of basic infrastructure and services needs to be questioned, despite the rapid economic growth that the economy has achieved and despite the improved standard of living in Oman. The Omani economy is vulnerable, not only because oil revenues are dependent on volatile international markets, but also because oil is a non-renewable resource and the oil wells are running dry.

1.4 THE HYPOTHESIS

Economic planning in Oman has been carried out from the point view of the historical experiences of the role of SOC in economic development. Statistical and historical data suggest that not only is physical and social infrastructure is a "necessary" requirement for any economic development to take place, but also induces and promotes economic growth. For example, a survey by Estache for the World Bank stresses the importance of infrastructure for development (Estache 1983). In choosing its investment strategy, the government assumed that SOC availability would induce and facilitate direct productive activities (DPA), thereby, diversifying the sources of income and reducing economic dependence on oil. However, government policies were carried out with less attention given to its impact on the market place. More specifically, government heavy investment on SOC and its *laissez-faire* policy on consumer and other imports influenced the productive structure of the economy in a way that has not been conducive to the objective of diversifying the sources of income and reducing oil dependency. The interplay between government policy and its impact in the market place is hypothesized in the following points:

- Government policy of increasing the size of national output through fiscal expansion policy, oil resources extraction, and the provision of social services and basic infrastructure, served well in delivering economic growth and improving the standards of living. However, these policies are not sustainable because of their strain on the country's financial assets and their compromise of future generation's resources.
- Government investment in SOC has not initiated the necessary linkages to induce development in the manufacturing and the agricultural sectors, on the contrary, the policy has impeded their growth. The rapid increase in government expenditure on infrastructure has led to the expansion of the service sector, a contraction of the agricultural sector and marginalization of the manufacturing sector. Scarce resources that could have gone to the production of DPA in the manufacturing and agricultural sectors were instead used for unproductive investments.
- The open policy towards the employment of foreign workers also contributed to the slow growth and stagnation of the manufacturing and agriculture sectors. The availability of cheap and unskilled labour (mainly from the Indian

subcontinent) made it very difficult for the manufacturing and agricultural sectors that require more skilled and more expensive workers, to compete with the service sector. Like the government investment policy, the labour policy hindered the establishment of DPA linkages and labour shifted towards the production of service-oriented industry that requires less skill.

- The import policies, which made it easy to import consumer goods, weakened the productive structure of the economy in two ways. Firstly, it made it difficult, if not impossible for the domestic manufacturing and agricultural sectors to develop and/or compete. Secondly, with the significant increase in imports, 6% per year over the past 40 years, capital was invested in the service sector for import of consumer goods, such as wholesale and retail trade, rather than in manufacturing or agriculture, thereby hindering the establishment of the necessary linkages and interdependencies in the DPA sectors.

1.5 OBJECTIVES OF THE STUDY

The overall aim of this study was to investigate the impact of the oil sector boom on the economic development of Oman. More specifically, there were four major objectives for this research. The first aim was to analyse linkages between the oil sector and the non-oil sectors. The study examined first the impact of oil price movements on GDP, the exchange rate and fiscal revenue. Once the relationship between oil prices and these three variables was established, the study investigated the Dutch disease and its possible impact on the Omani economy through the four symptoms of the Dutch disease. According to the Dutch disease theory, countries with abundant natural resources suffer from four major symptoms: exchange rate appreciation, a decline in the manufacturing sector, a boom in the service sectors and a labour shift from the manufacturing sector to the services sector and the resource extraction sector. Vector auto regression (VAR) and cointegration techniques were also used to establish long-run and short-run dynamics between the oil price, the exchange rate, GDP and government income.

Furthermore, the study investigated linkages and interdependencies between agriculture and fisheries, manufacturing, services, and the oil sectors. This was to examine which sector benefited most from the oil sector boom and how sensitive the non-oil GDP

sectors were to oil income fluctuations. In doing so, the study showed how sensitive and dependent the agriculture and fisheries, manufacturing, and the services sectors have been to the oil sector and oil price changes. Dynamic error corrections and cointegration techniques were used to establish the linkages and interdependencies between agriculture and fisheries, manufacturing, services, and the oil sectors, and to identify the long-run and short-run dynamics of the oil GDP and non-oil GDP sectors.

The second aim of this study was to investigate linkages between government revenues and expenditure linkages associated with the oil export boom. Since the oil windfall goes directly to the government, fiscal policy in Oman has influenced the domestic economy more than in less resource dependent economies. This research examined the effect of government expenditure on non-oil GDP growth, particularly, the manufacturing, services, and agriculture and fishing sectors. It investigated how these three variables (agriculture and fisheries, manufacturing and the services sectors) varied with changing government expenditure.

The third objective of this research was to examine economic efficiency and the changing dynamics of factor inputs and their contribution to GDP growth. Such analyses are very critical to assess Oman's ability to withstand the eventual depletion of oil resources. The results show the sources of growth in the Omani economy and whether GDP growth in Oman was a function of capital and labour accumulation or it was also the result of efficient use of factor inputs and technological progress.

The fourth objective of this study was to examine the underlying issues that face fiscal sustainability when oil income stops. Since government income is dependent on temporary oil income policy makers are faced with the challenge of finding an optimal government expenditure level that takes into account the expected stream of oil income and the eventual depletion of oil revenues as resources are being depleted.

1.6 SIGNIFICANCE

This study used time-series data from Oman to examine the linkages and interdependencies between the oil sector and the non-oil sectors from 1967 to 2006. The thesis focused on the linkages between oil price and oil sector activities, and their

impact on the non-oil sectors (the agriculture and fisheries, manufacturing, and services), and the impact of government income on non-oil GDP output and growth. The study of the relationship between oil and the non-oil sectors in Oman is of interest for several reasons. First, Oman is an open small economy that relies heavily on oil exports, which are characterized by high price fluctuation in the international market and are the major source of foreign currency. It imports most of its capital goods and technology. Despite the importance of oil in mineral dependant nations, there is little work on the impact of oil price movements on the macroeconomic dynamics of the Gulf Cooperation Council (GCC) countries: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates (U.A.E.). In fact, there is no work that we are aware of that looked into how the oil sector boom could impact GDP growth, exchange rate, or government revenue in Oman. In this thesis we have attempted to fill this gap in the literature.

In addition, Oman, like many other Arab oil exporting countries, is largely an oil driven economy with a small industrial sector (non-oil sectors), relatively small population, and high economic growth at times of favourable terms of trade. Because of the similarities of the economic structure between Oman and other Arab oil exporting countries and the similarities of political institutions, our study would have direct relevance to many other oil exporting countries in the region. In addition, it is likely that the economic policies practiced in Oman would be similar to those of the other Arab oil exporting countries. Thus, the study of Oman in relation to oil extraction activities makes reliable and relevant empirical estimates possible.

This thesis differs from most of the earlier work on the relationship between oil extraction activities and economic development in other respects. First, we used dynamic recent time series framework to investigate the linkages and interdependencies between the oil sector and the non-oil sectors. Some of the past studies have used static and unintegrated methods to estimate oil dependency, such as the value added of oil sector activities, the percentage contribution of oil exports to total exports, and the percentage share of oil income to total government income. In addition, linkage studies used input-output tables (analyses) to look for linkages between economic sectors, and that has proved to be complicated. In addition, for many developing countries input-output tables are not available, hence, making it hard to estimate linkages between

economic sectors. Second, by estimating the intersectoral linkages using VAR and cointegration techniques, it was also possible to look for direction of causality between the sectors. Identifying and understanding such dynamics is very important for countries that try to lessen dependence on minerals and diversify their sources of income.

The results of this study on the linkages and interdependencies between the oil and the non-oil sectors would have important policy implications, not only for Oman, but also for other countries that rely on mineral resources for income and foreign exchange. For example, if oil sector activities were found to have a positive impact on non-oil sector activities such as manufacturing, then Oman need not worry about the Dutch disease, but should focus on inducing the industrial sector so that it can replace oil sector activities once oil income runs low. Resources could be used better to increase direct productive activities and improve resource management in general. A long-run strategy may include structural reforms that would promote economic diversification away from oil dependence. However, if the oil sector boom is found to have an adverse effect on other sectors of the economy in Oman, the industrial sector in particular, then the government has to develop proper policies to counteract the Dutch disease.

1.7 OUTLINE OF THE STUDY

Following this introductory Chapter 1, Chapter 2 summarizes the economic development of Oman since 1967, covering government development policy, oil and economic growth, the structural composition of the economy, oil and exports, oil exports and GDP and government revenue and expenditure, oil and public finance, government expenditure structure, government expenditure and domestic demand, oil and saving rates. This is done for the purpose of providing the necessary historical and developmental background of the Omani economy. Next, the chapter outlines the impact oil export boom on the labour market and issues related to guest workers. Next, the chapter outlines the government economic vision *Oman 2020* and economic reforms taken to achieve the vision.

Chapter 3 reviews the current literature on natural resources and development, with a particular emphasis on the role of mineral resources in developing economies. The chapter then identifies the main economic thinking on the role of natural resources in

economic development and its impact on GDP growth. Next, the chapter reviews the empirical findings of the impact of natural resources on economic growth and development.

Chapter 4 investigates oil price movement and its impact on GDP, exchange rates and fiscal revenue. Next, the chapter discusses the Dutch disease in general and its impact on the service sector, manufacturing sector and the agriculture sector in Oman in particular.

Chapter 5 first defines what oil dependency is and then analyses the linkages between natural resources and development by examining the linkages and interdependencies between the agriculture and fisheries, manufacturing, services and the oil sectors. Next, the chapter discusses the sectoral dependencies and the underlying issues facing development planning in Oman. The chapter then investigates the role of fiscal policy in the non-oil GDP sectors by testing how agriculture and fisheries, manufacturing and the services sectors increase or decrease in the face of changing government expenditure.

Chapter 6 examines economic efficiency, and fiscal policy and debt sustainability in Oman. It provides additional answers to the discussion regarding oil dependency and how fiscal policy can improve the overall policy of economic diversification and reduce dependency on oil resources. Next, the chapter evaluates fiscal policy sustainability and proposes an optimal saving rate for the government.

Chapter 7 summarizes and concludes the major findings of the study, its significance and policy implication.

CHAPTER 2.
OMAN ECONOMIC BACKGROUND

Modern economic development and social development in the Sultanate of Oman was initiated after the 1970 revolution ... The oil resources of the country have developed over the past few years. But we should never lose sight of the fact that oil reserves are apt to be exhausted sooner or later. It should not therefore, be an exclusive privilege of our present generation but the wealth derived from it should be exploited in investments for the benefit and welfare of present as well as for future generations.
(Development Council 1976)

2.1 INTRODUCTION

The initial six years (1970-1975) of Sultan Qaboos of Oman (the Sultan) reign were characterized by political instability and other dramatic domestic and international changes. The Sultan overthrew his father, Sultan Said, in a bloodless coup in 1970. Immediately after the coup and until 1975, a group of Omanis, supported by the communist government of South Yemen challenged his authority in the southern parts of Oman.[3] The Sultan also had the task of establishing a government from scratch and enforcing his authority in a nation torn by tribalism and lawlessness in other parts of the country. Internationally, the Organization of Arab Petroleum Exporting Countries (OAPEC) in October 1973 boycotted oil supplies to the western nations in retaliation of their support for Israel in the 1973 Arab-Israeli war. Furthermore, the Organization of the Petroleum Exporting Countries (OPEC) agreed to cut oil production in order to increase the price of crude oil. Both events, the embargo and the OPEC decision, quadrupled the world oil prices and this increase in the cost of fuel was largely attributed to the economic instability and global recession that followed (Gelb 1988).

[3] In 1990, South Yemen united formally with North Yemen to become the Republic of Yemen.

Oman's pre-oil economy was primarily based on subsistence agriculture, grazing, fishing, and some trade. Its exports consisted of some agricultural products such as dates, dry limes, tobacco and vegetables. The literacy and skill levels of the labour force were low. The urban population was engaged in commerce and produced some basic services. The country lacked basic infrastructure. There were no paved roads or utility services. Mobility within Oman and access to the outside world were very limited. It could be said that producers did not participate in the money market and the pre-oil economy of Oman was caught in what Nurkse called "a vicious circle of poverty" (Nurkse 1970).

Since the discovery of oil in 1967 and the start of the oil export boom in 1973, the economy has gone through a significant transformation. To make best use of the oil assets, the Omani government embarked on an ambitious economic and social development programme through the implementation of successive five-year development plans. Nevertheless, because the country was lacking basic economic and service infrastructures, including a productive skilled labour force to develop its economy, oil revenues imposed a serious challenge to policy makers. The question of how best to make use of the sudden wealth was often raised. To answer this challenging question, a Development Council was established in 1974, chaired by the Sultan, and subsequently the government launched its First Five-year Development Plan (1976-1980) with specific objectives and goals for the future of the Omani economy (Official Gazette 1974).

This chapter is organized in the following manner. Section 2.2 describes the Omani government development strategy. The role of oil in the economic growth of the economy is detailed in Section 2.3. This discussion is concerned with the direct impact of oil revenues and the indirect impact of this income on other sectors of the economy, i.e. the non-oil sectors. Section 2.4 highlights the sectoral composition of the Omani economy and the development of GDP sectors during the last 40 years. The composition of Omani exports (oil and non-oil exports) and their development in 1970-2007 is discussed in Section 2.5. The role of oil revenues/exports for GDP growth and government revenues are presented in Section 2.6. We use historical economic data to show the close association between oil revenues and GDP growth and government revenues. The composition and structure of government expenditures are discussed in

Section 2.7. The role and impact of government expenditure in the overall domestic demand is discussed in Section 2.8. Then Section 2.9 establishes the link between oil receipts and savings. Section 2.10 also discusses oil income and its impact on the labour market. Section 2.11 presents all issues related to guest workers in Oman. Section 2.12 presents Oman's economic development framework and the government's blueprint for the current and future economic development vision *Oman Economic Vision: Oman 2020*. Section 2.13 discusses economic reforms taken by the government. Section 2.14 provides the summary of the chapter.

2.2 GOVERNMENT DEVELOPMENT POLICY

All five-year development plans emphasized three major aims: first, to diversify the sources of income by investing in income generating projects, particularly in manufacturing, mining, agriculture and fisheries; second, to lessen the economic dependence on oil; and third, to promote the private sector investment and participation in economic activities. The First Five-year Development Plan (Development Council 1976) had the following stated goals:

- Diversifying the sources of income in order to depend less on oil and eventually replace oil revenues.
- Investing in income generating projects, particularly in manufacturing, mining, agriculture and fisheries.
- Distributing investment geographically for the benefit of different regions of the country, with special emphasis on the least developed regions.
- Maintaining and developing the existing areas of population and protecting them against the dangers of mass immigration to these already densely populated areas.
- Protecting the environment and developing water resources, which are vital for any sustainable development.
- Developing human resources and depending less on foreign expatriates.
- Continuing the development of the basic infrastructure of the country, and facilitating the development of trade infrastructure, including transportation and storage areas.

- Removing obstacles to trade and encouraging competition and free market practices.
- Providing incentives to encourage private sector investment and participation in the development of the economy, such as tax exemptions and interest free loans.
- Improving the efficiency of the civil service.

Policy makers and developers in Oman recognized the above stated goals as "... a broad outline of the long-term targets and policies to be followed in preparing the consecutive five-year development plans" (Development Council 1981). Successive development plans have more or less stressed the importance of these basic goals. In addition, each five-year development plan emphasized a particular set of short-term targets and aims.

The particular short-term targets of the Second Five-year Development Plan (1981-1985) were to increase oil production to 330,000 barrels a day and achieve 13% GDP growth per annum (Development Council 1981). The plan also dedicated an average of about 3% of government expenditures to support direct productive activities (DPA) and about 1% to support the agricultural and fisheries sector, including the development of water resources. In addition, during the second development plan in 1980, the State General Reserve Fund (SGRF) was established with the objective of saving part of oil revenues in foreign assets for future generations and as a cushion to be used in case of an oil price collapse (Official Gazette 1981).

The focal short-term targets of the Third Five-year Development Plan (1986-1990) were to achieve a yearly GDP growth rate of about 4% and to increase oil production to 550 thousand barrel a day (Development Council 1986). The plan also called on the government to limit current and defence expenditure to 41% and 33%, respectively. In addition, the plan pledged 1% of government funds to support the private sector.

The quantitative short-term targets of the Fourth Five-year Development Plan (1991-1995) were to achieve a GDP growth of about 6% per annum (Development Council 1991). The plan also called for maintaining a balance between government revenues and expenditures through increasing non-oil revenues by 20% by the year 1995, and to limit the current deficit to 10% and current expenditure growth to 4%.

In the Fifth Five-year Development Plan (1996-2000), the government set a vision for the future economy of Oman for the coming 25 years (Development Council 1997). The vision was called *Oman Economic Vision: Oman 2020.* The vision has four main themes: first, to develop a strategy for economic balance and sustainable development; second, to develop human resources; third, diversify the sources of income; and fourth, to develop and promote the private sector (see Section 2.11).

The short-term targets of the Fifth Five-year Development Plan were to develop a strategy for economic balance and sustainable development through achieving a balanced budget by the year 2000, and to transfer any oil revenues resulting from an increase in oil prices above US$15 per barrel and up to US$17 to the State General Reserve Fund (SGRF). This, it was hoped, would increase the stock of the fund from less than one billion US$ in 1995 to 10 billion US$ in 2020. Like previous plans, the fifth plan aimed to increase oil production further to 880 thousand barrels a day. The plan also set a target of GDP growth rate of 5% a year. The targeted growth rate, it was hoped, would be driven by growth in the share of the non-oil sector to 67%, while the oil sector share would decrease to 33% by the year 2000 from its share of 67% in 1995.

The Sixth Five-year Development Plan (2001-2005) objectives were to solidify and emphasize the four main themes of *Oman Economic Vision: Oman 2020* (Development Council 2001). The short-term targets of the plan were to achieve a GDP growth rate of 4% per annum and increase the non-oil sector contribution to GDP to 65% by 2005. Non-oil sector contribution GDP was less than the 67% target that was set in the previous plan and therefore, the new 65% of non-oil GDP was the new target. The plan aimed to transfer any oil revenues resulting from an oil price above US$18 per barrel to the SGRF. Since human resources development was one of the pillars of *Oman 2020*, the plan aimed to increase the enrolment rate to higher education by increasing the enrolment rate for tertiary education from 43% in 2000 to 53% in 2005.

2.3 OIL AND ECONOMIC GROWTH

Oil exports played a major role in the expansion of the economy, both directly and indirectly. The direct effect of the oil boom has been through the increase of crude oil

production and processing and the indirect effect through the impact of oil revenues on other sectors of the economy. Annual crude oil production increased from 21 million barrels in 1967 to 259 million in 2007, an average yearly increase of 6.5% per year. The oil and non-oil real GDP during the same period experienced strong positive growth. The oil sector grew by 9.5% per year, reaching 18 billion USD in 2007, at constant 2000 prices.[4] The non-oil sectors grew by 8.3% per year, reaching just on 20 billion USD in 2007 (see Table 2.1). The non-oil sector includes the service sectors which grew 12.7% per year, reaching 14 billion USD in 2007, the manufacturing sector which grew by 19.6% per year, reaching nearly 4 billion USD in the same year. Of the other non-oil sectors the building and construction sector grew by 3.3% a year, reaching 0.96 billion USD in 2007, and the electricity and water sector, which grew by 16.3% per year, reaching 0.41 billion USD in 2007. The other non-oil sector is the agricultural and fisheries sector, the only sector that seem to have missed out from the oil abundance and which was basically unchanged over the period, rising by only 0.1% per year. It should be noted that some of these percentage changes are from a very small base in 1967.

Table 2.1: Oil production and GDP growth, constant 2000 prices, (million USD)

	1967	1976	1986	1996	2007	% pa change, 1967-2007
Oil production (million barrels)	21	134	204	325	259	6.5%
Oil sector	485	2918	4241	7329	18185	9.5%
Non-oil sector	823	21	6987	10296	19816	8.3%
GDP	1308	5021	11228	17625	38001	8.8%
Non-oil sectors						
Services	118	1442	5163	8618	14097	12.7%
Building & construction	258	499	876	384	955	3.3%
Electricity & water	1	36	159	157	413	16.3%
Manufacturing	3	24	409	701	3881	19.6%
Agricultural & fisheries	444	103	380	435	469	0.1%

Source: *Statistical Year Book*, Oman, various issues.

The strong real GDP growth of 8.8% per year was driven largely by the inflow of capital resulting from the oil export boom, with the national output experiencing high growth at times of increasing oil receipts, and a slowdown and negative growth at times of decreasing oil receipts. For example, real GDP grew by 16% per year between 1974

[4] OR is pegged to the USA$, 1 OR = 2.56 USA$ or 1USA$ = .38 OR since 1986.

and 1976, reflecting large inflows of capital following the international oil prices increases and a further increase in the production of oil. Again, GDP experienced strong growth of 11% between 1980 and 1985, as a result of another international oil price increase and a further increase in oil production.[5] In 2003-2007, Omani GDP experienced strong annual growth of 9.4%, reflecting increased capital inflow as a result of yet another international oil price increase. Similarly, the national output decreased by 3.1% and 4.3% in 1987 and 1988 respectively, reflecting a decrease in capital inflow as a result of lower oil receipts. Again, the national output stagnated, with no growth in 1999 following the 1998 oil price collapse.

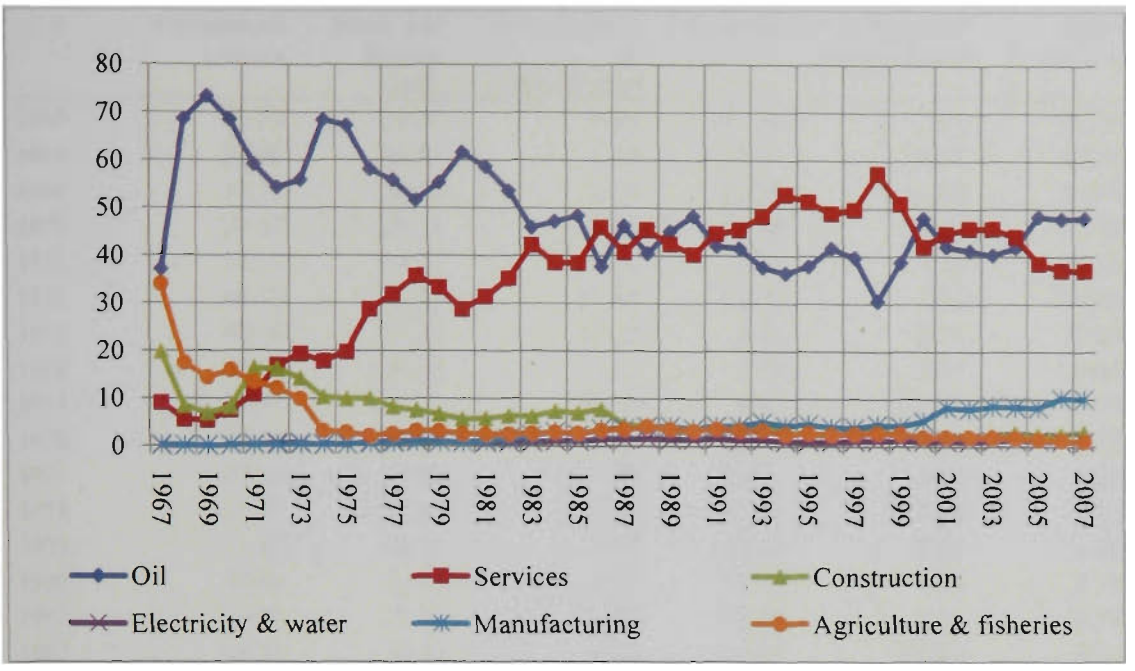
In short, historical data suggest that there is a strong and a positive link between the oil and the non-oil sectors in Oman. However, the agriculture and fisheries sector has experienced negative growth since the start of the oil exports. The sector does not seem to be positively linked to oil sector activities. As will be discussed later, the negative growth of the sector could be the result of what is called in the literature "Dutch disease".

2.4 SECTORAL COMPOSTION OF THE ECONOMY

Since the first shipment of oil in 1967, oil extraction activities and services dominated the Omani national output. According to the Omani *Statistical Year Book* data, the oil sector value added accounted for at least 52% of GDP until 1982 (see Figure 2.1). With the collapse of the international oil price in 1986, and the volatility of the international oil prices that followed, the oil sector share of GDP dropped to 38% in 1986 and since then the sector share has been in the range of 31% and 48%. The share of the oil sector seems to be affected directly by movements of the international oil price and less affected by non-oil sector activities. The oil sector and the service sectors have constituted between 84% and 90% of GDP since 1974.

[5] The fall of the Shah and the rise of the Ayatollahs in Iran in 1979 and major oil production cuts by OPEC caused the second oil price shock.

Figure 2.1: GDP sectors (as a percentage), 1967-2007



Source: *Statistical Year Book*, Oman, various issues.

Government services, together with the wholesale and retail trade sectors made up between 59.4% and 72.3% of total services during the past three decades (see Table 2.2). Government services share peaked at 48.3% of total services and 42.6% of non-oil GDP in 1984. In 2007, government services accounted for about a third of total services and a quarter of non-oil GDP. The manufacturing sector experienced steady and strong growth since the oil export boom, but its GDP share is still small. The manufacturing sector share of GDP increased from about 0.6% in 1971 to 9.8% in 2007, rising to 4.4 billion USD in 2007. The manufacturing sector GDP share contribution increased from 5% in 2000 to 10% in 2007, mainly as a result of the start of liquefied natural gas production in Oman in 2000. Excluding the liquefied natural gas (LNG) contribution, the manufacturing sector was 4% of GDP in 2007 (see Table 2.3).

Table 2.2: Selected services sectors (as percentage of services), 1967-2007

	Government services	Whole sale & retail trade	Transportation & communication	Real estate	Financial intermediation	Other services
1967	15.79	21.05	7.89	31.58	2.63	21.05
1968	27.08	18.75	6.25	25.00	4.17	18.75
1969	30.51	20.34	6.78	22.03	5.08	15.25
1970	29.87	20.78	9.09	19.48	7.79	12.99
1971	30.37	20.74	15.56	15.56	5.19	12.59
1972	46.22	15.97	13.45	10.50	3.36	10.50
1973	40.06	25.38	13.46	8.87	2.75	9.48
1974	45.99	26.96	12.19	4.76	3.47	6.64
1975	37.19	27.02	16.49	6.53	6.88	5.89
1976	27.10	29.80	5.28	25.85	10.13	1.72
1977	29.74	30.66	5.78	22.61	9.00	1.91
1978	31.97	30.04	6.06	21.31	7.99	2.22
1979	31.83	31.12	5.89	19.53	8.89	2.22
1980	32.60	30.67	6.42	17.91	9.36	2.18
1981	33.01	30.72	6.82	16.58	9.61	2.14
1982	34.21	30.83	6.93	14.66	10.02	2.21
1983	47.88	23.78	5.72	11.96	7.67	1.99
1984	35.78	29.91	7.13	13.01	10.26	2.67
1985	35.75	30.83	7.45	11.92	10.17	2.69
1986	38.08	28.14	7.94	11.04	10.55	2.96
1987	41.04	25.03	7.86	11.79	9.71	3.25
1988	39.72	27.46	8.04	11.56	8.44	3.39
1989	39.33	26.74	8.05	11.84	9.05	3.52
1990	39.48	26.61	7.75	11.30	9.96	3.42
1991	37.79	29.04	8.28	11.06	8.32	4.04
1992	38.67	29.22	8.05	10.64	8.09	3.78
1993	36.57	29.84	8.31	11.01	8.57	4.03
1994	37.24	23.39	11.74	17.00	5.32	3.67
1995	36.92	24.69	12.07	15.12	5.89	3.61
1996	36.59	24.75	12.48	14.27	6.28	3.78
1997	33.67	25.07	13.56	13.63	8.92	3.42
1998	32.92	26.50	14.17	13.37	8.03	3.36
1999	34.73	24.63	13.90	13.47	8.13	3.50
2000	35.35	24.91	13.77	12.88	7.83	3.61
2001	34.92	25.21	14.29	12.37	8.18	3.40
2002	34.66	24.99	14.63	11.91	8.82	3.37
2003	34.93	25.43	14.80	11.42	8.61	3.25
2004	34.01	26.90	15.53	10.96	7.82	3.06
2005	34.73	26.84	14.79	10.58	8.11	3.07
2006	34.35	28.65	16.62	6.77	8.75	2.87
2007	34.35	28.65	16.61	6.77	8.75	2.87

Source: *Statistical Year Book*, Oman, various issues.

Table 2.3: Manufacturing sector (nominal million USD), 2000-2007

	2000	2001	2002	2003	2004	2005	2006	2007
Manufacturing (oil refinery)	92	120	141	99	48	101	132	320
Manufacturing (LNG)	340	864	725	943	1106	1407	2673	2648
Other manufacturing	647	679	776	833	935	1052	1171	1406
Total Manufacturing	1080	1663	1642	1875	2090	2560	3976	4373
% contribution to GDP	5%	8%	8%	8%	8%	8%	11%	10%

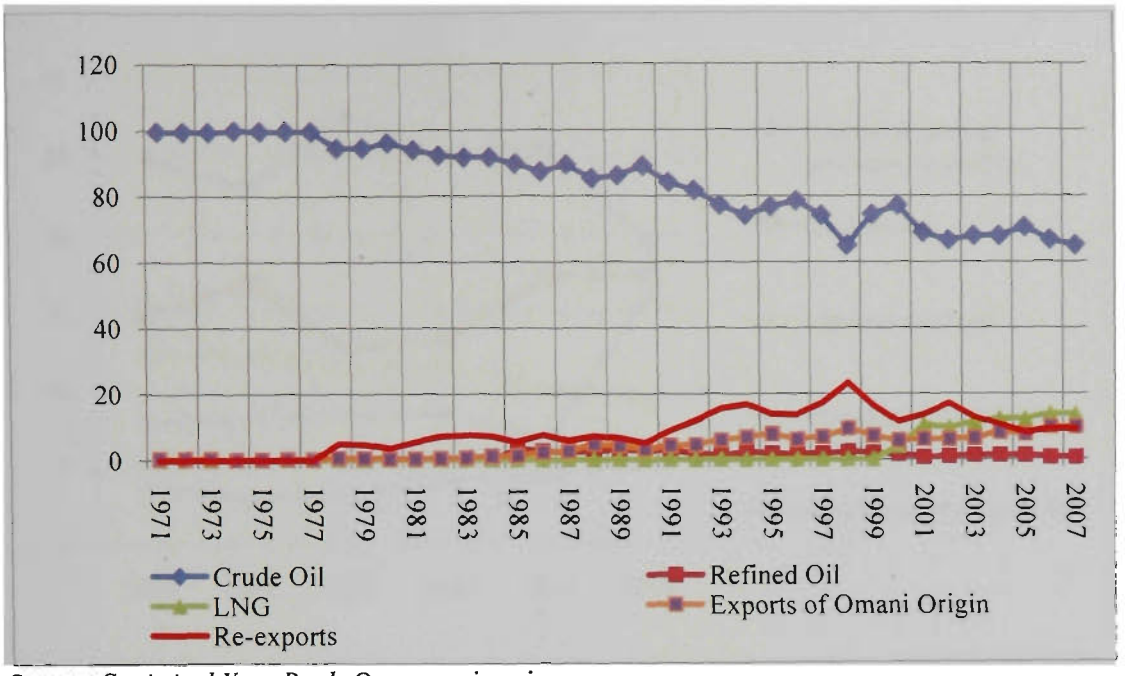
Source: *Statistical Year Book*, Oman, various issues.

Although the agriculture and fisheries sectors was the main economic activity of the pre-oil economy, with little protection, the shift of the productive structure towards oil and service industries during the post-oil export boom marginalized its role in the economy. Its contribution to GDP plunged from about 34% in 1967 to just 2.5% in 2007. The sector declined by an average of 3% a year, since the start of oil production in 1967.

2.5 OIL AND EXPORTS

Between 1967 and 1982, crude oil was virtually the only Omani export commodity, constituting 99% of total exports, and in 2007 it was still by far the most important export commodity, representing almost two thirds of total exports (see Figure 2.2). The share of non-oil exports increased gradually, and by 2007 they made up about a third of total exports. In 2007, re-exports comprised 28% of total non-oil exports and exports of Omani origin accounted for 37% of total non-oil exports. In year 2000, liquefied natural gas (LNG) came into production and it accounted for about 33% of total non-oil exports in 2007 and 13% of total exports.

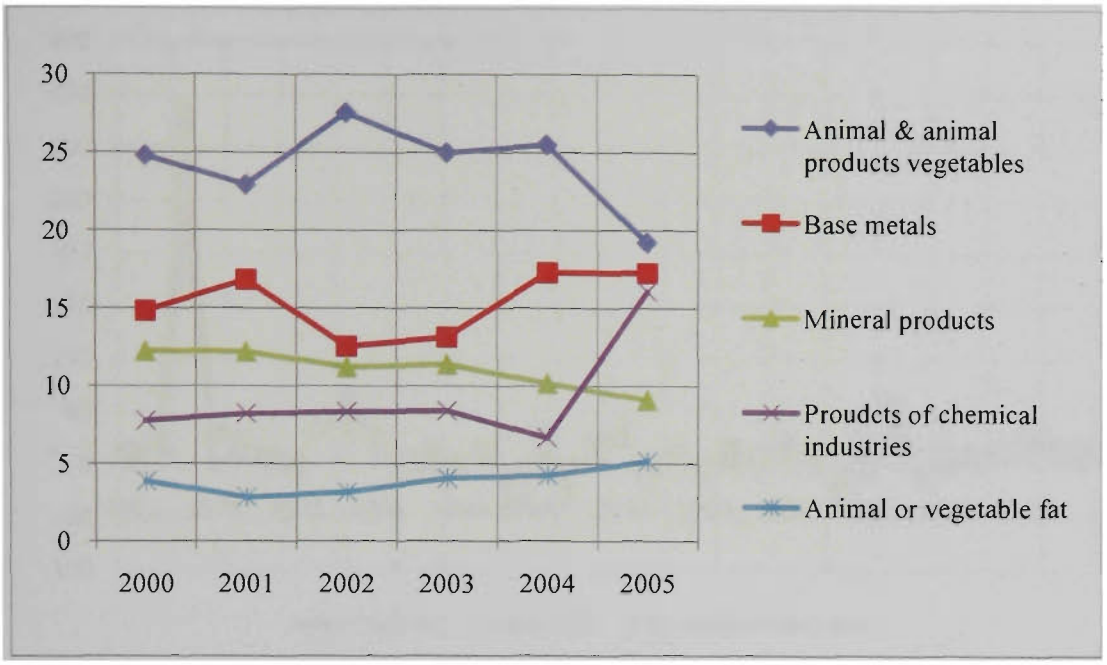
Figure 2.2: Omani exports (as a percentage of total export), nominal prices, 1971-2007



Source: *Statistical Year Book*, Oman, various issues.

Between the years 2000 and 2005, the four most important non-oil commodities exports of Omani origin, following LNG, were: animal and vegetables products, base metals, mineral products, and products of chemical industries (see Figure 2.3). Without the LNG, animal products accounted for 25% and 19% of non-oil exports in 2000 and 2005, respectively. The most important re-export products were vehicles, machinery, food and works of art. Vehicles comprised some 11% of total re-exports between the years 2003 and 2005. It is interesting to note the importance of the exports of animal products and vegetables of Omani origin despite the decline of the sector since 1976. The sector has maintained its importance in non-oil exports, while manufacturing and other value added produce have not made major contributions in exports. Furthermore, it is an indication of the challenge that faces policy makers in encouraging diversification programmes to increase the share of the manufacturing sector in the export market.

Figure 2.3: Non-oil exports of Omani origin (as a percentage of non-oil exports), 2000-2005

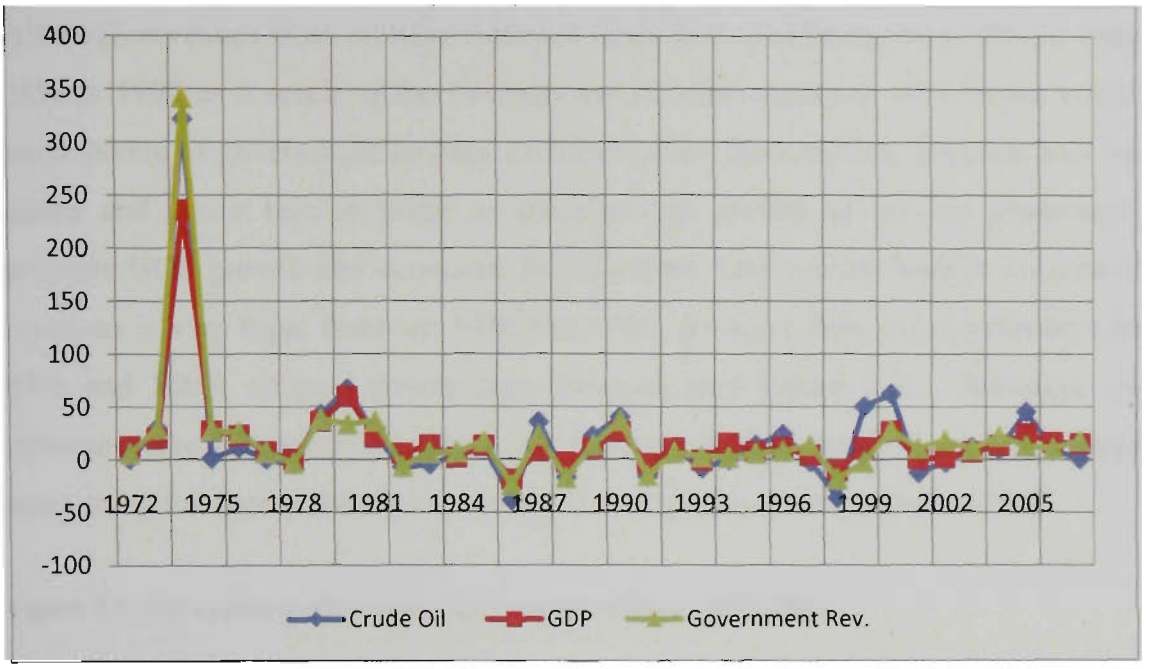


Source: *Statistical Year Book*, Oman, various issues.

2.6 OIL EXPORTS, GDP AND GOVERNMENT REVENUE AND EXPENDITURE

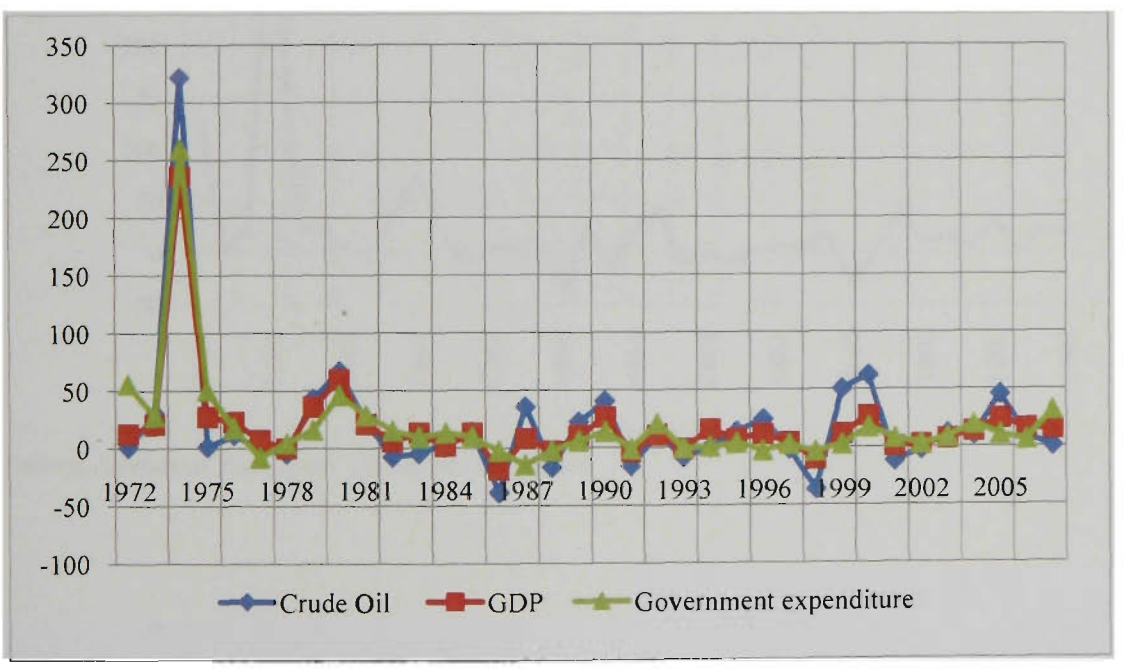
Figures 2.4 and 2.5 suggest that the value of oil exports has a substantial impact on the GDP level and government revenues and expenditure. For example, in 1987 the value of oil exports decreased by 5.4% and GDP stagnated, while government revenue from oil was reduced by 6.1%. Similarly, in 1986 oil export value plunged by 63% and GDP dropped by 23%, while government revenues from oil dropped by 63% the following year. Also, in 1998 oil export value dropped by 58% and GDP declined by 12%, while government revenues fell by 39% in the following year.

Figure 2.4: Oil exports, GDP and government revenue (percentage change), 1972-2006



Source: *Statistical Year Book*, Oman, various issues.

Figure 2.5: Oil exports, GDP and government expenditure (percentage change), 1971-2006



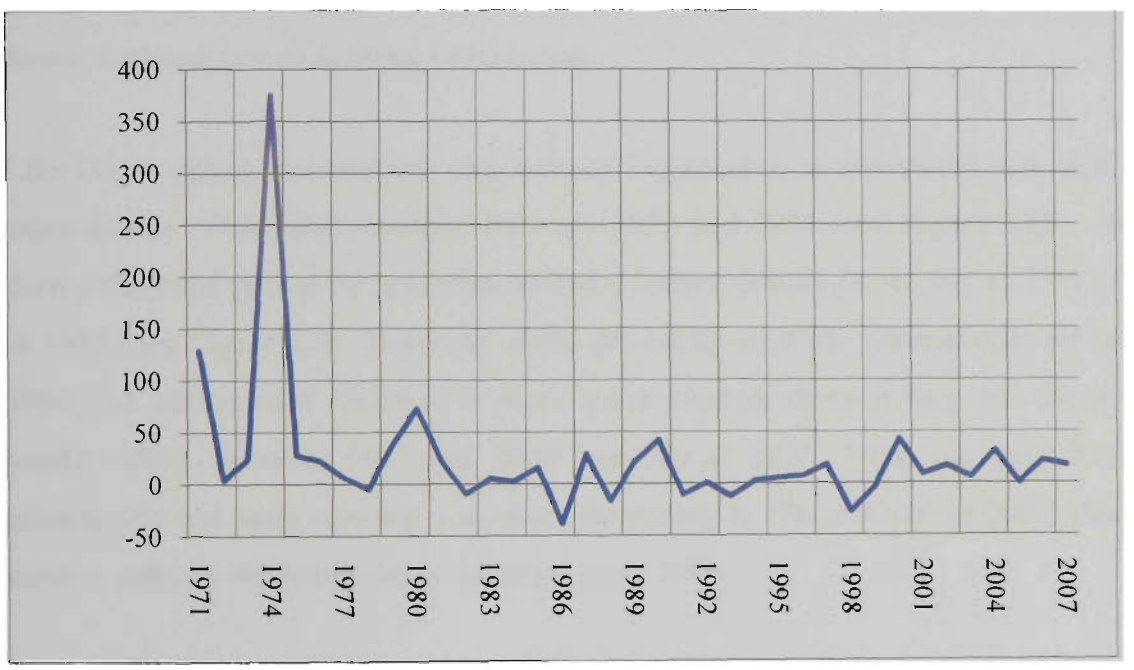
Source: *Statistical Year Book*, Oman, various issues.

2.7 OIL AND PUBLIC FINANCE

Unprecedented levels of revenue poured into the government of Oman as a result of the oil export boom. Revenues from oil increased at an average rate of 35% a year between

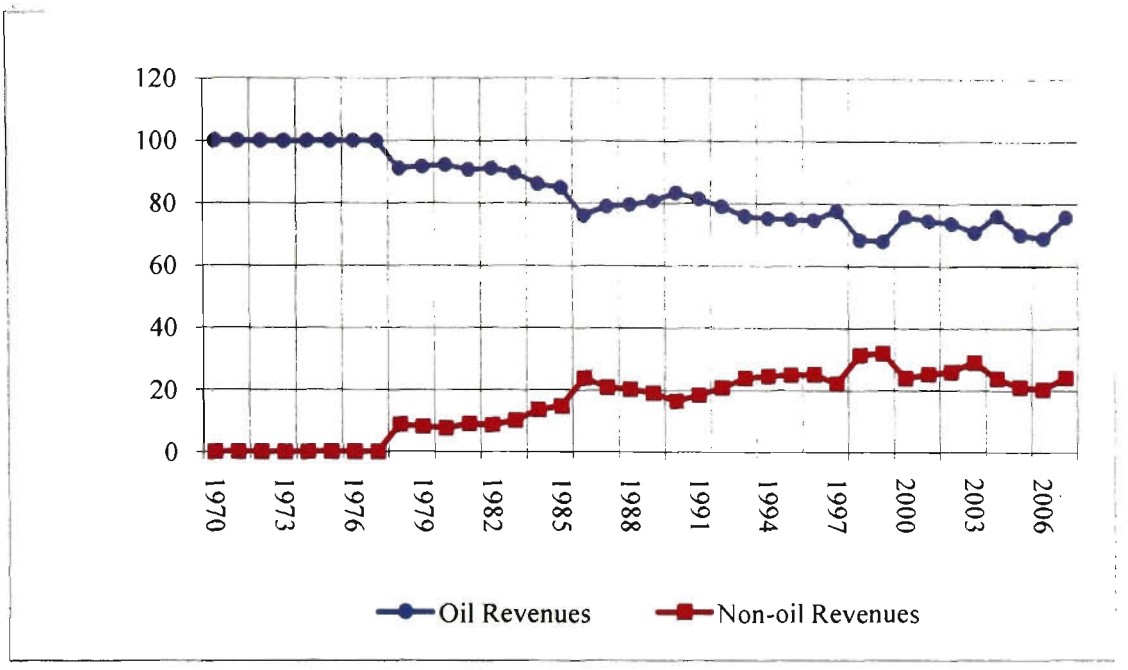
1970 and 1973, with an increase of 375% taking place alone in 1973 (see Figure 2.6). Although revenues from oil have flattened since then, and plunged by 38% in 1986 and 28% in 1998 as a result of the international oil price collapse, oil revenue is still the main source of government income, as fiscal policy favoured low taxation, low custom duties and fewer fees in order to stimulate the growth of non-oil production and promote GDP growth and economic development. Government budget reliance on oil revenues is very high. Between 1970 and 1985, revenues from oil constituted between 85% and 100% of total government revenues (see Figure 2.7). Although non-oil revenues have increased since then, government revenues from oil are still substantial, accounting for approximately two thirds of total government revenue in 2007.

Figure 2.6: Government oil revenues (percentage change), 1971-2007



Source: *Statistical Year Book*, Oman, various issues.

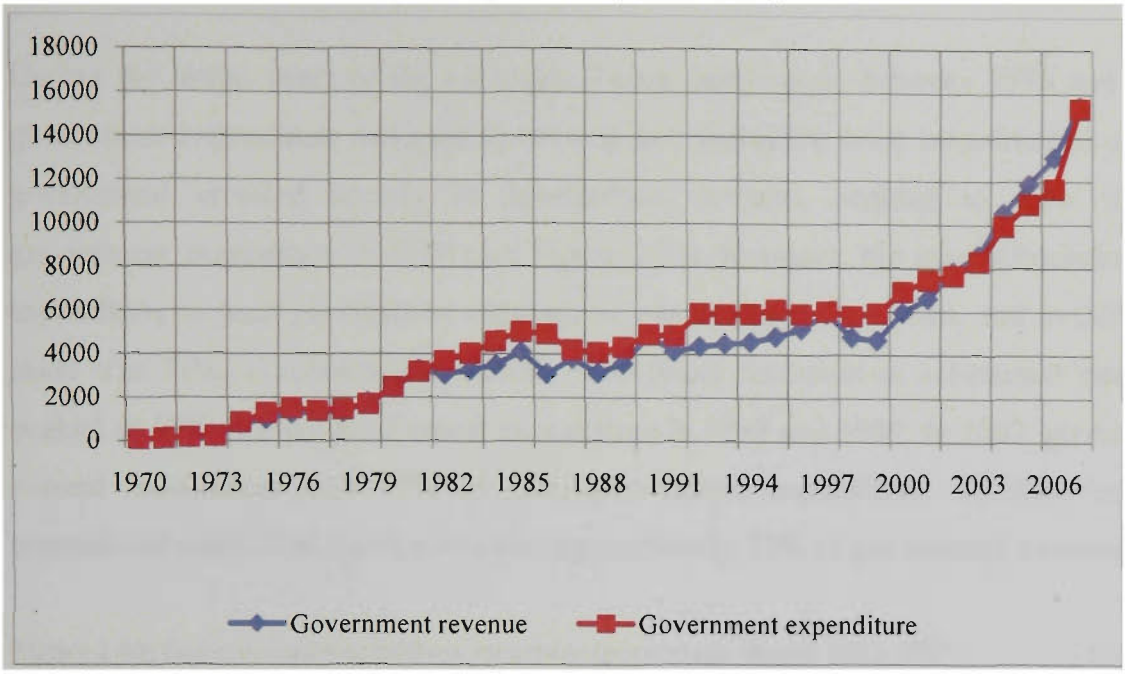
Figure 2.7: Oil and non-oil revenue structure (as percentage), 1970-2007



Source: *Statistical Year Book*, Oman, various issues.

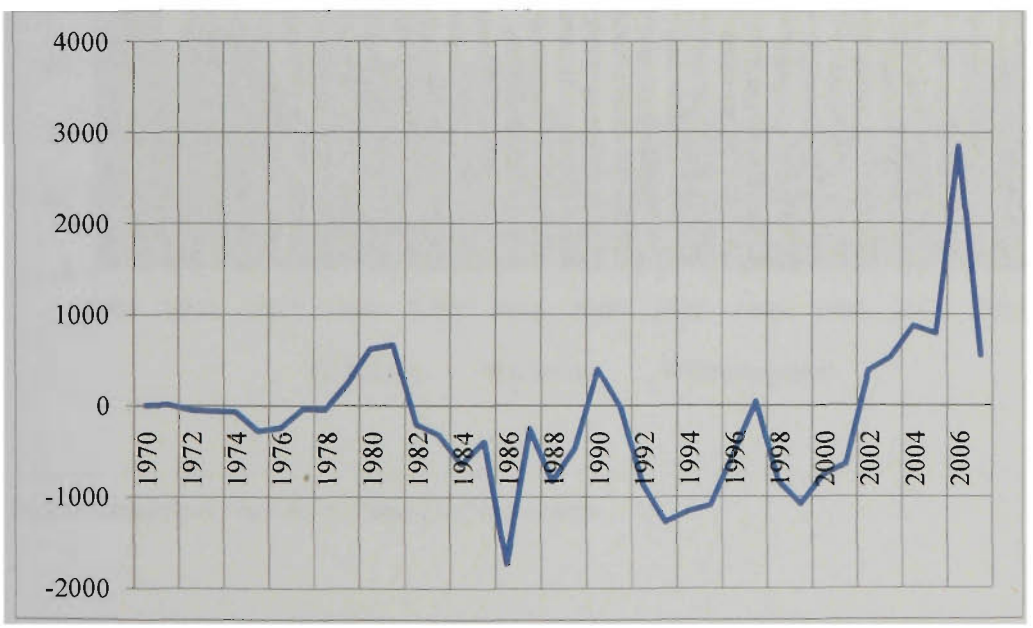
Like oil revenues, government expenditure increased at a substantial rate and fiscal expenditures outstripped revenues between 1972 and 2001 (see Figure 2.8). In fact, during the same period the government had a budget deficit, increasing to 25% of GDP in 1985 (see Figure 2.9). However, since the collapse of the international oil price in 1986, the government followed a much more prudent fiscal policy and the average yearly deficit between 1987 and 2000 was 7% of GDP. From the year 2001, the government has been running a surplus, increasing to 5% of GDP in 2007, thanks to another spike in the international oil price since 2001.

Figure 2.8: Government revenue and expenditure (million USD), 1970-2007



Source: *Statistical Year Book*, Oman, various issues.

Figure 2.9: Budget surplus/deficit (million USD), 1970-2007

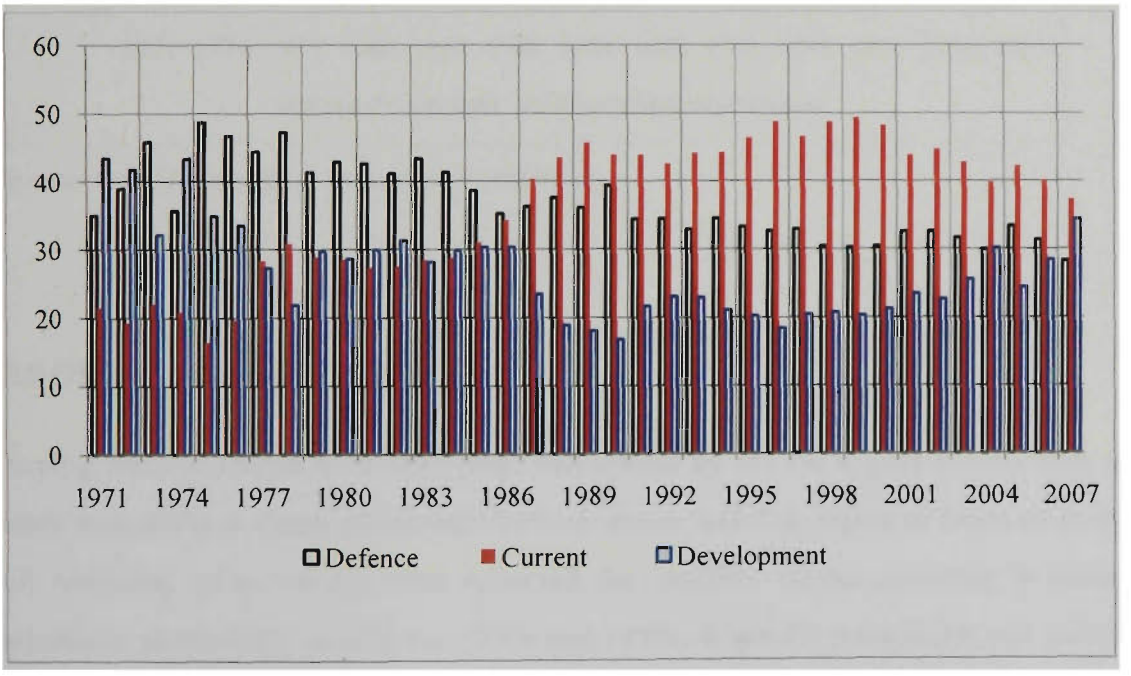


Source: *Statistical Year Book*, Oman, various issues.

2.7.1 Government Expenditure Structure

During the initial years of the oil export boom, particularly between 1970 and 1976, government expenditure was used to develop and deploy the basic infrastructure and the government invested heavily in development projects, peaking to 43% of total government expenditure in 1974 (see Figure 2.10). However, the share of development expenditure to total government expenditure has declined since then, and in 2007, the share was 34%. Government's current expenditure increased at substantial rates and peaked at 49% of total government expenditure in 1998 and 1999. In 2007, government current expenditure was 37% of total government expenditure. Civilian recurrent expenditure and defence accounted for approximately 72% of government expense.

Figure 2.10: Government expenditure structure (percentage share), 1971-2007



Source: *Statistical Year Book*, Oman, various issues.

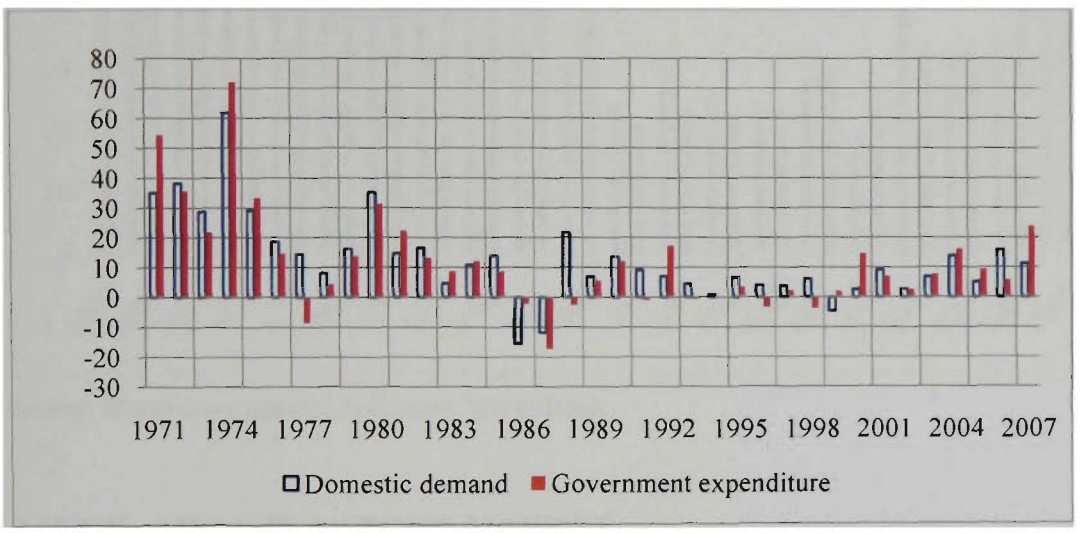
2.8 GOVERNMET EXPENDITURE AND DOMESTIC DEMAND

Government expenditure has, by and large, determined the overall domestic demand. There has been positive association between percentage change in government expenditure and domestic demand (see Figure 2.11). [6] Similar to government

[6] Domestic demand is defined as the sum of government and private consumption and gross capital accumulation.

expenditure, domestic demand enjoyed positive and strong growth between the years 1970 and 1985. Again, like government expenditure between the years 1986 and 1999 domestic demand experienced fluctuations and volatility, and sustained growth since 2000.

Figure 2.11: Government expenditure and domestic demand, 1971-2007

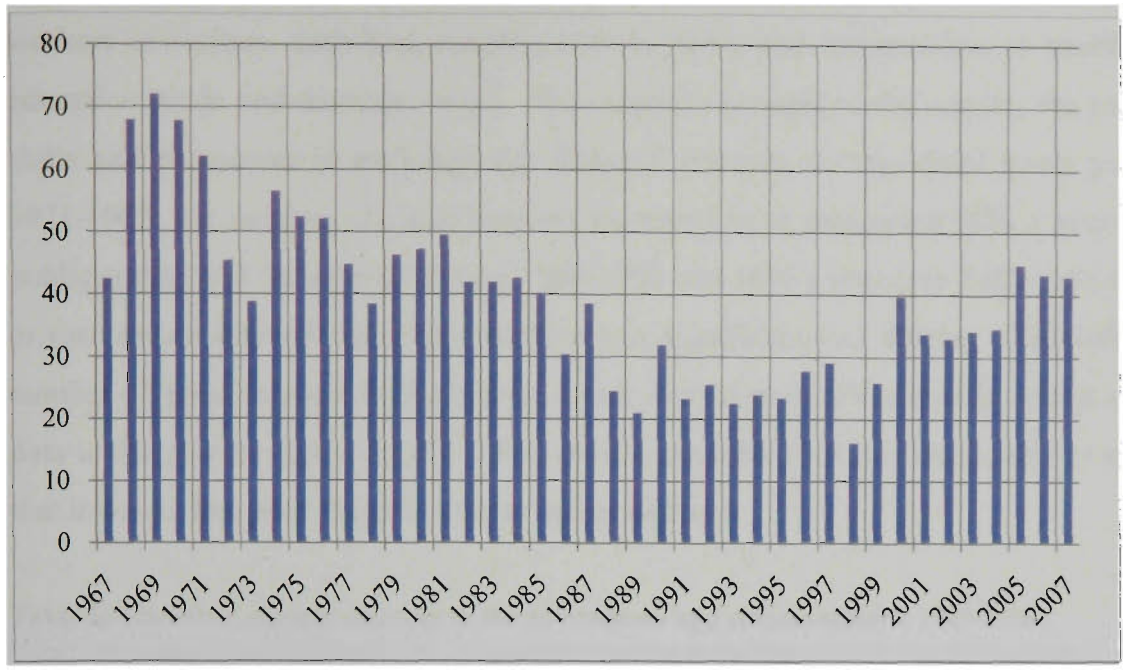


Source: *World Development Indicators*, World Bank.

2.9 OIL AND SAVING RATES

Saving rates in Oman have also been influenced by the oil export boom, with saving rates increasing at times of increased oil revenues and decreasing at times of decreased oil revenues. Also, saving rates reflected the inability of the economy to absorb oil windfalls, particularly during the 1970s and 1980s, when the population was quite small and the non-oil economy was still underdeveloped. The low absorption of the economy was particularly apparent in the 1970s and the early 1980s (see Figure 2.12). From the mid 1980s until the end of the 1990s, gross domestic savings decreased to 27% of GDP a year in comparison to the average of 50% of GDP a year during 1967-1985. In 2000 and 2007, the saving rate was 37% of GDP.

Figure 2.12: Gross domestic saving rates (as a percentage of GDP), 1967-2007



Source: *World Development Indicators*, World Bank.

2.10 OIL AND THE LABOUR MARKET

In 2004, the GCC countries hosted over 12 million foreign workers. According to Kapiszewski (2006), 82% of UAE's population are immigrants, topping the list of GCC countries, while in Oman the percentage of immigrants is 20%, the lowest proportion in the GCC countries (see Table 2.4). Most of the foreign workers are guest workers from the Indian subcontinent and South Asian countries like India, Pakistan, Bangladesh, Sri Lanka and the Philippines.

Table 2.4: GCC population, 2004

	Number of citizens	Percentage	Expatriates	Percentage	Total
Bahrain	438,209	62	268,951	38	707,160
Kuwait	943,000	36	1,707,000	64	2,650,000
Oman	2,325,812	80	577,293	20	2,903,105
Qatar	223,209	30	520,820	70	744,029
Saudi Arabia	16,529,302	73	6,144,236	27	22,673,538
UAE	722,000	18	3,278,000	82	4,000,000
Total	21,181,532	63	12,496,300	37	33,677,832

Source: Kapiszewski (2006).

The discovery of oil in the region and the oil sector boom in the 1970s enabled Oman and other GCC countries to rapidly expand and develop their economies. The oil and non-oil sector booms required skills and manpower that were not available

domestically, so Oman like the other GCC countries resorted to employing guest workers in various activities, ranging from building and construction, to health care, education, trade and domestic work. The migrants brought to the country the required skills and manpower in exchange for financial rewards. In the initial boom years of 1971-1985, the number of guest workers increased by a staggering 50% a year in the public sector, and the average during 1969-2006 was 19% a year (see Table 2.5). Omani private sector demand for guest workers was significant too. During 1980-2006, the number of guest workers in the private sector increased by 6% annually. Guest worker data in the private sector prior to 1980 are not available, but it is reasonable to assume that it was in line with the government sector demand.

Table 2.5: Number of guest workers in the government and private sectors, 1969-2006

	Government sector	% change	Private sector	% change
1969	356			
1970	120	-66	NA	
1971	255	113	NA	
1972	553	117	NA	
1973	1670	202	NA	
1974	3000	80	NA	
1975	5507	84	NA	
1976	6643	21	NA	
1977	9496	43	NA	
1978	11958	26	NA	
1979	13814	16	NA	
1980	15395	11	131000	
1981	16865	10	161000	23
1982	20162	20	177000	10
1983	21334	6	231000	31
1984	24924	17	265000	15
1985	27456	10	275000	4
1986	27327	0	248000	-10
1987	39283	44	216000	-13
1988	29535	-25	249000	15
1989	29535	0	258000	4
1990	30060	2	276500	7
1991	31825	6	352000	-87
1992	33357	5	421000	20
1993	34187	2	485000	15
1994	33495	-2	526000	8
1995	32630	-3	619000	18
1996	31488	-3	484000	-22
1997	31143	-1	494000	2
1998	31637	2	483000	-2
1999	29238	-8	475000	-2
2000	26765	-8	495000	4
2001	25228	-6	495000	0
2002	23481	-7	530000	7
2003	22038	-6	547000	3
2004	21085	-4	407000	-26
2005	22990	9	425000	4
2006	22946	0	425000	0
	Average change	19		6

Note: NA = not available.
Source: *Statistical Year Book*, Oman, various issues.

As it can be seen in Table 2.5, most guest workers were employed by the Omani private sector. For every guest worker in the public sector, there were 18.5 guest workers in the private sector in 2006. Businesses and individuals (sponsors) apply for foreign employment permits from the Ministry of Manpower for a fee. Once in Oman the guest worker must work for his or her sponsor, but may change sponsorship if the previous sponsor agrees.

2.11 GUEST WORKERS: BENEFITS VERSUS CHALLENGES

The influx of guest workers into the region including Oman posed several economic, social and security challenges. As oil income decreased, during the mid eighties and the late nineties, the presence of a large number of guest workers in Oman and other parts of the region alongside an increasing number of unemployed citizens brought into question the old policy of mutual benefits and exchange between guest workers and their employers in the region. Voices of concern about the increasing dependency on guest workers, with an increase in unemployment among citizens were raised. To encourage the private sector to employ Omanis, H.M. the Sultan in a meeting with members of the Omani Chamber of Trade and Commerce in 1990 stated the following:

> The previous era of development depended on foreign labourers to achieve (execute) many of its projects and that was necessary (because of lack of manpower and skills). However, as the education system bears fruit and the number of qualified Omani graduates at all levels increases, honourable job opportunities must be created for them. Since the public sector has been keen in its efforts to employ them in the past, the private sector must do the same in the coming phase of development. (Ministry of Information 2001)

In order to lessen the dependency on guest workers and to increase the opportunities among Omani citizens, the government initiated a policy aimed at replacing expatriates with employees in the local work force in what was called "Omanization". In the Fourth Five-year Development Plan (1986-1990) the government adopted several measures to restrict the number of guest workers and increase the number of Omanis in the government and private sector workforces. In addition to reducing dependency on guest workers and increasing the number of locals in economic activities, it was viewed that such policies would help reduce Oman's balance of payments by decreasing foreign remittances, which amounted to 4.4 billion USD in 2006. Reducing the number of

expatriates, it was argued, would also help decrease public spending on subsidized services such as electricity, water and health that were consumed by guest workers.

The Omanization measures taken by the government have included the following:

- Controlling the number of guest workers by imposing a percentage quota on certain jobs and banning guest workers from doing other jobs (see Table 2.6).
- Increasing guest worker fees and using the income to train and upgrade the skills of the local work force.
- Deporting thousands of illegal guest workers to increase the employment opportunities for Omanis.
- Award government contracts to companies that meet Omanization targets.
- Initiating micro-financing development programmes to encourage young Omanis to join the private sector and increase their entrepreneurial skills. Such schemes include the "Sanad" programme, supervised by the Ministry of Manpower for self employment and entrepreneurship.[7]

[7] Sanad is an Arabic word that means support.

Table 2.6: Omanization targets as per Ministry of Manpower requirement (percentages), 2009*

Sector	Job/occupation or establishment classification	2006	2007	2008	2009	2010
IT	Senior management	5	6	7	8	9
	Sales and marketing	100	100	100	100	100
	Technical support & Infrastructure	11	12	13	14	15
	Applications & services Development	11	12	13	14	15
TELECOM	Engineers	40	50	52	52	54
	Technicians	55	65	65	65	70
	Skilled labour	60	65	70	75	80
	Total percentage	52	60	62	64	68
TRAVEL AND TOURISM	Aviation companies	81	84	86	88	90
	Tourist restaurant	55	65	75	85	90
	Travel & tourism	55	65	75	85	95
	Hotels (3, 4, 5) stars	65	70	75	80	85
	Car rent	65	75	80	85	90
	Hotels (1, 2) stars & lodges	35	40	45	50	55
OIL AND GAS	Productive & operating	82	85	87	90	90
	Direct services	70	75	77	80	82
	Assisting services	62	65	67	70	73
	Local companies	75	75	77	80	82
CONSULTANCY SERVICES	Engineers	20	25	25	25	25
	Draughtsman	60	70	70	70	70
CONTRACTING	Material supervision jobs	40	45	45	45	45
	Land survey	70	80	80	80	80
	Accountants	50	60	60	60	60
	Admin. posts	80	90	90	90	90
	2nd category & above	27.5	30	30	30	30
	Continued projects	70	80	80	80	80
ELECTRICITY AND WATER	Power plants in Ghubrah, Rusayl, Wadi Al Gizzi, Musandam and Dhahirah					
	Engineers	78	78	78	78	78
	Assistant engineers	100	100	100	100	100
	Technicians	76	76	76	76	76
	Skilled workers	100	100	100	100	100
	Power plants in Manah, Al Kamil, Barkah and Salalah					
	Engineers	43	43	43	43	43
	Assistant engineers	45	45	45	45	45
	Technicians	51	51	51	51	51

Sector	Job/occupation or establishment classification	2006	2007	2008	2009	2010
	Skilled workers	50	50	50	50	50
	Debt Collection Companies					
	Manager / Supervisor /					
	Programmer	39	39	39	39	39
	Accountant / Cashier	87	87	87	87	87
	Meter clerk	89	89	89	89	89
	Worker / assisting					
	Occupations	100	100	100	100	100
	Total percentage	85	90	90	90	90
AUTOMOBILES		45	50	52	55	58
SALES &						
DISTRIBUTION		45	50	55	60	65
TRANSPORT	Sea ports	70	74	78	78	78
AND	Navigation agencies					
NAVIGATION	& clearing offices	67	71	77	77	77
	Marine transport	90	90	95	95	95
	Shipping	64	74	84	84	84
ACCOUNTING	Managers	15	20	23	26	29
OCCUPATIONS	Specialists	30	40	45	50	55
	Professionals	40	50	55	60	66
	Clerical occupations	75	100	100	100	100
PRIVATE	Private Schools					
EDUCATION	Academic	9	10	11	12	15
	Non-academic	50	50	54	56	58
	Private Universities & Colleges					
	Academic	8	10	12	14	16
	Non-academic	62	65	68	71	74
	Private Training Centres & Institutes					
	Management & finance	55	60	70	80	90
	Technicians & assistant					
	Trainers	15	20	25	30	35
	Trainers	15	20	25	30	35
INDUSTRY		35	35	35	35	35
TAILORING						
FACTORIES		25	25	25	25	25
BANKS		90	90	90	90	90

Note:* The Omanization percentage requirements are imposed to the private sector only.

Source: *Ministry of Manpower Report, 2008.*

2.11.1 Guest Workers: Security and Social Concerns

Another consequence of the presence of a large number of guest workers in Oman and the region was security and social concerns and tensions. Guest workers brought along views, customs and traditions that were not necessarily viewed favourably by the authorities of the host countries or the local populations. Although Arab migrants shared the language and religious background, they brought in secular and social views and ideologies that were politically too radical and had the potential of threatening the political stability of the authorities of the host countries (Kapiszewski 2001). For example, in Oman the Popular Front for the Liberation of Oman (PFLO) had Arab and socialist sympathizers from Yemen, Egypt, Syria and Libya who had Arab nationalist ideologies with socialist agendas (Halliday 1974). The PFLO carried out warfare against the Sultan and wanted to introduce a socialist based agenda that was different from the vision the Sultan had for the future of Oman.

In addition, there were concerns about the impact of Asian guest workers on the Arabic language, identity and culture. According to an article published by Islam Today, 80% of secondary school students in the GCC countries have difficulty reading Arabic while 75% use English language daily (Mohammed 2009). The presence of foreign workers not only threatens the Arabic language, but the very identity of GCC Arabs, the writer of the article warned.

There has also been an increasing concern of the international community regarding labour rights and other human rights in the GCC countries. Concerns range from basic labour rights, such as trade union activities and strikes, to other human rights concerns such as physical, sexual and psychological abuse (Amnesty International 2005). Human and labour rights issues have also been raised by the USA and EU during negotiation on free trade agreements (FTA) with the GCC countries (AFL-CIO 2005; Citizens Trade Campaign 2005; FIDH 2008)

2.11.2 Guest Workers: The Solution to Foreign Labour Dependency

The oil export boom attracted a considerable inflow of foreign labour into the country. According to the 2001 census, non-Omani residents in the capital of Oman, Muscat,

constituted about 46% of the population. The total non-Omani residents comprised about a third of the total population of 2.7 million (see Table 2.7). The non-Omani labour force comprised some 80% of the total civil labour force, with about 83% of private sector employees being foreigners in 2007.

Although the government does not have published statistics on the number of unemployed Omanis, the number has been increasing. According to the 2007 Ministry of Education Statistics, about 49,000 Omani pupils leave the high school system every year, of which 15,000 join tertiary and technical education. So at least 34,000 high school leavers join the labour market every year and the figure is increasing.[8] Finding job opportunities will be a major challenge facing the government in the next phase of development.

Table 2.7: Population manpower, 2007

	Omani	Expatriate	Total
Population	1,923,000	820,000	2,743,000
Government employee (Civil)	99,896	14,728	114,624
Private sector employees	131,775	638,447	770,222

Source: Ministry of National Economy data for population and private sector employees and Ministry of Civil Services Statistics Book for government employees.

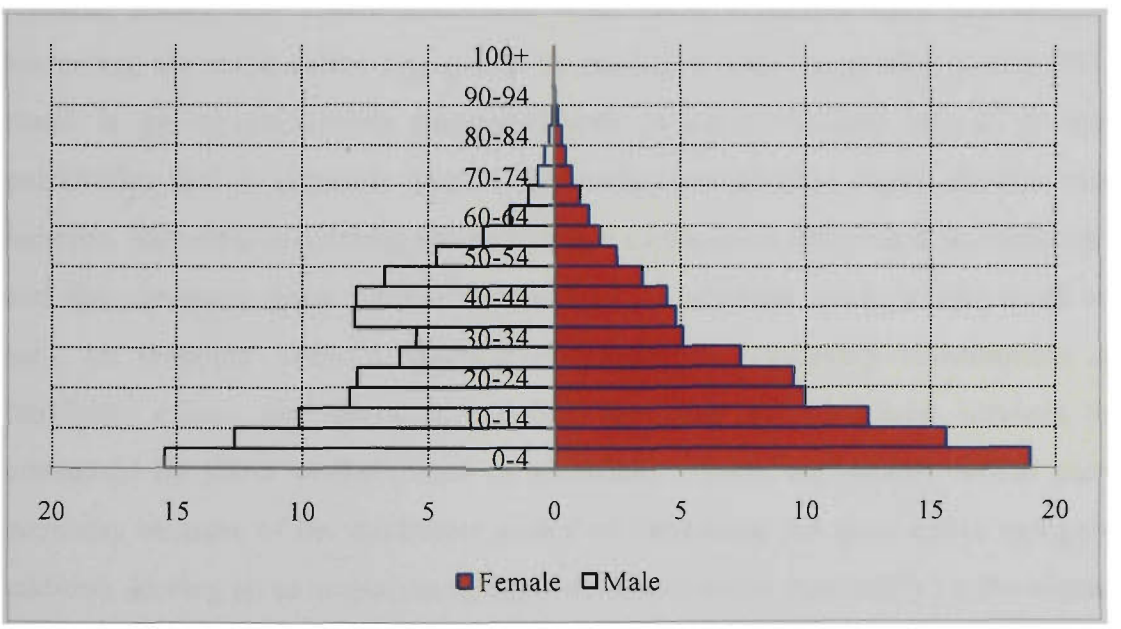
Replacing a guest worker with a local worker, and training and upgrading the skills of Omanis, are some of the initiatives the authorities have taken to reduce foreign labour dependency and create more job opportunities for Omanis. In addition, in response to concerns expressed by the international community, the GCC countries ratified a number of treaties and agreements, including ratifying several International Labour Organization (ILO) conventions abolishing all types of forced labour (conventions number 29 and 105).

Nevertheless, the average number of foreign workers has been increasing at 6% a year during 1980-2006 and the negative growth that is observed in Table 2.5 is associated with an oil income drop and the forced deportation of illegal immigrants that was carried out in Oman in 2004. The decrease in the number of foreign workers was not therefore the result of the Omanization programme. In addition, guest workers who

[8] According to the census, 42% of the populations are 14 years old or younger.

make it to the GCC countries are allowed to renew their visa status an unlimited number of times and many of them do and stay for a long period of time. Therefore, guest workers are almost residents and the forces of demand and supply for labour in the region have overcome regulatory obstacles and other concerns that have been voiced against the presence of guest workers. The oil income economy in Oman and the other oil exporting countries run at a pace that requires skills that are not available domestically. According to the 2003 census data, 42% of the population were 14 years of age or under and with a forecast population growth of 3%, this group would represent 38% in the year 2023 (see figures 2.13 and 2.14). Such a high percentage of this non-productive age group means that the dependency on foreign labour is going to remain high. And if we assume that the economy is likely to grow at about 3% annually, then the Omani economy is likely to remain dependent on the work contribution of guest workers for a long period of time.

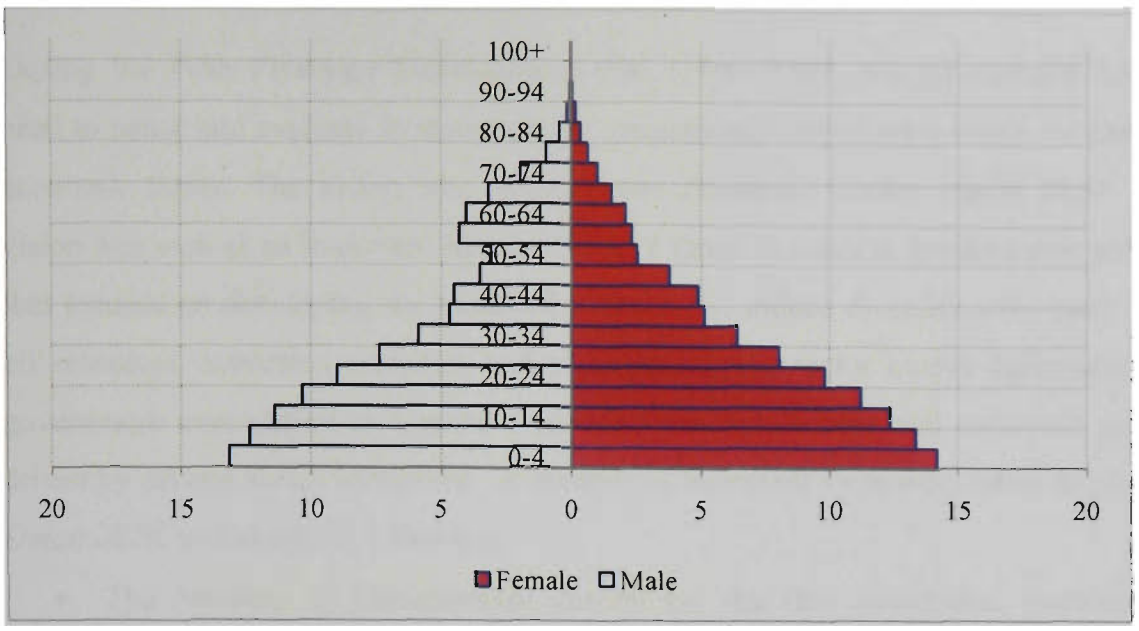
Figure 2.13: Oman population pyramid, 2003



Note: Age group on x axis and percentage on y axis.

Source: Ministry of National Economy, General Census of Population, 2003.

Figure 2.14: Forecast for Oman population pyramid, 2023



Note: Age group on x axis and percentage on y axis.

Source: Calculated from Ministry of National Economy data, General Census of Population, 2003.

Another policy that Oman and most other GCC countries have not considered is increasing the most active age group by having a major migration policy. What this mean is giving citizenship (naturalization) to guest workers instead of the work permit/visa that is currently used. Such policy would have many obvious economic benefits, including increasing the percentage of the most active and working age group and thus decrease guest worker dependency. In addition, many of the other benefits, such as reducing Oman's balance of payments, increasing consumption and its multiplier effect, and decreasing public spending on subsidized services that are consumed by guest workers such as electricity, water, and health, would accrue the economy because of the deliberate policy of increasing the most active age group. In addition, having an immigration policy would be viewed favourably by the international community, which has been quite critical of the region's stand on human right records.

Last but not least, in a short period of time, the government has achieved so much in terms of economic development and maybe the next challenge that the government needs to address is developing its institutions and civil society. Such development would need a clear and transparent legal and judiciary system that has respect for human rights, dignity and freedom of choice.

2.12 OMAN EONOMIC VISION: OMAN 2020

During the Fifth Five-year Development Plan (1996-2000), the government felt the need to pause and evaluate its development programmes and to set a vision for Oman's economic future. The vision was called *Oman Economic Vision: Oman 2020.* The vision was seen as an important step for Oman's future in order to evaluate past policies that focused on developing the basic infrastructure to induce diversification away from oil resources extraction activities and examine non-oil sector output dependence on government expenditure to a more diversified productive base and economic growth driven by private sector initiatives. A number of important steps were taken to plan for *Oman 2020*, including the following:

- The Ministry of Development carried out the first population, housing and establishment census in 1993 and the final results were published in 1995. The data was particularly important for many specialized government authorities that did not have detailed and comprehensive data until hitherto. The data was made available to evaluate past performance and plan for future programmes.
- Updating the national accounts estimates. The United Nations 1993 'System of National Accounts' was adopted to estimate the national accounts including production, savings, investment and consumption data. This was seen as an important step in preparing the data (economic and social indicators) for the next stage of development in Oman.
- Establishing a 'National Information and Documentation Centre'. The Centre's main objective is to provide raw economic and social indicators data for government agencies and research centres, and the private sector.
- Conducting economic surveys on establishments with more than 100 workers. The main objectives of these surveys were to obtain detailed information on cost and production sizes for all economic activities in the country. The data was in turn used to make better estimates of the national income accounts.
- Beside the above mentioned survey, the Ministry of Trade and Commerce conducted the first industrial census in 1994 for all non-mineral sector industries. Data on production, costs, investment and employment was collected to improved GDP and value added industries estimates.
- The Ministry of Agriculture and Fisheries carried out a detailed survey on the agriculture and fisheries sector in Oman. The data collected includes details

about agriculture, fisheries and animal resources, employment data, and production and costs of agriculture and fisheries activities in the country.

- A macroeconomic model based on "World Bank Revised Standard Model" was used to prepare the five-year development plans. The model was considered particularly important in showing the equilibrium between the different sectors of the economy, including production and services sectors.

Armed with detailed data about Oman economy, the vision set four main objectives; first, to achieve fiscal balance: second, to develop human capital and upgrade the skills of the workforce; third, diversify the sources of income; and fourth, to develop and promote the role of the private sector in leading economic activities. The broad policy to achieving the economic vision would be through a business-friendly environment that would induce diversification and economic growth, and by providing basic health education services and utilities that would help in facilitating and improving the standard of living and by creating a stable macroeconomic environment that would promote private sector capabilities and improve its confidence to lead economic initiatives.

The vision also recognized that Oman's economy faces major challenges that need to be addressed in order to achieve the stated objectives and avoid negative outcomes that could have been the result of past policies. The major challenges according to the *Oman Economic Vision: Oman 2020* are:

- Increasing government expenditure and decreasing financial reserves.
- Continuous dependence on exhaustible oil resources that are declining.
- The dominant role of government expenditure in stimulating non-oil sector activities.
- The small contribution of the private sector in economic activities, including low levels of savings and investments.
- Weak regulatory environment that promotes long-term investment.
- Weak linkages between the oil sector and other sectors of the economy, including industrial sectors.

- Inefficient human capital in the government sector and the private sector. This is manifested in a low level of national labour participation and high rate of employment of guest workers.

2.13 ECONOMIC REFORMS

The government adopted several economic reforms that would help in achieving the above stated goals and overcome the challenges. In order to achieve a balance between government expenditures and income, the following mechanisms were adopted:

- Achieve a balance between public revenues and expenditures in 2000 and maintain a balanced budget with the aim of achieving a surplus in fiscal balance equal to 3% of GDP.
- Review fiscal budget plans in accordance with actual revenues realized so that in the case of actual revenues falling below expectations, government expenditure should be cut equally and in line with achieved revenues.
- Privatize public utilities including, electricity and water, sewerage, posts and telecommunications.
- Increase non-oil income so that its contribution is 60% of total government revenue by 2020 through raising government fees, impose charges on basic public services and improve the efficiency of collecting corporate taxes and revenues.
- Increase government savings by restricting withdrawals from the General Reserve Fund.
- Other mechanisms included, limiting withdrawals from the State General Reserve Fund, simplifying financial procedures to reduce central authority, and decentralize decision making.

In order to reform the government's role in the economy and reduce its role in the production of commodity services and increase its role in the provision of basic services such as education and health, the following mechanism were adopted:

- Provide and upgrade basic services, including education and health, and basic infrastructure.

- Promote and encourage the private sector by reviewing subsidies and other policies that would promote market disciplines and induce efficient use of scared resources.
- Improve the delivery of government services by decentralising and allocating more funds to remote regions.
- Improve the government database, and information technology in general, and work towards an electronic-based delivery and dissemination of government services and information.

In order to develop human resources and increase the skill levels of the labour force, the following main mechanisms were adopted:

- To have a clear population policy that would promote family planning in order to have balanced growth between population and economic growth rates.
- Improve free primary education and primary health care. In primary education, emphasis should be placed on basic science teaching and English language from the first year of primary education.
- Allocate more resources to provide and encourage technical education and vocational training.
- Allocate more resources for tertiary education and postgraduate studies.
- Allow the private sector to invest in education and health care in order to reduce the pressure on government services.
- Work towards decreasing the disequilibrium in the labour market between the Omani work force and guest workers by increasing the cost of employing guest workers through imposing additional charges in recruiting them.

To diversify the source of income and reduce dependence on oil income, the following main mechanisms were adopted:

- Encourage the exploitation of other natural resources such as natural gas and other non-oil minerals.
- Promote and encourage export base industries that have value added and are capital intensive rather than labour intensive.
- Induce linkages between oil sector and non-oil sector activities including the industrial and services sectors.

- Encourage foreign direct investment and technology transfer.

The fifth policy called for developing the private sector so that it leads economic activities and economic diversification efforts. The main mechanism to promote private sector role is through the following:

- Privatize part of government-owned companies in electricity and water, sewerage, posts and telecommunications.
- Gradually reduce direct government subsidies in order to promote market discipline and integrate Oman's economy with the world economy.
- Upgrade the current level of infrastructure, including increasing power and water capacity, and overcome supply shortages, especially in the industrial zones.

The sixth policy called for integration of the linkage between the Omani economy and global economy. The main mechanism to promote this integration is through the following mechanisms:

- Encourage the free flow of goods, capital and technology and support domestic, regional and international policies that encourage the free flow of trade and promote technological transfer.
- Join the World Trade Organization (WTO) and promote regional economic relations that would increase market access for Omani products and services, such as the GCC grouping.
- Encourage market disciplines in order to increase the efficiency of the economy, so that Omani products can compete in the international market.

The seventh policy called for increasing the standard of living and equal distribution of income among all citizens. The mechanism to achieve such policy is through the following:

- Provide basic social security cover for the most vulnerable groups of the society.
- Encourage independence and self reliance by upgrading and training vulnerable groups to narrow the income gap between regions and groups.
- Promote policies that give equal opportunities to all in the community.

2.14 CONCLUSION

Over the past four decades, oil extraction activities transformed the economy of Oman. Revenues from oil exports played a major role in deriving economic growth. They have also enabled the government to push for development programmes and build basic services and provide basic utilities. Oil extraction activities dominated the GDP sectors and the productive structure of the economy has gone through fundamental structural changes since then. The oil sector is directly linked to oil price and volume of production. Despite the fluctuations and the volatility of the international oil market, oil prices have been favourable to oil producing nations, and the oil export boom has lasted for a long period of time in comparison to other primary goods. However, oil resources are finite and oil production has been declining since 2000, despite the use of sophisticated technology in the mature fields, called enhanced oil recovery technique (EOR). In addition, despite the increasing role of the service sectors, it is very unlikely that these will drive growth in the economy. The service sector in Oman does not play a similar role to other developed and transition economies where the share of the service sector is between 55% and 75%. The service sector contribution to total exports in Oman is very small. Government services alone made up between 30% and 48% of the service sectors between 1970 and 2007. Wholesale and retail trade and transportation and communication sectors constituted between 29% and 45% of the service sector. The latter two are directly linked to foreign trade and have no value added or local content. The fourth most important service sector is real estate and it is a non-traded sector. All four sectors accounted for 85% to 90% of total services. Therefore, the service sector in Oman at this stage cannot become the main growth driver.

Like domestic production, Omani exports are not well diversified. As of 2007, two thirds of total exports consisted of oil. In addition, refined oil is directly linked to oil production in Oman and the indirect contribution of oil production to non-oil exports may also be significant.[9] Furthermore, despite the important role of the service sector in the national output, its contribution to exports is very small. Despite the gradual increase of the non-oil exports, in 2007 oil exports accounted for two thirds of total exports. In addition, the indirect contribution of oil extraction activities to non-oil exports may be substantial. Last but not least, the value of oil exports influenced the

[9] The refinery company is government-owned and buys all its needs of oil from Oman.

size of GDP and economic growth. Also, the value of oil exports determined the size of government revenues/expenditure.

Government revenue/expenditure oil dependency is further evidence of the economy's dependence on oil resources. In 2007, two-thirds of government revenue came from oil. It is also very unlikely that the government would increase its non-oil revenue at a time when it is under pressure to diversify the sources of income and promote non-oil growth. And domestic demand has been heavily influenced by fiscal policy. The overall domestic demand is determined by how much the government spends.

Researchers and policy planners suggest that fiscal and economic policy in oil-dependent nations like Oman need to have a major saving policy. The policy must not only take into account the needs of today, but also the requirements of future generations. Such long-term planning will ensure sustainability and smooth transition of the economy once natural resources are depleted. They suggest that governments dependent on non-renewable natural resource income should convert the income accrued from natural resources to financial assets and limit consumption to interest from financial assets only to compensate for resource depletion. Further, Elbadawi and Majd (1993) estimated that gross domestic savings should be as much as 60% of GDP to compensate for the depletion rate of resources.

In the labour market, the government needs to address two issues. The first issue is, reducing the economy dependency on foreign labour by replacing expatriates with an Omani work force, a policy that the government has started since the fourth development plan and is called "Omanization". The second issue that the government needs to address is creating new job opportunities and that can only be achieved through a strong non-oil GDP growth.

CHAPTER 3.
LITERATURE REVIEW

When civilization (population) increases, the (available) labor again increases. In turn, luxury again increases in correspondence with the increasing profit, and the customs and needs of luxury increase. Crafts are created to obtain (luxury products). The value realized from them increases, and, as a result, profits are again multiplied in the town. Production there is thriving even more than before. And so it goes with the second and third increase. All the additional labor serves luxury and wealth, in contrast to the original labor that served (the necessities of) life. The city that is superior to another in one (aspect of) civilization (that is, in population), becomes superior to it also by its increased profit and prosperity and by its customs of luxury which are not found in the other city. The more numerous and the more abundant the civilization (population) in a city, the more luxurious is the life of its inhabitants in comparison with that (of the inhabitants) of a lesser city. This applies equally to all levels of the population, to the judges (of the one city) compared with the judges (of the other city), to the merchants (of the one city) compared with the merchants (of the other city), and, as with the judges and merchants, so with the artisans, the small businessmen, amirs, and policemen (4:272).

Ibn Khaldun, 14th century Arab thinker, quoted from Hassan (1995)

3.1 INTRODUCTION

Researchers investigating the role of natural resources in economic development differ on what role natural resource abundance plays in economic development. Ginsberg (1957) not only considered natural resources to be the fifth factor of production after land, labour, capital and technology, but also that resource endowment promotes fast

economic growth. According to Johnston and Mellor (1961), agricultural contribution to economic growth is significant, especially in early stages of economic growth. With reference to the USA economic growth experience, Wright and Czelusta (2003) suggested that between 1890-1910, the USA was both an industrial and mineral-based economy and mineral extraction activities contributed positively to the advancement of technology and know-how of the USA economy. Several other studies found that the rapid industrialization and economic growth 'in the golden age of development' during the period 1870-1913 was largely in countries with abundant natural resources, and that resource abundance contributed positively to their rapid economic growth (Lewis 1979; Findlay and Lundahl 1999).

This view of the positive role of resource endowment to economic growth is also derived from the experience of several developing economies. Using the linkage theory proposed by Hirschman (1958), to explain Peru's economic performance, Roemer (1970) argued that the fishing industry induced the development of upstream and downstream industries. According to Roemer, it was the fishing industry in Peru that led to the development of a ship-making industry (an upstream industry activity for fishing) as well as the development of fishmeal-based industries (a downstream activity for fishing), and as a result Peru was able to achieve a yearly compound growth of 5.5% between 1950-1967. Botswana is often used by economists as a success story in using mineral resources to develop an economy. For example, Sarraf and Jiwanji (2001) suggested that Botswana was able to achieve economic development and sustained economic growth because of its diamond resources activities that were well managed.

However, many other studies have suggested that resource abundance is not necessarily an advantage. In fact, these studies found that resource abundance could be quite a disadvantage, hindering economic growth. In a cross country study for the period 1971-1989, Sachs and Warner (1995) found that countries with abundant natural resources experienced slow economic growth in comparison to countries with poor natural resources. Their finding is robust, even after controlling for other variables that are important for economic growth.[10] In another study, Sachs and Warner (2001) controlled what they called "the unobservable growth deterrent" (Sachs and Warner 2001, p837).

[10] Other determinants of economic growth include openness, per capita income, investment rates, and government efficiency.

And they confirmed their previous finding that there is a negative association between resource abundance and economic growth. Auty (2000) found that abundance of natural resources in many non-democratic developing nations affects economic policies and leads to corruption, and this compromises sound economic policies that would promote economic growth. Sala-i-Martin and Subramanian (2003) examined the impact of resource abundance in Nigeria and found that corruption and wastage induced by resource abundance contributed to poor economic performance of the economy.

This chapter is organized as follows. Section 3.2 discusses the role of natural resources in economic development from the point view of the production function theory. Export instability and terms of trade theory and their relation to natural resources are discussed in Section 3.3. Section 3.4 presents the Dutch disease theory and how natural resource discovery or better terms of trade harm other sectors of the economy, the Dutch disease model, and some empirical findings on the impact of the Dutch disease. The staple/linkage theory and its relation to natural resources is discussed in Section 3.5. This section will present the theory, its historical background, and then will discuss the linkage of mineral dependent economies. Section 3.6 reviews the impact of oil resources in the GCC countries. Section 3.7 examines the oil sector and its linkages in Oman. Section 3.8 estimates the forward and backward linkages of the manufacturing sector in Oman. Section 3.9 reviews staple/linkages estimation. Section 3.10 concludes this chapter.

3.2 THE PRODUCTION FUNCTION THEORY

Does resource abundance promote economic growth and development? Or does it hinder economic growth and development? To answer these questions and to place the Omani case in historical and theoretical contexts, at least four economic theories can be identified.[11] The four theories are:

1. Production function theory.
2. Export instability theory
3. Dutch disease theory.
4. Staple/Linkage theory.

[11] For further discussion on this issue, see also Gelb (1988).

The production function theory is concerned with expanding output through factor inputs and the efficient allocation of these inputs. It is based on the Harrod-Domer model that specifies the relationship between growth, national saving level, and output. The model states that GDP is positively correlated to national saving levels, and negatively correlated to the national savings level/output ratio. The model can be expressed as follows:

$$G = S/K \qquad (3.1)$$

where G is GDP growth, S is saving rate and K is capital.

Expressed in other words, the Harrod-Domer model explains how output growth can be achieved through increases in the labour force and capital formation and trade. The model was developed further by Solow (1956) and Swan (1956). In the Solow-Swan model, growth is not only the function of capital accumulation (as in Harrod-Domer model), but also of technological change. In the steady state, technological change is the driving force in economic growth, and savings determine income levels but not the rate of growth. The production function can be expressed simply as follows:

$$Y = F(L, K, A) \qquad (3.2)$$

where Y is output, L is labour input, K is capital input and A is technology.

The model assumes that economic agents allocate resources efficiently and that there is a diminishing return to labour and capital increases.

In relation to natural resource abundance, therefore, the production function predicts that utilization of natural resources should remove some of the constraints to economic growth. The income earned should facilitate the purchase of capital goods that can be used not only to produce other goods and services, but also to tap into underutilized resources, the (K) in the (3.1) model. In addition, the earned income from natural resources increases the economy's ability to create surpluses that can be used to promote economic development, the (S) in the (3.1) model. Moreover, it allows the imports of the necessary skills and services to produce more goods and services, the (A) in the (3.1) model.

3.3 EXPORT INSTABILITY AND TERMS OF TRADE THEORIES

3.3.1 Export Instability

Export instability is concerned with the effect of income change from a country's exports due to changes in demand and price in the international market, while terms of trade is concerned with the relative value of a country's exports to imports. Blattman, Hwang et al. (2004) suggested that developing countries are more prone to export instability and terms of trade decline, than developed economies, and that such international fluctuations in demand and prices have a negative impact on the developing economies and their abilities to grow.

The export instability theory posits that economies dependent on income from natural resources are subject to boom and bust cycles due to the fluctuations of the international price of primary commodities, and that any gains at times of favourable terms of trade are offset by periods of poor prices. The theory suggests, since most developing countries exports consist mainly of primary products, such as agriculture and minerals and such products tend to suffer from terms of trade variations in comparison to manufactured goods, their economic output will be affected negatively. In addition, it has been argued that export instability discourages investment because of uncertainty about the future, and that leads in turn to a slowdown in output. Moreover, the ability to purchase inputs necessary for production is reduced because of falling proceeds. For example, Glezakos (1973) found a negative correlation between export instability and GDP growth rates, particularly in less developed countries (LDCs). Controlling for other variables effecting growth, Ozler and Harrigan (1988) found similar results to Glezakos, that is, export instability has a significant negative effect on GDP growth rates. Gyimah-Brempong (1991) estimated the effect of the export instability for 34 Sub-Saharan African countries for the period 1960-1986. In his model, output is not just the function of labour, capital and exports, but also of an export instability index.[12] He found that export instability is robust to economic output, and that export instability has a negative impact on GDP growth.

---

[12] In his model, Gyimah-Brempong uses a linear equation as: $y = \alpha_0 + \alpha_1 k + \alpha_2 l + \alpha_3 X + \alpha_3 \mu + \varepsilon$ where Y is output, K is capital, L is labour, X is export, μ is the export instability earnings and ε is the error term.

However, other studies have found a positive relationship between export instability and economic growth. This has been explained by economic agents reducing consumption in the short-run, with the increased savings leading to more investment in the long run. That, in turn, would have a positive impact on output growth. Other studies did not find any relationship between export instability and economic growth. Such studies argue that economic agents anticipate changes in the export income and make provisions in their plans for any income shortages, hence export instability does not harm economic growth. Lim's (1974) paper on the effect of export instability on the economic development of west Malaysia in 1947-70, found no conclusive evidence of a negative effect of export instability on GDP growth. Fosu (1992) examined the impact of export volatility on 35 sub-Saharan countries for the period 1970 to 1980 and found that there is no significant statistical impact of export instability on GDP growth. However, his findings support the proposition that export instability and the uncertainty that accompanies it encourages higher levels of savings. He found that there is a significant and positive statistical correlation between export instability and higher rates of gross capital formation.

Yet other studies found that export instability has negative impact on some countries, while it has positive effects on another set of countries. Investigating nine Asian countries, Sinha (1999) found that export instability had positive impact on Korea, Myanmar, Pakistan and Thailand, while it had a negative impact on Japan, Malaysia, Philippines and Sri Lanka. The impact was neither negative nor positive on India.

3.3.2 Terms of Trade Theory

The terms of trade theory was proposed by Prebisch (1950) and Singer (1950). They argued that since developing countries mainly export primary commodities and those are prone to terms of trade decline in comparison to manufactured goods, this in turn would hinder economic growth, making them unable to catch up with developed economies. Mendoza (1997) investigated the impact of terms of trade on GDP growth of nine developed economies and 31 developing economies for the period 1971-1991. His findings showed that there is a positive relationship between terms of trade and GDP growth.

Two important points emerge from the above exposition. The first is that developing economies are more likely to be affected negatively by export instability because of the weakness of their export base. Their exports are less diversified and therefore they are more prone to the vagaries of the international market. The second point is that most of the literature agrees that terms of trade is robust to economic growth.[13] In conclusion, both theories (export instability and terms of trade) are equally optimistic and quite pessimistic about the ability of resource abundant economies to achieve significant economic growth. The empirical findings of both views suggest that primary resources are more affected by export instability and terms of trade variations, but differ on the impact of such changes on the country's economy.

3.4 THE DUTCH DISEASE THEORY[14]

The Dutch disease theory can be defined as a situation where a booming sector, induced by a resource discovery or favourable terms of trade, causes a re-allocation of capital and labour from other sectors of the economy to the booming sector. Such re-allocation of factors of production and increased wealth resulting from the boom would lead to an increase in the relative prices in the non-tradable sector, compared to the tradable sector, causing an appreciation of the real exchange rate. Real exchange rate appreciation would put the non-booming tradable sector under pressure because of loss of competitive disadvantage in the domestic and international markets. According to Corden (1984), Cairnes was the first to examine the effect of a booming sector on the economy in 1884. An important paper that specified the impact of a booming sector on other sectors of the economy was Gregory's (1976) paper on the implications of the growth of the mineral sector in Australia, for the rural and manufacturing sectors.

A boom is usually resource based and could be the result of natural resource discovery (like oil in the countries of the GCC countries) or favourable terms of trade (like coffee in Brazil and minerals in Australia). According to Cordon and Neary (1982), a booming sector would have two major economic impacts. First, the booming sector would attract

[13] Although most literature agrees that terms of trade are robust to economic growth, it is taken for granted that terms of trade for primary products are likely to deteriorate, and hence the gap between developing economies and developed economies is likely to increase.
[14] The Dutch disease theory is also referred to in the literature as the resource curse theory (see Stevens, 2003).

capital and labour, away from the manufacturing and services sectors. Such resource reallocation has been called "resource movement effect". Second, the increased wealth from the booming sector would lead to price and wage increases, resulting in an aggregate demand increase in the economy. The increased spending resulting from wealth generated in the booming sector has been called "the spending effect". Cordon and Neary used Salter's (1959) model that separates production into traded goods and non-traded goods, to explain the transmission channels of the resource movement effect and the spending effect of the Dutch disease. Prices in the tradable sector, including the booming sector and the manufacturing sector are set by the international market, whereas the non-traded sector prices are set by domestic market forces. The reallocation of factors of production and increased wealth resulting from the boom would lead to an increase in the relative prices of the non-tradable sector to the tradable sector, causing an appreciation of the real exchange rate. The appreciation of the exchange rate would reduce the international competitiveness of the manufacturing sector market and in consequence the manufacturing sector would decline.

3.4.1 The Dutch Disease Model

The Dutch disease model divides production into tradeable products (such as oil) and non-tradeable products (such as a hair cut), where tradeable products are subject to international market prices and non-tradeable products abide by domestic market forces. According to the theory, resource discovery or better terms of trade accordingly will have two effects on an economy as follows.

1. Resource movement effect

   The resource movement effect happens when labour demand in the booming resource sector increases and as a result labour shifts from other manufacturing sectors to the resource sector, causing a decline in the manufacturing sector output in the short run and de-industrialization in the long run.

2. Spending effect

   The spending effect happens when demand in the non-traded sector (services) increases as a result of the extra wealth brought in from the resource boom. The increase in the demand for non-traded sector goods and services shifts the demand for labour away (another demand shift) from the manufacturing sectors to the non-traded sectors, causing an indirect de-industrialization. In addition, the increased demand for non-traded goods and services increases their price. The price increase in the non-traded sector results in an increase in the real exchange rate, causing further de-industrialization. The increase in the real exchange rate happens because its real value is the function of the ratio of domestic price and international price level, and since traded goods are set by the international market and not by the domestic market, an increase in the price of the non-traded sector would lead to an increase in the real value of the exchange rate. The real exchange rate can be expressed as follow:

   Real exchange rate = P_d/P_f

   where P_d is the domestic price level and P_f is the foreign price level. So an increase in P_d would result in an increase in the value of the real exchange rate.

The combined effects of the Dutch disease (resource movement and spending effects) will have a devastating effect on the manufacturing non-booming sector. The negative impact of the Dutch disease can be summarized as follow:

- an appreciation of the exchange rate;
- the production of the manufacturing non-booming sector falls;
- the output of the non-traded sector rises; and
- the export of the non-booming manufacturing sector falls.

3.4.2 Empirical Studies of the Dutch Disease Theory

Empirical studies on the Dutch disease including developed and developing countries found mixed evidence to support the existence of the ailment. Some studies showed that growth in manufacturing sector was slower in natural resource based economies. A study by Hutchison (1994) on the effect of the Dutch disease found that, although in the

short run, Norway's manufacturing sector declined, the manufacturing sectors in the Netherlands and the United Kingdom grew. According to the study, the booming sector increased the aggregate demand of the economy and as a result, the manufacturing sector in the Netherlands and the United Kingdom experienced positive growth. The study could not confirm in the long run, natural resource boom growth at the expense of the manufacturing sector. In another extensive cross country study between the years 1970 and 1990, Sachs and Warner (1997) showed that resource rich countries tend to grow slower than resource poor countries. The main reason for the poor performance of resource rich economies was because of the poor performance of the manufacturing sector. An IMF (1995) survey, found a long-term decline between 1970 and 2004 in the manufacturing sector in Norway. The study, however, concluded that the decline of the manufacturing sector was partly explained by a decline in the aggregate demand in the European Union GDP and hence demand for manufacturing exports from Norway.

Studies on the effect of the Dutch disease on GCC countries are rare, and in Oman they are even rarer. In a comparative study between Saudi Arabia and Botswana, Auty (2001) links exchange rate appreciation, a Dutch disease symptom, in Saudi Arabia to the rapid rate of absorption following the sharp increase in oil windfall between the years 1974-81. As for Oman, we are not aware of any empirical study that looked into the effect of the Dutch disease and oil shock on the economy. The discovery of oil and the sharp increase in energy prices has no doubt lead to unprecedented levels of export earnings and income wealth growth. Such sudden influx of earnings into the economy from one sector, oil, presents a good case study for the Dutch disease.

We have examined the four economic major ailments of the Dutch disease in Oman. First, did the sudden flood of income from the oil sector into the economy harm the manufacturing sector and did the manufacturing sector decline as a result? Second, did non-traded sector growth outstrip the growth of other sectors of the economy and grow at the expense of the traded sector? Third, did capital and labour shift from the tradable sector to the non-tradable sector, as it became cheaper to import than to produce domestically? Fourth, did real wages in the oil industry rise, causing an increase in the real exchange rate?

3.5 STAPLE/LINKAGE THEORY

The staple theory was developed by Canadian economists to explain how income from natural resources transformed the productive structure of the Canadian economy into a more diversified and sustainable productive structure (Watkins 1963). Canada's economic history is used as an example of the role played by natural resources in economic development. In fact, the staple thesis was postulated by a Canadian economist to explain how natural resource exports contributed positively to the development of the Canadian economy (Watkins 1963). According to the theory, the export of raw commodities, such as agriculture products, minerals, fish and fur to Europe, induced the development of other industries that eventually led to economic development and sustainable growth in Canada.

The linkage theory also examined how one industry would lead to another industry. It is an extension of the staple approach to economic growth. The linkage theory proposed by Hirschman, however, specified the types of linkages a leading industry in an economy may induce. Hirschman (1973) explored the role of intermediate goods in industrialization, in what he called linkages. The main assumption of the linkage strategy is that underdeveloped economies' main problem is not lack of resources, but the inability to invest scarce resources in the money market economy. Hence expansion should give preference to projects that "maximize induced decision making" (Hirschman 1973, p72), i.e. concentrate on a few key industries with strong linkages to the leading industry. By doing that, an underdeveloped economy can break out of the vicious circle of poverty.

Hirschman and other researchers looked at the Leontief input-output tables to test the linkage effects and to measure production linkages of an economy. However, they disagreed on the best methods for measuring the indirect effect of an industry. Yotopoulos and Nugent (1973) suggested the use of the inverse of the input-output column sum to capture the total linkage effect, that is the sum of both backward and forward linkages and the indirect effects that result from such linkages. According to Jones (1976), Rasmussen suggested using a weighted inverse of the row sums to measure the inter-sectoral linkages, or what is called an "index of sensitivity dispersion" (Jones 1976, p326) to capture both the direct and indirect linkages effects. However, he

argued that neither of these techniques captures total forward linkages. The total linkage effect used by Yotopoulos and Nugent captures direct and indirect effects on "supplier industries but not user industries" (Jones 1976, p325) or the backward linkage only. On the other hand, Rasmussen's calculation, by using the sum of the rows captures part of the forward linkage that is total intermediate sales of an industry sector. To capture both direct and indirect linkage effects, Jones suggested calculating intermediate sales as a share of total sales, including final demand instead of intermediate inputs as a share of total inputs including value added.

Other researchers and development economists have used the linkage theory without really specifying how linkages might function in an economy or suggesting methodologies that allow testing of the hypothesis. Baldwin (1966) for instance, believed that because of the productive structure, such as the market opportunities of the economy and the input coefficient of labour, capital, and material inputs of the export industry and economies of scale in other economic activities supplying the export industry or dependent on its output, linkages in an underdeveloped economy would be weak. Prebisch (1950) and Singer (1950) were pessimistic about the abilities of underdeveloped economies to foster linkages in their economies, because foreign multinational companies dominate the leading economic activities in developing countries and all the profits and benefits are sent (by foreign multinational companies) outside the economy.

3.5.1 Empirical Studies of the Linkage Theory

Researchers differ on the multiplier effect of the primary sector such as agriculture on other sectors of the economy. Hirschman (1973) suggested that the agriculture sector has weak linkages to other economic sectors because it did not induce new investments or downstream industries. In his strategy, Hirschman suggested that policy planners should promote non-agriculture investment, industrial investment in particular, because of its spillover effect and greater linkages to other sectors of the economy.

However, other researchers suggest natural resources such as agriculture can stimulate and induce other economic activities and encourage economic development. Vogel (1994) examined the strength of the forward and backward linkages of the agriculture

sector and its role in encouraging industrialization using a social accounting matrix, and concluded that the sector had the potential of inducing intersectoral linkages even in low and middle income developing countries. In another study by Delgado (1998) of the International Food Policy Research Institute, confirmed the findings of Vogal that the spillover of the agricultural sector can accelerate economic growth in rural regions, and that in turn would have a positive effect on the country's growth.

In the 80s and early 90s, work on the linkage theory investigated production, fiscal, and consumption linkages of the mining and petroleum industries (Hirschman 1981; Auty 1993; Auty 2001). Hirschman and Gelb stressed the importance of fiscal linkages for mining and petroleum activities, while Auty researched the failure of "resource-based industrialization" (RBI) or the forward linkage.

3.6 THE IMPACT OF OIL RESOURCES ON THE GCC COUNTRIES

Perhaps no region in the world in post World War II was transformed by a single commodity like the GCC group of countries.[15] That single commodity is oil. This was particularly the case as a result of the oil price increase in October 1973. International oil prices jumped from 2.5 USD in 1972 to 11.6 USD per barrel of oil in 1973. As a result, a significant amount of wealth poured into the governments of the GCC. The substantial amount of revenue that became available provided the potential for rapid economic development. Income from oil transformed the societies and economies of the region at unprecedented levels. The revenues enabled the governments of the region to build infrastructure, establish and encourage the development of industrial and agricultural sectors, and finance, education, health and cultural programmes. The result was dramatic increases in per capita incomes and significant increases in output growth. The mostly barren and desert countries of the region enjoyed an average per capita income of about 39,641 USD in 2006 (see Table 3.1). Life expectancy increased from 64 years in 1980 to 76 years in 2006, and literacy rates increased from 60% to 84% during the same period. The GCC countries now have some of the most modern highways and advanced telecommunication systems in the world.[16]

[15] Oil was first discovered in the Arabian Peninsula in Bahrain in 1932.
[16] This includes the only 7-star hotel in the world, the Burj Alarab of Dubai.

Table 3.1: Selected economic and social indicators, 2006

	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE
GDP (constant million USD)	18,377	101,477	72,055	61,179	549,322	212,420
GDP per capita (constant USD)	26,306	41,961	23,213	76,228	20,341	49,795
Life expectancy at birth (years)	75	78	75	75	73	79
Population, total (millions)	0.72	2.54	2.62	0.89	23.12	4.10

Source: Penn World Tables, Version 6.3, and World Bank Indicators for life expectancy.

Against the backdrop of the success of the GCC countries in increasing per capita income, better living conditions and GDP growth rates, is the continuous reliance on oil income. Reliance on oil resources can be seen from the size of the oil sector in GDP, the ratio of crude oil exports to total exports, and the ratio of government income from oil (see Table 3.2). As can be seen from the table, the GCC countries rely heavily on oil income. In 2004, the average oil sector GDP was 41% for all GCC countries, while government income from oil was 72%. And in 2006, crude oil exports comprised 84% of total exports for the GCC countries.

Table 3.2: GCC countries oil dependence (percentage)

Country	Oil sector GDP (2004)	Crude oil exports (2006)	Government oil income (2004)
Bahrain	24	81	73
Kuwait	47	90	75
Oman	42	91	78
Qatar	62	91	65
Saudi Arabia	42	91	65
United Arab Emirates	32	62	78
Average	41	84	72

Source: GCC Secretariat Statistics Data Base and World Bank Indicators for the percentage of crude oil exports.

Researchers who study the economies of the region raise two major issues. The first issue is concerned with the abilities of the GCC countries to sustain economic growth in the long run because of dependence on oil resources for export revenues, jobs and overall economic output. The resource curse and Dutch disease theories have been used to describe the failure of many resource-led economies to sustain high GDP growth and the GCC countries are cited in several studies as examples of countries inflicted with both the resource curse and the Dutch disease.

In addition, other empirical research provided evidence for the poor economic performance of oil exporting countries, especially during the 1980s and 1990s when international oil prices dropped, casting doubt on their abilities to sustain high GDP growth rates. For example, Yousef (2004) reviewed the development of the countries of the Middle East and North Africa since 1950, including the GCC countries, and found that in the 1980s and 1990s the region experienced GDP growth of just 0.3% and 0.7%. Hakura (2006) looked at the economic performance of the MENA region during the same period and found that not only did the region perform poorly, with an average per capita GDP growth of just 1.2% between 1980 and 2000, but the GCC countries actually experienced a negative per capita GDP growth of about 1.1%.

Our more recent data obtained from Penn World Tables shows that between 1971 and 2006, on average, GCC per capita GDP grew by 1.4% (see Table 3.3) and that on average GCC GDP grew by 6.3% in the same period (see Table 3.4). However, this aggregation conceals important differences among the GCC group of countries. While Kuwait had negative per capita GDP growth and Bahrain, Qatar, and Saudi Arabia had less than 1% real per capita GDP growth rates, Oman and UAE in comparison experienced real per capita GDP growth rates of 3.2% and 5.4%, respectively. In addition, GDP growth rates for Oman and UAE were much higher in comparison to other GCC countries, 7% and 14% respectively.

Table 3.3: Real per capita GDP percentage growth rates (USD in 2005 constant prices)

Year	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE
1971	21,118	97,297	8,740	80,712	25,498	15,288
1981	22,806	35,664	14,638	71,574	42,432	70,298
1991	18,017	30,568	20,374	43,757	23,314	40,820
2001	21,048	34,826	25,875	58,396	18,731	39,834
2006	26,306	41,961	23,213	76,228	20,341	49,795
AVG*	0.80	-1.54	3.19	0.25	0.51	5.36
AVG* GCC	1.36					

Note: AVG* is average growth rates in 1971-2006.
Source: Penn World Tables, Version 6.3.

Table 3.4: Real GDP (million USD in constant 2005 prices)

Year	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE
1971	4,760	77,187	7,015	10,048	160,316	4,405
1981	8,288	51,077	18,121	17,842	450,944	75,200
1991	9,283	29,164	37,555	20,177	380,150	79,055
2001	13,583	71,113	67,878	38,475	446,254	134,931
2006	18,377	101,477	72,055	61,179	549,322	212,420
AVG*	4.04	2.26	6.82	5.76	4.69	14.32
AVG* GCC	6.31					

Note: AVG* is average growth rates in 1971-2006.
Source: Penn World Tables, Version 6.3.

The second major concern is the ability of the GCC countries to diversify sources of income away from the oil sector. While Yousef (2004) acknowledged that the region sustained high economic growth, of 6% per worker per year in the 1960s and early 1970s, it suffered falling total factor productivity from positive 3.4% in the 1960s to negative 1.5% in the 1980s and negative 0.5% in the 1990s. Other researchers have found similar results (Samir Makdisi 2000; Elhiraika and Hamed 2001). The negative results of the TFP are associated with significant oil sector reliance (see Table 3.3). Some researchers have argued that this persistent dependence on oil income, is evidence of the inability of the GCC countries to diversify away from oil resources and develop non-oil sector based industries (Saif 2009).

In short, since the 1970s, oil resources enabled the GCC countries to sustain positive GDP growth and per capita income. The only exception was Kuwait which experienced a 1.5% drop in per capita income. In addition, Oman and UAE seem to have done particularly well in GDP and per capita GDP growth, in comparison to the other four members of the GCC. Nevertheless, all GCC countries, including Oman and UAE that have had better growth rates, are still dependent on oil income and have not diversified their economic sectors away from oil.

3.7 OIL SECTOR AND ITS LINKAGES IN OMAN

According to the linkage theory, the availability of SOC encourages the development of DPA, that in turn encourages more SOC investment, and that again encourages more DPA (backward and forward linkages). For example, building a road that links different regions of a country facilitates domestic trade, and that in turn encourages agricultural and industrial investment (the forward linkage of SOC). Increased investment in the

agricultural and industrial sector induces additional investment in the existing SOC (backward linkage of DPA). Such spillover effects between economic sectors is well known, however, estimating how an economic sector can create forward and backward linkage are difficult, particularly in the absence of input-output data.

Hirschman postulated his linkage hypothesis as a development strategy and a planning tool for developing countries to industrialize, by developing key sectors that will maximize linkages between economic sectors. For example, key sectors that have the potential of maximizing sales to other manufacturing sectors (forward linkages) or purchase from others (backward linkage) were to be encouraged by policy planners. Such planning and deliberate investment strategy, it was hoped, would encourage the development of an industrial sector that would in turn drive fast and sustained economic growth in many developing nations.

In oil dependent economies, the debate is concerned with the kind of relationship that exists between the oil sector and the non-oil sectors, including agriculture, manufacturing and service sectors. Does the oil sector create significant interrelationships with the non-oil sectors? What forms does it take? Is the linkage running from the oil sector to the non-oil sectors? Or are the intersectoral linkages running from the non-oil economy to the oil economy? And what are the causal relationships that exist between the oil and the non-oil sectors? This research addresses these questions, together with their implications for policy formulation that will foster linkages and induce faster economic growth.

3.7.1 Fiscal Linkages

Over the past forty years, Oman's GDP growth rates have been mainly the function of the oil sector growth rate, despite the stated objectives of diversifying sources of income and reducing oil dependency. Fiscal policy through government expenditure has been the main driver of growth and development in the non-oil economy. Oil proceeds accrue to the government; and through government expenditure and investment, oil income is channelled to other sectors of the economy. To use linkage hypothesis terms, the oil sector in Oman has four major linkages; fiscal linkage, forward linkage, backward linkage and consumption linkage. The fiscal linkage has shaped the growth pattern in

the non-oil sector and the macroeconomic policies in Oman. The allocation of oil proceeds was the function of how much oil income accrued to the government.[17] During the first and second oil price boom, in 1973-1975 and 1979-1981, oil proceeds were used to develop basic infrastructure and provide services. However, the economy's absorptive capacity was low and in order to protect the domestic money supply from foreign exchange shock, the government accumulated foreign assets abroad. And when oil prices dropped in 1981-1986, the government reduced its expenditure and withdrew its foreign assets to finance its recurrent and development expenses. Low oil prices and increased government expenditure in 1987-1999 resulted in using most of the country's reserves. As a result, the government resorted to deficit financing and foreign borrowing to finance its expenditure, including development programmes. The need for borrowing was also due to the significant increase in the economy's absorptive capacity.

In response to continued low oil receipts during 1986-1999, the Omani government introduced a wide range of economic reforms aimed at reducing oil dependence, that characterized periods of higher revenues and lower absorptive capacity, and that became unsustainable with lower oil revenues, an expanding private sector and growing populations. These reforms included privatizing government services such electricity and water in what is called build-operate-transfer (BOT) programmes. The private sector builds and operates the facility, and in return the public sector buys the output from the owners at a pre-set and agreed price. Privatization also included selling part or wholly-owned public companies.[18] In addition, the government also established the SGRF, an oil stabilization fund, increased non-oil revenues through increasing fees and better collection of corporate income tax, and used a conservative oil price estimate for government expenditure planning.

3.7.2 Forward Linkages

The oil sector forward linkage refers to how oil sector output was used as an intermediate input into making other goods. In Oman, the forward linkage of the oil

[17] Government income depends on the international oil price and volume of production.
[18] Privatization in Oman in this sense is different from privatization of public enterprises in the former bloc of Eastern Europe, where state-owned companies were privatized as a result of the fall of communism; and the movement from command economies to market system economies it is also different from privatization in western Europe such as the UK, were publicly-owned companies were viewed as becoming a burden on the state so the government decided to sell them to the private sector.

sector and gas associated with oil, was used as fuel into electricity production and was used to meet the energy demand for energy intensive activities. It also resulted in the establishment of oil refining activities to meet the domestic market demands of petroleum products. The gas associated with oil production also made it feasible to establish a petrochemical industry, the output from which was used as feedstock into producing petrochemical products. The forward linkage of the oil sector made important contributions to the development of the manufacturing sector and its share in GDP. More specifically, the first direct forward linkage of the oil sector came through the development of oil refining activities. Refining capacity expanded from 18,000 barrels in 1985 to 31,000 barrels in 2006. Natural gas production increased from 141 thousand cubic feet in 1985 to one million cubic feet in 2006. The second direct forward linkage of the oil sector came through the development of the petrochemical industry. The value of petrochemical production increased from 0.7 billion USD in 1993 to 3.7 billion USD in 2006, at constant 2000 prices. Oman followed a cautious approach towards resource-based industrialization (RBI), because of the huge capital investments in such projects and market risks involved. Nevertheless, the development of resource based industries, though small, was in terms of its contribution to GDP share, an important aspect of using oil resources to diversify the sources of income and accelerate the pace of industrialization.

3.7.3 Backward Linkages

The backward linkage of the oil industry refers to the kind of inducement/pressure the oil sector creates in the domestic economy to cater for its needs and requirements of goods and services and its input requirements. Because of the capital intensive nature and technological requirements of the oil sector which are beyond the capability of Omani economy, the oil sector activities induce service-related activities to cater for the oil sector requirements, such as contracting, transportation and general logistics. Because of lack of data, it is difficult to give accurate account of oil service-related activities. However, the oil sector in Oman employs around 6,000 Omani and non-Omani workers, while the service sector that supports the oil industry employs around 12,000 Omanis and non-Omanis. During 1981-1986 when oil prices dropped, oil sector related services were also affected and a large number of foreign and Omani workers were made redundant. When oil prices increased, oil sector related activities

experienced a healthy growth and a large number of foreign and Omani workers were employed.

The fourth linkage associated with oil resources is consumption linkage. This linkage refers to the effect of increased consumption resulting from oil income. The linkage theory suggests that increased consumption may increase demand for imports, but also encourages local agents to manufacture consumer products to meet this increased demand. Manufactured goods, including consumer goods, increased from less than 1% in 1980 to 8% of GDP in 2006. The drop of oil exports in 1986-1999 was associated with an increase in non-oil exports, while the rate of import growth declined. In addition, a decline in import growth and the development of other sectors, including the growth of import competing industries encouraged the development of the non-oil sector and non-oil exports that also enjoyed direct government support.

However, as mentioned above in section 2.4, the increase of manufactured goods was largely driven by the oil refinery products and LNG (hydrocarbons), with consumer goods production still limited. Manufacturing growth directly linked to an increase in consumption demand that could be attributed to an increase in the manufacturing capabilities of the economy away from oil was around 4% of GDP in 2007.

3.8 LINKAGES OF THE MANUFACTURING SECTOR IN OMAN

A survey of the "manufacturing industries" conducted in 2006 by the Ministry of Trade and Commerce covered large and medium industries which employ more than 10 workers, leaving industries with 9 or less workers out of the survey. Moreover, the survey did not cover the mineral industry, including the oil sector. Hence, for a full contribution of the manufacturing sector to GDP, the Oman *Statistical Year Book* is the best source.

The Ministry has summarized the manufacturing sector in Oman into 15 industries out of 467 (see Table 3.5). The number of employees in the sector was about 35,000 workers or about 19% of the total work force, of which 62% were expatriates. The biggest employer was the non-metallic mineral products sector that catered mainly for the construction industry, employing about 23% of the sector, of which 32% are

Omanis. The second largest employer was the food and beverage sector, employing 21% of the manufacturing sector, of which 45% are Omanis (the biggest Omani employer). Fabricated metal products came third in the rank, employing about 9% of the manufacturing sector. Refined petrol products employed 0.03% of the sector, however, the percentage of Omanis working for the sector was 73%. Chemical and chemical products employ 0.04% of the sector, of which 46% were Omanis.

Table 3.5: Manufacturing sector (number of employees and cost of material input), 2005

Sector	Number of employees	% of Omani	Cost of material input (USD)	% of Omani
Food Products/Beverages	7424	44.69	469,361,231	32.65
Paper/Paper Products	555	45.05	22,704,727	9.15
Printed Materials/Recorded Media	1440	35.69	19,144,818	47.55
Refined Petro. Products	1157	72.86	1,509,900,270	97.00
Chemicals/Chemical Products	2086	45.73	133,572,951	45.23
Rubber/Plastics Products	1593	35.34	58,556,488	23.90
Other Non-Metallic Mineral Products	8114	32.27	154,989,192	72.15
Basic Metals	1206	54.39	193,488,738	24.44
Fabricated Metal Products	3236	30.62	54,360,551	50.02
Machinery/Equipment	679	39.91	23,093,395	32.46
Electrical Machinery/Apparatus	989	47.02	126,785,652	14.49
Medical, Precision/Optical Instruments	59	50.85	3,248,800	8.15
Motor Vehicles, Trailers/Semi-Trailers	365	27.40	829,662	99.72
Furniture, Manufacturing	3068	29.56	47,958,743	45.73
Other Industries	2920	40.55	26,697,787	42.00

Source: Ministry of Trade and Commerce, Yearly Industrial Statistical Book, 2005.

3.8.1 Backward and Forward Linkages of the Manufacturing Sector in Oman

Linkages calculations show that motor vehicles, trailers/semi trailers have strong backward and forward linkages (they have the least amount of imported content with about 100% of domestically produced content material) (see Table 3.6). These results

confirm the view that industrial products, especially heavy industries have strong backward and forward linkages. This, however, does not mean that Oman was producing any motor vehicles, rather Oman was manufacturing most of its requirements of semi-trailers, which came under the same classification as motor vehicles.[19] Further, it is expected that semi-trailers would have strong backward and forward linkages because the input material (the metal) is available locally and output (the semi-trailers) are manufactured as semi finished products for tracks and long vehicles.

Paper and paper products come second to motor vehicles, trailers/semi-trailers with strong backward and forward linkages. This is perhaps expected given that most, if not all, goods need paper products at some stage. Third, came rubber and plastic products, showing almost just as much as the semi-trailer industry in strong backward and forward linkages. In addition, the rubber and plastic industry has more inter-industry links than the semi-trailer industry. The sector has inter-industry links with 9 other industries and the semi-trailer industry has inter-industry links with one industry only, and that is the fabricated metal products (indicating that it could be catering mainly for that particular industry). Furniture production and electric machine production and printed materials/recorded media show strong backward linkages but very little forward linkages. This result indicates that furniture and electric machine production and printed materials/recorded media may be semi final products and go mainly to final users or consumes. Refined petrol products show weak backward and forward linkages indicating that they cater mainly to final users or consumers. Chemical and chemical products have weak backward linkages but stronger forward linkages. These results are expected also and indicate that chemical and chemical products are used by many other industries as an input, but use little input or purchase very little products from other industries in Oman. Finally, food and beverages products show very insignificant backward and forward linkages. These results mean that food and food products are mainly imported and the Oman food industry does not have strong linkages to other industries in Oman. It would have been feasible or expected for the food industry to grow and create strong backward and forward linkages, given the historic importance of

[19] Because of the significant linkages the industrial sector creates, as confirmed by statistic estimation, development economists were optimistic about the future of industrial-based economies to develop fast and catch up with the developed world.

the agriculture sector in Oman that might have induced food processing and food production.[20]

Table 3.6: Linkage of the manufacturing sector in Oman, 2005

Industry	Backward linkage	Forward linkage
Food Products/Beverages	0.0788	0.0019
Printed Materials/Recorded Media	0.8902	0.0000
Paper/Paper Products	0.9988	0.9988
Refined Petro Products.	0.0915	0.0127
Chemicals/Chemical Products	0.0300	0.6847
Rubber/Plastics Products	0.9720	0.9466
Other Non-Metallic Mineral Products	0.2831	0.0238
Basic Metals	0.0245	0.4264
Fabricated Metal Products	0.7402	0.6598
Machinery/Equipment	0.2058	0.1751
Electrical Machinery/Apparatus	0.8844	0.0171
Medical, Precision/Optical Instruments	0.1897	0.0000
*Motor Vehicles, Trailers/Semi-Trailers	1.0000	1.0000
Furniture, Manufacturing	0.7572	0.0000
Other Industries	0.0827	0.4558

Note: Following Jones (1976) we estimate the backward linkage as the ratio of the sectors intermediate inputs to total value of production, $BL_j = \frac{\sum_i Xij}{Xj}$ where, xij is the number of units of commodity i used in the production of xj units of commodity j and the and the forward linkage as the ratio of inter-industry demand to total demand, $FL_i = \frac{\sum_j Xij}{Zi}$ where, Z_i is the sum of inter-industry i ($\sum_j Xij$) and final demand (Y_i) for commodity i (see Section 3.9).

* The strong backward and forward linkage of Motor Vehicles, Trailers/Semi-Trailers industry that is clear from the table is expected given that Oman produces most of its requirements of semi-trailers, which came under the same classification as motor vehicles. Further, it is expected that semi-trailers would have strong backward and forward linkages because the input material (the metal) is available locally and output (the semi-trailers) are intermediate products (manufactured for tracks and long vehicles) (see also section 3.8.1)

3.9 STAPLE/LINKAGE THEORY ESTIMATION

Studies of linkages have looked at the production linkages of an economy or input-output matrices to estimate the forward and backward linkages of economic sectors, while ignoring other multiplier effects of an economic activity. For example, Youtopoulos (1973) tested the linkage hypothesis by looking into input-output tables to

[20] As will be discussed later in chapters 4 and 5, the agriculture sector does not appear to participate in the mainstream economy.

estimate the backward and forward linkages of the production structure, while ignoring the multiplier and indirect possible linkages that an economic activity could induce. Laumas (1976) discussed the weighting problems in testing linkage hypotheses, while in actual fact his paper investigated the weighting problems in testing production linkages only. Jones (1976) acknowledged the problems of estimating linkages of economic activities using input-output tables, but suggested using the inverse of column sum of input tables to measure direct and indirect linkages of the backward linkage of an industry and the use of the of the inverse of row sum of the output table to estimate the forward linkage of an industry.

Quantitative analysis uses input-output tables to measure production linkages (forward and backward). So direct backward linkages for the *jth* sector is measured by calculating the ratio of its intermediate inputs in the total value of production:

$$BLj = \frac{\sum_i Xij}{Xj}. \qquad (3.3)$$

where, Xij is the number of units of commodity i used in the production of $\frac{X}{j}$ units of commodity j.

Direct forward linkages for the *ith* sector is measured by calculating the ratio of its inter-industry demand to total demand:

$$FLi = \frac{\sum_j Xij}{Zi}. \qquad (3.4)$$

where, Zi is the sum of inter-industry i ($\sum_j Xij$) and final demand (Yi) for commodity i.

To capture both direct and indirect forward linkage affects, Jones suggested calculating intermediate sales as a share of total sales including final demand, so for the *jth* sector:

$$TLj = \sum_i a^* ij \ . \qquad (3.5)$$

where, $a^* ij$ is total sales.

Hirschman formulated his linkage theory or "unbalanced growth" theory as an alternative to the hypothesis of the "big push" or "balanced growth" of Rosenstein-Roden (1943). Central themes in both doctrines are the importance of the inducement mechanism and complementarities to stimulate the development process. Both hypotheses suggest that lowering the cost of technology is vital for any industrialization to take place. However, the unbalanced growth model stresses the central role of a leading economic activity to induce investment decisions and lower the cost of industrialization.

Hirschman suggested the following order of priorities for industrialization:

- high backward linkage and high forward linkage;
- high backward linkage and low forward linkage;
- low backward linkage and high forward linkage; and
- low backward linkage and low forward linkage.

Before embarking on further empirical investigation, it is useful to ask several questions that would help us define and understand the nature of the relationship between the oil and non-oil economies. The first question to be asked is how independent non-oil sector activities are of the oil extraction activities? An important aspect of natural resource dependence is the lack of a self-sustaining productive base, so the second question to be asked is how diversified the non-resource sector activities are? Answering these two questions is very critical because the lack of a self-sustaining and diversified productive base threatens the economies of resource dependent nations when revenues fall or when the stock of resources are exhausted. Examining the linkages and directional relationship between the resource and the non-resource sectors, therefore, increased our understanding of the dynamics of natural resources and their impact on the different sectors of the economy. Measuring the linkages between the resource and the non-resource sectors by VAR and cointegration methodologies would revealed the nature of interactions and the dynamics between natural resources and other sectors of the economy.

The staple/linkage approach is the most suitable framework of analysis for our study. The production function is not an adequate approach to understand the story of oil discovery and its impact on the non-oil sectors activities. The production function approach would clearly suggest that the economy has been growing and the standard of living has increased by bounds and leaps. We are not suggesting otherwise, indeed oil revenues have enabled the governments of the region to pursue ambitious development programmes that have had a clear and positive impact on livelihoods, including a higher standard of living and better health. However, besides GDP and per capita GDP, growth, we are interested in development of the non-oil economy. The reason being, once oil resources are exhausted, the non-oil economy's ability to grow will determine the level of GDP growth and the standard of living that is sustainable. But the production function does not address this.

Hence, this study used VAR and cointegration techniques to test for linkages between the oil and the non-oil sectors in Oman for the period 1967-2007. Furthermore, the study measured fiscal linkages and explored how all linkages interacted and influenced the development process of the economy.

The second step in our analysis was to look for directions of causality between the resource and the non-resource sectors. In order to do that, we used the Granger causality test, which is useful in two ways: first, to see if the results support our VAR and cointegration findings; and second, the test helps to explain how changes in the oil sector might affect the non-oil sectors in Oman.

3.10 CONCLUSION

To summarize this exposition of the literature, four major linkages have been identified following resource discovery or better terms of trade. The first major linkage is associated with the direct economic impact of the resource on the economy. The revenue is channelled to the economy through increased consumption, increased ability to import capital goods and higher levels of savings.

The second major linkage is associated with the international price of the resource. Researchers recognise the importance of oil in mineral dependant nations and there is an

expanding interest on the impact of oil price movements on the macroeconomic dynamics of the Gulf Cooperation Countries (GCC). This research will expand our understanding on how oil price changes could impact GDP growth, the exchange rate or government revenue in Oman.

The third economic linkage of the mineral sector is the 'the resource curse theory' or 'Dutch disease' linkage. According to the Dutch disease theory, countries with abundant natural resources, minerals in particularly, suffer from four major symptoms: first, exchange rate appreciation; second, a decline in the manufacturing sector; third, a boom in the service sectors; and fourth, a labour shift from the manufacturing sector to the services sector and the resource extraction sector. In economies where natural resources are owned by the state, the resource curse is channelled to the economy through government expenditure and the governance of resource income.

The fourth linkage is also associated with the economic impact of the resource on the economy, but through the multiplier effect of the resource activity on the economy. This impact is channelled to the economy through fiscal and production linkage. Fiscal linkages are concerned with the impact of government expenditure on national output, while production linkages investigate the forward and backward linkages that result from mineral extraction activities. Production linkage theory tries to estimate the backward linkage (the supplying industry) and forward linkage (the demand industry) to natural resource sector activities.

CHAPTER 4.
INTERNATIONAL OIL PRICES, GDP, GOVERNMENT REVENUE AND DUTCH DISEASE

Oil is fantastic and induces fantasies. [...] it created, in practice, a culture of miracles... Oil wealth had the power of a myth.
José Ignacio Cabrujas, Venezuelan writer, director and actor, quoted from Coronil (1997)
All in all, I wish we had discovered water.
Shiek Ahmed Zaki Yamani, quoted from Ross (1999)

4.1 INTRODUCTION

Interest in the impact of oil resources on the economic performance of oil producing nations can be traced back to the early 1970s, following the dramatic quadrupling of international oil prices in 1973. The recent economic performance of Gulf Cooperation Council (GCC) and the large fiscal and current account surpluses in the wake of another oil price hike since 2003 revived the interest in the impact of mineral resources on domestic output, fiscal policy and other macroeconomic indicators (Setser 2007; Strasky, Adolf et al. 2008). The debate has evolved around the impact of the oil sector on the non-oil sectors and the fiscal dependence on oil income. This research is particularly relevant to the increasing interest on the impact of oil price movements on the macroeconomic dynamic of the GCC countries. This is specially the case since it is going to investigate into details, how oil price change impact GDP growth, exchange rate or government revenue in Oman.

Further, many cross-country studies provide evidence of the adverse effects of the resource export boom to exporting countries because of the Dutch disease (Gelb 1988; Auty 1993; Sachs and Warner 2001). Other regional studies of the Middle East and North Africa (MENA) region have estimated lost opportunities because of currency appreciation (a Dutch disease symptom) (Nabli and Veganzones 2002; Nabil, Keller et

al. 2004). According to the latter authors, because of currency overvaluation during 1970-99 in the MENA region, the ratio of exports to GDP was reduced by 18% on average per year.

Other recent work in the region has suggested that the exchange rate has not been affected by the oil export boom to the extent it has been indicated in the past. According to Setser (2007), the GCC real effective exchange rate has not been appreciating in response to international oil price increases. Setser found that the exchange rate in the majority of the GCC dropped by 22% during 2001-2006, despite the significant international oil prices increases.

This chapter is organised as follows. Section 4.2 specifies the objective of the chapter. Data and the methodology used to establish the link between oil price movements and GDP growth, government revenue and the exchange rate are discussed in Section 4.3. Section 4.4 presents the results of the time series analysis of the investigated variables, that is, the oil price movements and GDP growth, government revenue and the exchange rate. The Dutch disease and its possible impact on GDP sectors, the non-traded sector (services), labour market, and exchange rate is discussed in Section 4.5, and Section 4.6 offers a summary of this chapter.

4.2 OBJECTIVES OF THIS CHAPTER

Using the historical data as evidence in Chapter 2 dealing with the Oman economy, we argued that the oil and service sectors have dominated the economy and that government spending policies have influenced the size and the overall demand of domestic economy. Further, the chapter hypothesized that government policies are increasing the size of national output through fiscal expansion policy, oil resources extraction, and the provision of social services and basic infrastructure. This is not sustainable because of their strain on the country's financial assets and the compromise of future generations' resources. This chapter examines firstly the impact of oil price movements on GDP, exchange rates and fiscal revenue. Once the links between oil income, GDP, exchange rate and government revenue are established, and the dynamics of the effect of the oil price on economic output and fiscal revenues are understood, the next section explains the relationship between oil income and the exchange rate, the

manufacturing sector, the service sector, and labour (the four symptoms of the Dutch disease).

The second objective of this chapter is to investigate Dutch disease and its possible effect on the economy. The prominent role and size of services in the economy, coupled with a decline in the size of the agriculture and fisheries sector and the small contribution of the manufacturing sector to the economy, suggest that the Omani economy is suffering from Dutch disease. Indeed, the Omani Fifth Five-year Development Plan warned that the "bias" towards the production of services is the result of high currency appreciation and that is one of the symptoms of Dutch disease (1997). To build a complete picture and understanding of the transmission channels of oil resources into the economy, this chapter investigates the possible impact of Dutch disease on the national output.

According to Dutch disease theory, countries with abundant natural resources, minerals in particular, suffer from four major symptoms: exchange rate appreciation, a decline in the manufacturing sector, a boom in the service sectors and a labour shift from the manufacturing sector to the services sector and the resource extraction sector (Corden and Neary 1982). Dutch disease has also been linked to other negative outcomes associated with a resource boom, such as rent-seeking activities and corruption (Mehlum, Moene et al. 2002; Stevens 2003).

We focused on these four major economic symptoms of Dutch disease in answering the following questions:

- Has the Omani economy suffered from Dutch disease?
- Besides the oil sector, why did services becmme the other major economic activity? What is the link between services and Dutch disease in Oman?
- Did the traded sector, including the manufacturing and agriculture and fisheries sectors, decline as a result of the oil sector boom?

4.3 DATA AND METHODOLOGY

The time series data used in this section was gathered from the IMF's International Financial Statistics, the World Bank's World Development, the Oman Statistical Year Books and various governmental/national institutions in Oman, and it covers annual series from 1970 to 2006 for the variables GDP, government revenue and the exchange rate. The data was further transformed from nominal to real terms using price deflator index (consumer price index 2000). International oil prices were sourced from Oman's Statistical Year Books and the Omani Ministry of Finance and compared with the International Energy Agency (IEA) price information.

To investigate the link between oil price shock and GDP growth, government revenue and the exchange rates, we applied a cointegration and error correction model technique that captured both long-run and short-run dynamics of oil price shocks. The long-run and short-run impacts of oil prices on Oman's macroeconomic environment are critical to understanding the linkages and transmission channels of oil resources into the non-oil economy. In addition, such understanding would help policy makers in Oman in prescribing the proper policy to achieving diversification and lessening economic oil dependence.

The VAR and cointegration approach proceeded in four steps. In the first step, variables were selected for the data generating process (DGP). The time series of the individual variables were then investigated for deterministic and stochastic trends, and structural changes. A standard practice in the literature is to first test the individual variables for stationarity using the augmented Dickey Fuller (ADF) procedure. The ADF test is based on the following equation with constant and trend:

$$\Delta y_t = \alpha_0 + \beta t + (\rho - 1) y_{t-1} + \theta \sum_{i=1}^{m} \Delta y_{t-1} + e_t \qquad (4.1)$$

where $\Delta y_t = y_t - y_{t-i}$, y is the variable we are testing, m is the number of lags and e_t is stochastic error term. The ADF can also be constructed without a constant or trend as:

$$\Delta y_t = \delta y_{t-1} + \theta \sum_{i=1}^{m} \Delta y_{t-1} + e_t \qquad (4.2)$$

where $\delta = (\rho - 1)$.

The hypothesis is: H0:$\delta = 0$(unit root)

H1:$\delta \neq 0$

If t*>ADF critical value then we cannot reject null hypothesis, i.e. unit root exists. If t*<ADF critical value then we reject the null hypothesis, i.e. unit root does not exist.

If the stationary test showed that all of the variables were stationary I (0), then a VAR in levels could be estimated. If, however, the variables are non-stationary and integrated of the same order, a cointegration VAR model was used.

In the second step, a VAR in levels was estimated. VAR models were developed to avoid the problems associated with the endogenous/exogenous assumptions (Sims 1980).[21] The method treats each variable in the equation as the result of its own lags and the lags of all other variables in the model. Following Asteriou (2006), VAR regression can take the following form:

$$y_{1t} = \beta_{10} + \beta_{11} y_{1t-1} + \alpha_{11} y_{2t-1} + u_{1t} \quad (4.3)$$

$$y_{2t} = \beta_{20} + \beta_{21} y_{2t-1} + \alpha_{21} y_{1t-1} + u_{2t} \quad (4.4)$$

and equations (4.3) and (4.4), can be written as:

$$\begin{pmatrix} y_{1t} \\ y_{2t} \end{pmatrix} = \begin{pmatrix} \beta_{10} \\ \beta_{20} \end{pmatrix} + \begin{pmatrix} \beta_{11} & \alpha_{11} \\ \alpha_{21} & \beta_{21} \end{pmatrix} \begin{pmatrix} y_{1t-1} \\ y_{2t-1} \end{pmatrix} + \begin{pmatrix} u_{1t} \\ u_{2t} \end{pmatrix} \quad (3.5)$$

$$y_t = \beta_0 + \beta_1 y_{t-1} + u_t \quad (3.6)$$

In the third step, a reduced rank of cointegrated VAR was estimated in levels to identify the cointegrating vectors and estimate the parameters of the long-run relationship. In this process, we imposed restrictions on the rank to ensure that the cointegration space imposed on the VAR model was such that the restricted long-run matrix was identified for a specific rank identity. In addition, the imposed restriction allowed us to test and provide evidence of the long-run relationship between our variables, and how the independent variables influenced the dependent variables.

[21] Such problems include the limits of economic theory to specify dynamic identities among the estimated variables, and the side of endogenous variables may be present in both sides of an equation.

In the fourth, and final, step the cointegrating VAR was transformed into a vector error correction model (VECM). VECM captures the changes of the short-run dynamics of the estimated variables, while it restricts the long-run behaviour of the variables. According to the theory, the error correction mechanism or "equilibrium error" captures the speed of adjustment towards a long-run equilibrium state (Charemza and Deadman 1992). Since we investigated more than two variables in our models, we used the VECM Johansen maximum likelihood (ML) cointegration technique to determine the possible number of long-run relationships in our variables. The Johansen procedure makes use of the β coefficients to derive long-run equilibrium and the α coefficients or the error correction term that measures the speed of adjustment towards long-term equilibrium. As explained by Asteriou (2006), the procedure is based on the VAR method of cointegration and the VECM equations can be expressed as:

$$x_t = A_1 x_{t-1} + u_t \tag{4.7}$$

$$\Delta y_t = (A_1 - I)x_{t-1} + u_t \tag{4.8}$$

$$\Delta x_t = \prod x_{t-1} + u_t \tag{4.9}$$

where $, \prod = (A_1 - I)$ and in a system of g variables x_t and u_t are g*1 vectors, A_1 is a g*g matrix of parameters and I is a g*g identity matrix.

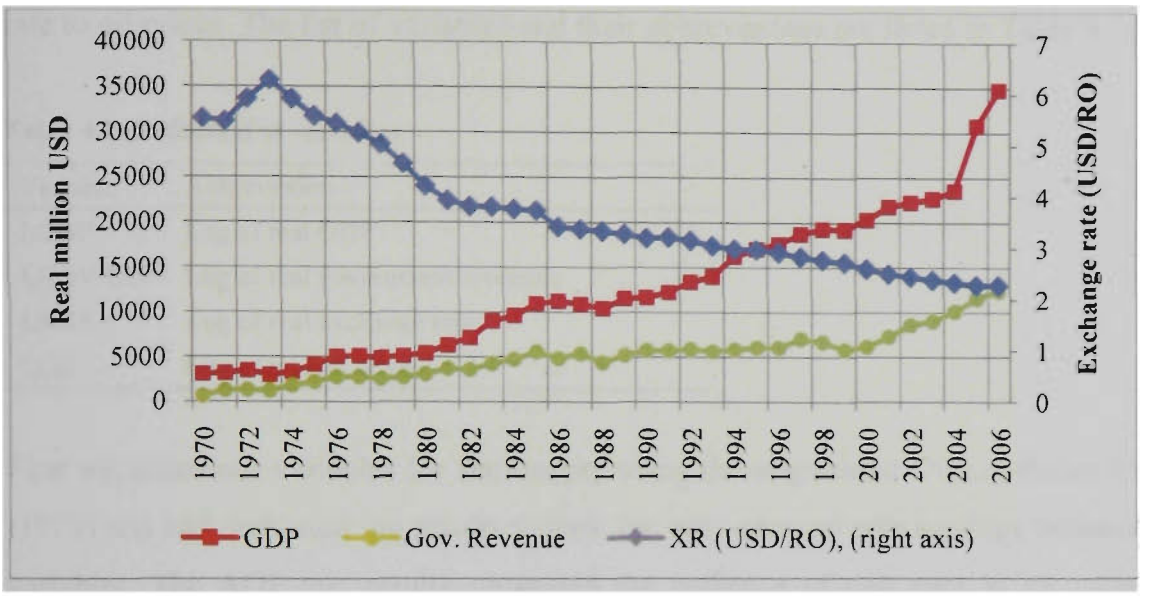
4.4 OIL PRICE, GDP AND GOVERNMENT INCOME: TIMES SERIES ANALYSIS

Since domestic production has been dominated by the oil sector, oil revenues accounted for most of the government's revenues and oil exports have been the most important export commodity, it is likely that there would have been strong relationships between Oman's GDP, exchange rate, fiscal revenues and the price of oil. Looking at figures 4.1 and 4.2, it is difficult to draw definite conclusions about the relationship between oil price, GDP, government revenue and exchange rates.

Although the GDP and government revenue variables have not been as volatile as the oil price, they seem to have followed oil price trends. Like oil prices, GDP and government revenues experienced sharp increases during 1970-1983, followed by more sharp increases during 2001-2006, again in line with oil prices movements. The exchange rate did not seem to be linked to oil price movements at all. In fact, the real

exchange rate has been depreciating since 1974, except in 1991 where it increased by 0.4%. Like most GCC countries, Oman has been pegging its exchange rate to the US dollar to contain inflationary pressures and provide domestic currency stability (Omani Ministry of National Economy 1984-2006).[22]

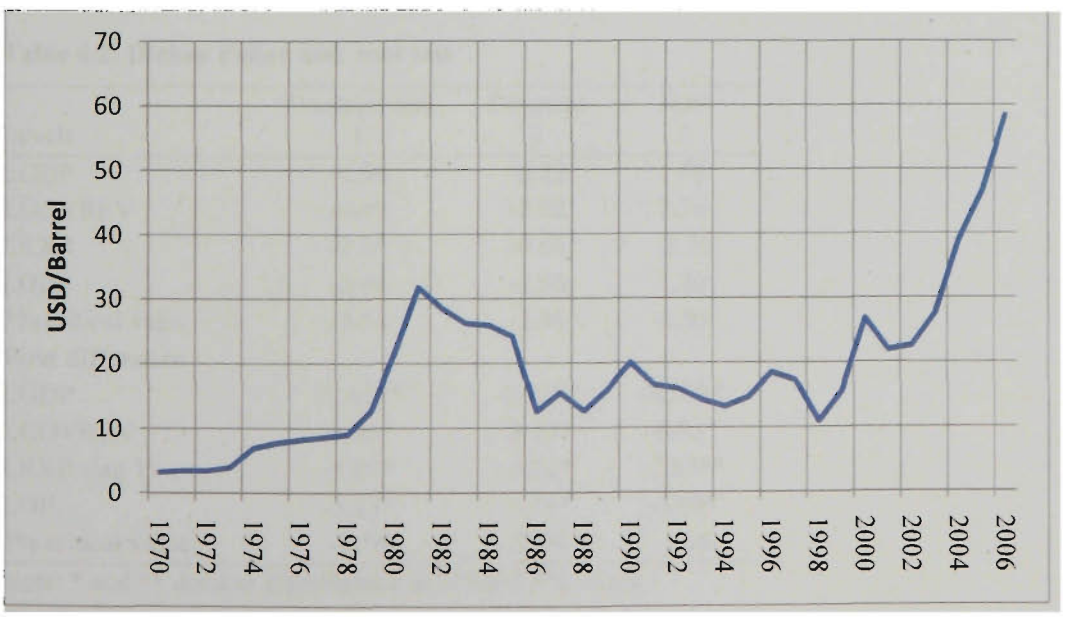
Figure 4.1: GDP, government revenue and real exchange rate, 1970-2006



Note: XR is exchange rate.

Sources: *Statistical Year Book*, Oman, various issues; for the exchange rate ERS International Macroeconomic Data Set.

Figure 4.2: International oil price, 1970-2007



Source: *Statistical Year Book*, Oman, various issues.

[22] USA$= 0.3457 Rial Omani in 1974 to 1985 and 0.3845 Rial Omani since 1986.

4.4.1 Oil Dependency: Long-term and Short-term Empirical Investigation

Cointegration and vector error correction models (VECM) were used to examine the long-run relationship effect and short-run dynamics of oil prices and exchange rate changes on GDP and government revenues. The test provided empirical evidence on the long-term relationships between real GDP, real government revenues and real exchange rate to oil prices. The list of variables and their abbreviations are listed in Table 4.1.

Table 4.1: Definition of variables

Variable	Abbreviation
LGDP	Log of real GDP
LGOVREV	Log of real government revenues
LRXR	Log of real exchange rate
LOIL	Log of real oil price

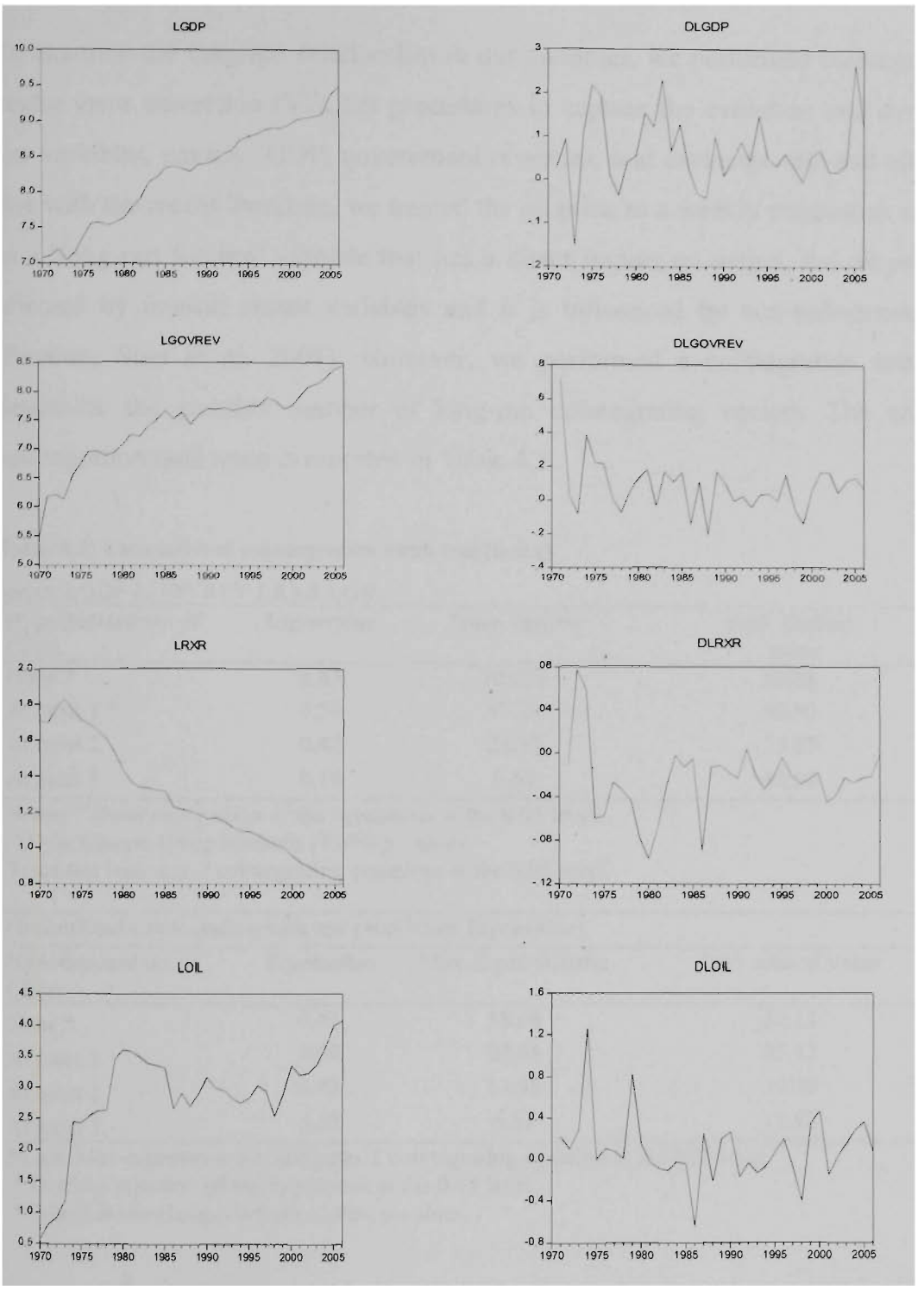
First we tested our variables for stationarity using the augmented Dickey-Fuller (ADF) (1979) test and then used the results to look for inter-sectoral relationships between our variables. The ADF test results suggested the presence of unit root in all variables. Nevertheless, in levels we cannot reject, the null hypothesis that the variables are not stationary. However, when we differentiate our variables, they become stationary, and therefore the null hypothesis was rejected in favour of the alternative hypothesis. Hence, our variables were integrated of first order $I(1)$ (see figures 4.2 and 4.3).

Table 4.2: Dickey Fuller unit root test

Levels	Constant and 1	Constant 2	Non 3
LGDP	-2.34	-0.22	1.48
LGOVREV	-4.96	-2.92	2.76
LRXR	-2.59	-0.66	-2.30
LOIL	-2.48	-2.50	1.20
5% critical value	-3.54	-2.96	-1.95
First difference			
LGDP	-3.82**	-3.92**	-2.27**
LGOVREV	-7.96*	-8.17*	-6.93*
LRXR (lag 1)	-5.00*	-5.02*	-2.83**
LOIL	-5.37*	-5.36*	-4.99*
5% critical value	-3.56	-2.96	-1.95

Note: * and ** donates significance at 1% and 5% levels.

Figure 4.3: Variables in levels and after first difference, 1970-2006



Note: D indicates differentiated variable.

In Figure 4.3, GDP and government revenue seem to be positively correlated with oil price trends. Notice how the fluctuation in oil prices affected GDP and government revenue. On the other hand, the exchange rate does not seem to have followed oil price movements and has not experienced similar fluctuations, like the previous three variables. The real exchange rate graph shows that it has been depreciating since 1975.

4.4.2 Long-run Estimation: VAR and Cointegration

To examine the long-run relationship in our variables, we performed cointegration and vector error correction (VECM) procedures to capture the evolution and dynamics of our variables, namely: GDP, government revenues, real exchange rate and oil price. In line with the recent literature, we treated the oil price as a weakly exogenous variable or as a 'long-run forcing' variable that has a direct impact on output, but oil price is not affected by non-oil sector variables and it is influenced by non-endogenous factors (Pesaran, Shin et al. 2001). However, we performed a cointegration test first, to determine the possible number of long-run cointegrating vectors. The unrestricted cointegration rank trace is reported in Table 4.3.

Table 4.3: Unrestricted cointegration rank test (trace)

Series: LGDP LGOVREV LRXR LOIL

Hypothesized no. of CE(s)	Eigenvalue	Trace statistic	0.05 Critical value	Prob.**
None *	0.83	105.31	63.88	0.00
At most 1 *	0.50	47.24	42.92	0.02
At most 2	0.42	24.59	25.87	0.07
At most 3	0.18	6.61	12.52	0.39

Notes: * Denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.
Trace test indicates 2 cointegrating equations at the 0.05 level.

Unrestricted cointegration rank test (maximum Eigenvalue)

Hypothesized no. of CE(s)	Eigenvalue	Max-Eigen statistic	0.05 critical value	Prob.**
None *	0.83	58.08	32.12	0.00
At most 1	0.50	22.65	25.82	0.12
At most 2	0.42	17.98	19.39	0.08
At most 3	0.18	6.61	12.52	0.39

Notes: Max-eigenvalue test indicates 1 cointegrating equation at the 0.05 level.
* Denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

A trace of cointegration indicated that there are two long-run relationships in our variables. To use VAR language, we rejected the null hypothesis of (K=0) and our test suggested that we have two cointegrating vectors (K=2), though the maximum Eigenvalue test indicated that there is one cointegrating long-run relationship in our variables, because both tests are used equally in the literature, and according to Toda (1994) trace results in case of a small number of samples is better. Further, Lutkepohl, Saikkonen et al. (2001) found that the results of both tests are similar. We were

interested in understanding the effect of oil prices and exchange rates on GDP and government revenue, so in the first equation we normalized the β-vector for GDP and assumed that government revenue was not a relevant factor in explaining the national output, so we set government revenue variable to zero. In the second equation, we normalized the β-vector for government revenues and we assumed that the exchange rate was not a relevant factor in explaining government receipts, so we set the exchange rate to zero.

The results suggested that the exchange rate variable was negatively correlated to GDP growth and in the second regression the GDP variable was significantly negative to government revenues. These results were not as expected for the exchange rate and government revenue in relation to GDP (see Table 4.4).

Table 4.4: Long-run equilibrium, oil price change and GDP, and government revenue

Cointegrating equation	Cointegration equation 1	Cointegration equation 2
LGDP(-1)	1.00	-0.47*
		(0.06)
		[-7.29]
LGOVREV(-1)	0.00	1.00
LRXR(-1)	2.47*	0.00
	(0.09)	
	[27.71]	
LOIL(-1)	0.10***	-0.54*
	(0.05)	(0.09)
	[1.74]	[-6.27]
C	-11.67	-2.01

Notes: *, ** and *** indicate statistical significance at the 1%, 5% and 10% levels respectively.
Standard errors in ( ) and t-statistics in [ ].
Note also that when written in proper equation order, the sign of the variables will reverse. This should be taken into account for correct interpretation. Figures given directly reflect results taken from the program.

We re-ran our test but this time we set the exchange rate and government variables to zero in the first equation (GDP equation), and in the second equation (government revenue equation) we set the exchange rate and GDP to zero. We found two long-run cointegration vectors for GDP and government revenues in the following form (see also Table 4.5):

$$gdp_t = 0.26 oilprice_t + 0.05 time + 6.50 \qquad (4.10)$$

$$govrev_t = 0.57 oilprice_t + 0.03 time + 5.24 \qquad (4.11)$$

Table 4.5: Long-run equilibrium, oil price change and GDP, and government revenue

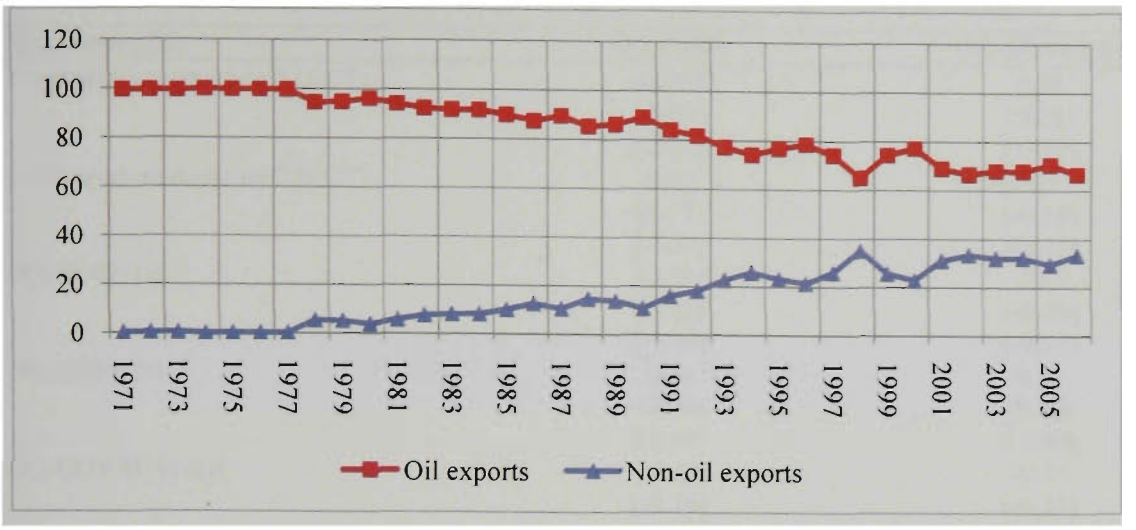
Cointegrating equation	Cointegration equation 1	Cointegration equation 2
LGDP(-1)	1.00	0.00
LGOVREV(-1)	0.00	1.00
LRXR(-1)	0.00	0.00
LOIL(-1)	-0.26***	-0.57***
	(0.065)	(0.09)
	[-4.18]	[-6.32]
@TREND(70)	-0.052***	-0.027***
	(0.00)	(0.00)
	[-17.84]	[-6.54]
C	-6.51	-5.25

Note: *** indicate statistical significance at 1%.
Standard errors in ( ) and t-statistics in [ ].
Note also that when written in proper equation order, the sign of the variables will reverse. This should be taken into account for correct interpretation. Figures given directly reflect results taken from the program.

On the long-run, oil price had a positive impact on GDP and government revenues. The first and second long-run equations state that a 10% increase in oil prices caused 2.6% growth in GDP and 5.7% increase in government revenues. As expected, the impact of oil price changes on both variables was positive. It was also expected that government revenues were more affected by oil price fluctuations because of heavy reliance on oil income proceeds.

The question asked at that point was, what about the exchange rate? How did the exchange rate affect GDP? The exchange rate movement did not have much effect on GDP. This low impact of exchange rate on GDP can be explained by the overwhelming size of crude oil exports and the small contribution of non-oil output to exports. The international market demand for oil has not been affected by exchange rates because of the low price elasticity of demand for energy. And although, non-oil exports output contribution to total exports increased from virtually zero in 1970 to 33% in 2006, it was not affected by exchange rate movements (see Figure 4.4). In addition, as evident from Figure 4.1 the exchange rate has been depreciating and would not have had a negative impact on GDP output.

Figure 4.4: Oil and non-oil exports (percentage contribution), 1971-2006



Source: *Statistical Year Book*, Oman, various issues.

4.4.3 Short-run Dynamics

We examined the short-run fluctuations by a vector error correction model (VECM). The error correction model (ECT) was used to understand the dynamics of short-run equilibrium between variables and the impact of a sudden change/shock on the system. As expected, the error correction term (ECT) that captures the speed of adjustment to equilibrium is statistically significant and negative for the GDP and government revenue regressions. Hence, the two regressions support the cointegration results (see Table 4.6). Note that we perform various diagnostic checks for residual heteroscedasticity and autocorrelation problems. From the statistics given, we note that our estimation results are free from the theoretical and estimation problems of heteroscedastisity and autocorrelation problems. The results from the Jarque-Bera test also show the residuals are normally distributed. The reported error correction parameters are -0.65 and -0.41 for the GDP and government revenue equation respectively. This indicates that at time t (current period), more than 65% of the deviation from the long-run equilibrium at time t-1 (previous period) in the GDP variable was corrected. The error coefficient for the government revenue variable showed a 41% movement back towards equilibrium, following the oil price shock. In addition, our test suggested that a 10% oil price movement upwards in the short run was associated with a 1.7% increase in government revenue, confirming the close dependency of government revenue on oil income.

Table 4.6: Short-run equilibrium, oil price change and GDP, and government revenue

Error correction	D(LGDP)	D(LGOVREV)
Cointegration equation 1 (ECT)	-0.65***	0.20
	(-0.20)	(0.24)
	[-3.22]	[0.87]
Cointegration equation 2 (ECT)	0.20	-0.41***
	(0.15)	(-0.18)
	[1.33]	[-2.32]
D(LGDP(-1))	0.43**	-0.07
	(0.22)	(-0.29)
	[1.94]	[-0.24]
D(LGDP(-2))	0.21	0.22
	(0.20)	(0.27)
	[1.01]	[0.80]
D(LGOVREV(-1))	-0.20	-0.15
	(-0.16)	(-0.23)
	[-1.26]	[-0.69]
D(LGOVREV(-2))	-0.23***	-0.18
	(-0.10)	(-0.14)
	[-2.18]	[-1.27]
D(LRXR(-1))	0.35	0.45
	(0.48)	(0.65)
	[0.72]	[0.69]
D(LRXR(-2))	0.71	1.91***
	(0.45)	(0.61)
	[1.57]	[3.117]
#D(LOIL(-1))	-0.03	-0.04
	(-0.06)	(-0.08)
	[-0.45]	[-0.47]
D(LOIL(-2))	0.07	0.17***
	(0.05)	(0.068)
	[1.45]	[2.52]
C	0.08***	0.13***
	(0.03)	(0.04)
	[3.02]	[3.65]
R-squared	0.60	0.64
Adj. R-squared	0.42	0.49
Sum sq. resids	0.10	0.17
S.E. equation	0.07	0.09
F-statistics (p. value)	5.458 (0.004)	6.203(0.010)
LM(2)- $\chi^2(2)$	7.233 (0.149)	5.18 (0.186)
ARCH (2)	2.38 (0.217)	2.94 (0.158)
JB (2)	1.04 (0.064)	1.33 (0.097)

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Standard errors in ( ) and t-statistics in [ ]. ARCH is AutoRegressive Conditional Heteroscedasticity effect and ***we*** are ***testing*** for ***heteroscedasticity*** at the 0.05 significant level, LM is multivariate test statistics for residual serial correlation and JB is the Jarque-Bera residual vector normality test.

ECT is the error correction term.

Although oil price in period t-1 is negatively associated to GDP it is statistically insignificant and can be expected because multicollinearity. Hence, this should not reduce the overall significance of the model.

4.4.4 GDP and the Exchange Rate: Quarterly Data

To see how consistent our results were in relation to GDP, government revenue and the exchange rate, we applied the procedure on quarterly data. The Ministry of National Economy provided quarterly data on GDP, government revenue, oil prices and the real effective exchange rate for the period 1995Q1-2006Q4. We tested for long-run relationships and found that there were two cointegrating vectors. The unrestricted cointegration rank trace is reported in Table 4.7.

Table 4.7: Unrestricted cointegration rank test (trace)

Series: LGDP LGOVREV LRXR LOIL

Hypothesized no. of CE(s)	Eigenvalue	Trace statistic	0.05 critical value	Prob.**
None *	0.41	51.37	47.86	0.02
At most 1 *	0.38	30.93	29.80	0.037
At most 2	0.26	12.16	15.49	0.15
At most 3	0.02	0.60	3.84	0.44

Notes: Trace test indicates 2 cointegrating equations at the 0.05 level.
* Denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

Unrestricted cointegration rank test (maximum eigenvalue)

Hypothesized no. of CE(s)	Eigenvalue	Max-Eigen statistic	0.05 critical value	Prob.**
None*	0.41	29.44	27.58	0.04
At most 1	0.38	18.77	21.13	0.10
At most 2	0.26	11.56	14.26	0.13
At most 3	0.02	0.60	3.84	0.44

Notes: Max-eigenvalue test indicates no cointegration at the 0.05 level.
* Denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

The cointegration rank trace indicates that we can formulate and estimate two error correction models that capture the short-run and long-run dynamics. In the first equation, we normalized the β-vector for GDP and set the revenue and exchange rate variables to zero; and in the second equation, we normalized the β-vector for revenues and set GDP and exchange rate variables to zero. We treated oil prices as weakly exogenous to all vectors.

The results show that GDP and government revenues were positively correlated to oil price changes (see Table 4.8). Oil price had a positive impact on GDP and government revenues. The first and second long-run equations (column (1) and column (2)) states

that a 10% increase in oil prices caused 6.1% growth in GDP and 5.6% increase in government revenues. The impact of oil price change on both variables was positive and the signs are expected. These results are consistent and close to the previous annual data (see Section 5.3). In addition, the quarterly data suggested that oil prices had a much stronger impact on GDP (10% increase in oil prices caused 6.1% growth in GDP) than was suggested by the annual data series (oil prices caused 2.6% growth in GDP).

Table 4.8: Long-run equilibrium, oil price changes and GDP, and government revenue

Cointegrating equation	Cointegration equation 1	Cointegration equation 2
LGDP(-1)	1	0
LGOVREV(-1)	0	1
LRXR(-1)	0	0
LOIL(-1)	-0.61***	-0.56***
	(-0.06)	(-0.14)
	[-11.01]	[-4.02]
C	-4.22	-2.36

Notes: ***indicate statistical significance at 1% level.
Standard errors in ( ) & t-statistics in [ ].
Note also that when written in proper equation order, the sigh of the variables will reverse. This should be taken into account for correct interpretation. Figures given directly reflect results taken from the program.

4.4.5 Short-run Dynamics

The reported error correction parameters range between -0.23 and -1.86 for the GDP and government revenue equations, respectively (see Table 4.9). While being negative and statistically significant, these results validate our use of dynamic error correction framework in our estimation. It is also common that these sort of multivariate regressions show lower R-square. From the coefficients ECT term, we could say, for example, that the government revenue regression shows a 180% movement back towards equilibrium following the oil price shock, an indication of the strong impact of the oil price shock on government revenue. In addition, our test suggested that a 10% oil price movement upwards in the short run was associated with 2.9% increase in GDP, confirming the close dependency of GDP on oil income.

Table 4.9: Short-run equilibrium, oil price change and GDP, and government revenue

Error correction	D(LGDP)	D(LREV)
Cointegration equation 1	-0.23**	-1.86***
	(0.12)	(0.77)
	[-1.91]	[-2.40]
Cointegration equation 2	0.13***	0.15
	(0.04)	(0.25)
	[3.35]	[0.60]
D(LGDP(-1))	-1.04*	0.68
	(0.40)	(1.41)
	[-2.58]	[0.48]
D(LGDP(-2))	-0.49	-0.88
	(0.45)	(1.57)
	[-1.09]	[-0.56]
D(LGDP(-3))	-0.49	-0.169
	(0.46)	(1.61)
	[-1.07]	[-0.11]
D(LGDP(-4))	-0.34	1.45
	(0.40)	(1.40)
	[-0.86]	[1.03]
D(LGOVREV(-1))	-0.013	-0.61
	(0.11)	(0.37)
	[-0.12]	[-1.61]
D(LGOVREV(-2))	-0.07	-0.73***
	(0.10)	(0.36)
	[-0.69]	[-2.05]
D(LGOVREV(-3))	0.058	-0.38
	(0.100)	(0.35)
	[0.57]	[-1.08]
D(LGOVREV(-4))	0.053	-0.04
	(0.087)	(0.31)
	[0.60]	[-0.12]
D(LXR(-1))	-0.081	-0.99
	(0.52)	(1.82)
	[-0.17]	[-0.54]
D(LXR(-2))	0.69	-0.01
	(0.52)	(1.81)
	[1.34]	[-0.00]
D(LXR(-3))	0.48	0.48
	(0.52)	(1.82)
	[0.93]	[0.26]
D(LXR(-4))	0.20	1.44
	(0.48)	(1.70)
	[0.41]	[0.85]
D(LOIL(-1))	0.29***	-0.21
	(0.14)	(0.50)
	[2.04]	[-0.41]
D(LOIL(-2))	0.27*	0.66
	(0.15)	(0.54)
	[1.77]	[1.23]
D(LOIL(-3))	0.18	-0.10
	(0.17)	(0.59)
	[1.06]	[-0.17]
D(LOIL(-4))	0.19	-0.62
	(0.16)	(0.56)
	[1.17]	[-1.12]
C	0.05***	0.046
	(0.02)	(0.08)
	[2.45]	[0.61]
R-squared	0.48	0.52
Adj. R-squared	0.02	0.09
Sum sq. residuals	0.08	0.93
S.E. equation	0.06	0.22
F-statistics	1.691 (0.062)	1.362 (0.058)
LM(2)- $\chi^2(2)$	5.194 (0.124)	4.32 (0.107)
ARCH (2)	2.61 (0.217)	3.11 (0.09)
JB (2)	1.89 (0.111)	1.22 (0.105)

Notes: ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Standard errors in ( ) and t-statistics in [ ].

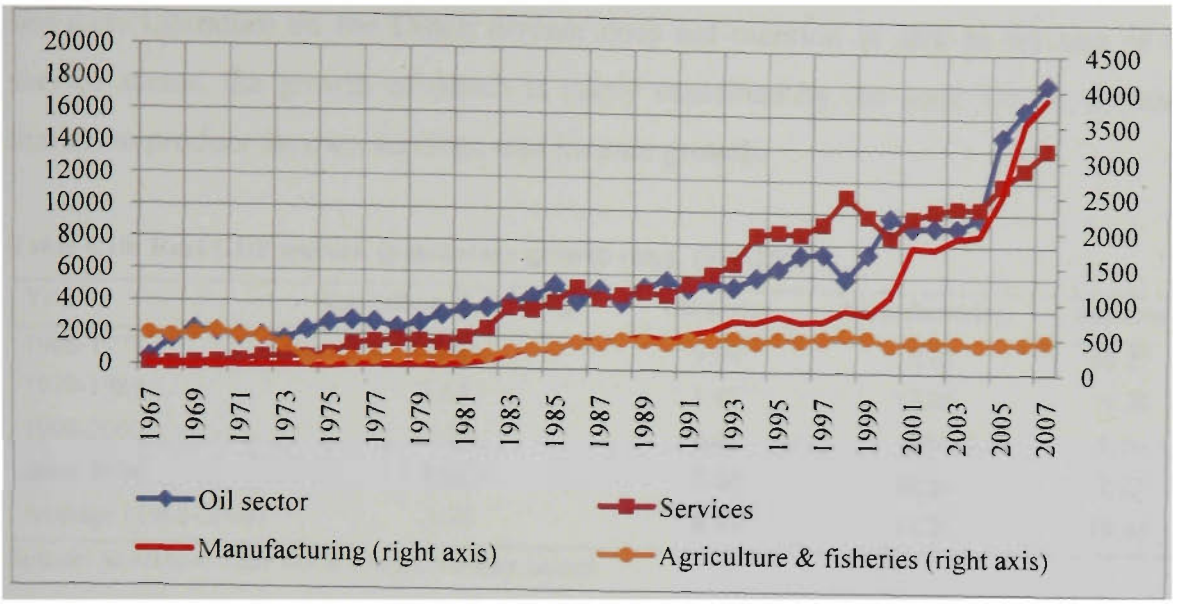
4.5 DUTCH DISEASE AND ITS EFFECTS ON OMAN

Did the sudden flood of income from the oil sector into the economy harm the manufacturing sector and did the manufacturing sector retard as a result? The historical data indicate that, although the manufacturing sector contribution to GDP has been small, it has benefited from the oil export boom. In fact, apart from the agriculture sector, all sectors of the economy have benefited equally from the oil sector boom. The oil, manufacturing, and services sectors, all grew by 14% per year (real growth) between the years 1967 and 2006. Therefore, the oil sector boom has had a positive impact on the overall growth of the manufacturing sector.

Figure 4.5 shows the evolution of the GDP sectors: oil, agriculture and fisheries, manufacturing, and services. With the exception of the agriculture and fisheries sector the oil and non-oil sectors seem to be strongly linked. Hence, our historical data show that, unlike agriculture and fisheries, the manufacturing sector has not been put under pressure as a result of a boom in the energy sector. The manufacturing sector experienced an annual growth rate of 14% in 1967-2006. Similarly, during the same period, services experience 14% growth rate annually (see Table 4.10).

The agriculture sector seems to have experienced *de-agriculturization*. The sector's contribution to GDP dropped from 34% in 1967 to just 2.5% in 2007. However, the traditional agriculture and fisheries sector, as far as size is concerned, has been dwarfed by the oil sector boom. In other words, the proportional contribution of the agriculture and fisheries sector to national output decreased as a result of the energy sector boom, but not as a result of a sudden drop in the actual size of the agriculture sector. In 1967, the sector added value was estimated to be 500 million USD (constant 2000 prices), the same as in 2007 (see Figure 4.3). The sector experienced a significant decline during 1968-1978 (see Table 4.10). This significant drop in the sector could be linked to the sudden boom in the oil sector industry.

Figure 4.5: Oil sector and non-oil sector (real million USD), 1967-2006



Note: Construction and electricity and water sectors are not included.

Source: *Statistical Year Book*, Oman, various issues.

4.5.1 Dutch Disease and the Non-trade Sector

The second economic symptom of the Dutch disease is the growth of the non-traded sector, services, at the expense of the traded sector. Did the non-traded sector growth outstrip the growth of other sectors of the economy? While it is true that the service sector's importance increased from 9% in 1967 to 37% in 2006, its growth rate over the last 40 years, as mentioned above, was comparable to the manufacturing sector. Both sectors experienced an annual average growth rate of 14% between the years 1967 and 2006 (see Table 4.10).[23] The booming mineral sector in Oman, unlike that of the Netherlands, United Kingdom or Australia did not lead to *de-industrialization*.

The size of the service sector could be attributed to several underlying factors. The income elasticity of demand for services is high and the demand for basic food and manufactured products could be easily met by imports. In other words, the service market had no choice but to produce its own services. Second, the government's investment in social overhead capital and its fiscal expansion promoted the expansion of service based industry. Third, with the increasing income and wealth, demand for

[23] Oman's real annual growth rate for the period 1967-2006 is 9% according to Oman Statistical Year Books and World Bank Development Indicators.

services increased, which encouraged, in the long run, local agents to produce more services. Literature on the Dutch disease does not mention or link to the size of the service sector, the growth of which is partly explained by the need for the domestic market to produce its own services, and income growth.

Table 4.10: Real GDP sectors, (percentage growth rate), 1968-2006

Year	Agriculture & fisheries	Oil sector	Manufacturing	Services
1968-1978	-18.28	9.09	18.07	30.27
1979-1989	7.64	5.47	17.04	11.30
1990-2000	-1.29	4.62	6.26	5.84
2001-2006	1.36	7.40	16.56	7.17
Average (1968-2006)	-3.16	6.55	14.21	14.48

Source: *Statistical Year Book*, Oman, various issues.

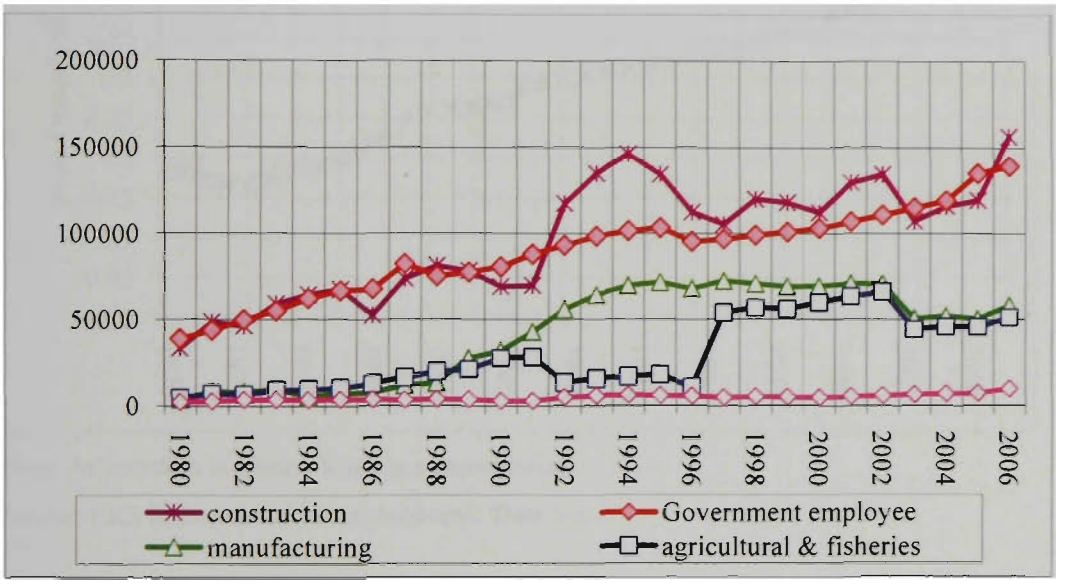
4.5.2 Dutch Disease and the Labour Market

Did capital and labour shift from the tradable sector to the non-tradable sector, as it became cheaper to import than to produce domestically? To test the proposition, we selected four economic activities from the available employment data in the Omani *Statistical Year Book* on the number of expatriate employees in the private sector, distributed according to the type of economic activity. The four economic activities we chose were: agriculture and fisheries, mining and quarrying, manufacturing, and construction (see Figure 4.6). In addition, we used data on the number of employees working for the government, Omanis and expatriates. Although the data is small and the number of observations is limited, it gave a good picture of the evolution and development of the employment sector. We did not have details of the number of Omanis working for the private sector, but according to the 2003 census, 84% of those working for the private sector were expatriates and only 16% of the private sector employees were Omanis. Therefore, and for the purpose of this exercise, the data was sufficient to explore if there was a labour shift from the tradable manufacturing sector to the booming traded sector and the non-traded sector.

The labour data showed that the construction industry and the government employed the largest number of people, followed by manufacturing and then agriculture and fisheries. The data suggested that the bulk of labour was allocated to the production of non-traded

goods. Although the service industry employed the largest number of people, that was not at the expense of the manufacturing sector. Labour and capital did not move away from the traded sector, instead the labour force in all sectors increased until 2001, with the exception of the agriculture and fisheries sector. The number of people working in agriculture and fisheries decreased. According to the statistics, between the years 1991 and 1996, the number of expatriates working for agriculture and fisheries dropped by 3%. In 2003, number of workers for the agriculture and fisheries, manufacturing and construction industries dropped, before picking up again. In short, with the exception of agriculture and fisheries sector, the historical data did not suggest any labour movement from the manufacturing sector to the booming sector or to the non-traded sector.

Figure 4.6: Number of expatriate employees by type of economic activity (selected activities), 1980-2006



Note: Government employees includes Omanis and expatriates.

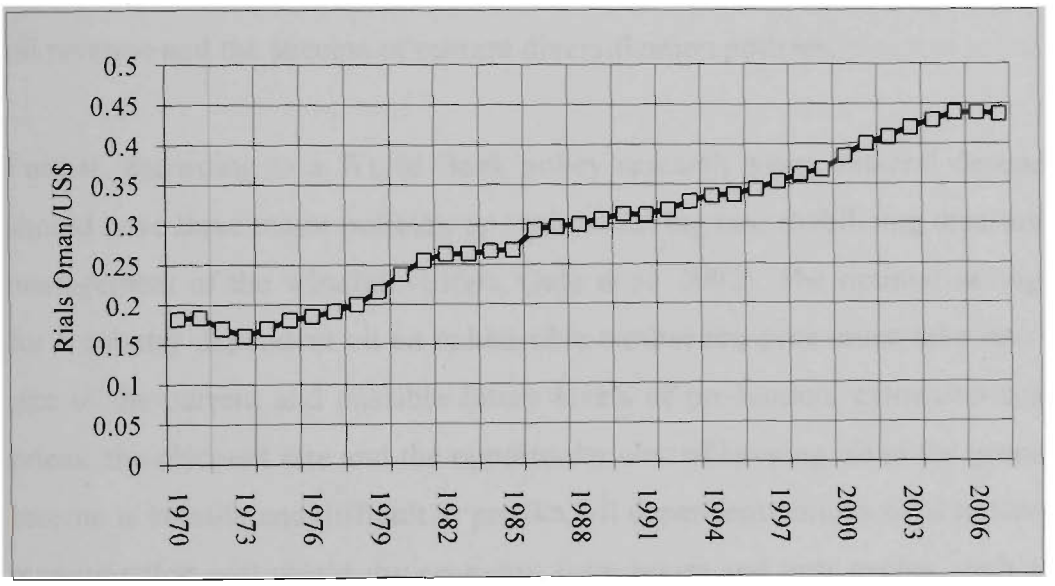
Source: *Statistical Year Book*, Oman, various issues.

4.5.3 Dutch Disease and Exchange Rate

The fourth symptom of the Dutch disease is caused by real exchange rate appreciation. Did the sudden influx of oil revenues into the oil sector cause relative prices in the non-traded sector to increase in relation to the traded sector, causing an appreciation of the real exchange rate? Figure 4.7 shows that the real Rial Omani (RO) has been depreciating since 1970. The open character of the economy and the fixed exchange rate to the USD contributed to the stability the stability of exchange rate (Khan 2009). The

other contributing factors to the stability of the exchange rate are low cost of energy and low cost of labour. The value of the exchange rate could not have been the problem facing the non-oil sector, as claimed by the Development Council. As discussed in Section 5.3, the exchange rate is not a relevant factor in explaining output growth in Oman because of the relative small size of non-oil exports to national output. In addition, since the exchange rate in Oman is pegged to the USA dollar, fiscal policy is the only available option that could reduce the impact of a positive shock on the money supply on the domestic economy.

Figure 4.7: Real exchange rate (RO/USD), 1970-2007



Note: An increase in Omani Rials is a depreciation.

Source: ERS International Macroeconomic Data Set.

4.6 CONCLUSION

In this chapter we examined how the national economy, government revenue and exchange rates are affected by international oil price shocks. We investigated the time-series properties of the data in order to avoid spurious results, and then we applied a cointegration and error correction model technique that captured long-run and short-run dynamics of the investigated variables. Further, we examined the Dutch disease and evaluated its impact on the economic output of Oman.

Firstly, the empirical findings show that oil price movements had a significant impact on GDP and government revenue.[24] The long-run GDP and government revenue equations suggest that there has been a positive relationship between oil price change, and GDP and government revenue. The equation states that a 10% increase in oil prices caused 2.6% growth in GDP and a 5.6% increase in government revenues. In addition, we used quarterly data for the period 1996 to 2006 and the results confirmed strong correlation between oil price changes, and GDP and government revenue. Such results indicate that changes in oil prices would have a direct impact on GDP growth and government revenues. Over the long term, Oman's economic growth and government revenue will depend on many other factors. Such factors include fiscal management of oil revenue and the success of current diversification policies.

Further, according to a World Bank policy research paper, mineral dependant nations should have three major policies; an optimal saving rate, stabilizing measures, and good management of the windfall (Eifert, Gelb et al. 2002). The optimal saving rate policy for a country dependent on an exhaustible natural resource, must take into account the size of the current and possible future levels of production, extraction costs, resource prices, the discount rate and the opportunity cost of keeping oil in the ground. Since oil income is volatile and difficult to predict, oil dependent nations need to have stabilizing measures that will shield the economy from boom and bust cycles, such as funds that will save oil windfalls at times of boom. Good management of oil wealth requires a clear and a transparent expenditure policy by the government, to discourage rent seeking behaviour, and a balanced approach towards the distribution of the rent through prudent public spending, investment, subsidies and transfers. The linkages and interdependencies between the oil and the non-oil sectors are examined in detail in the next chapter. Details of optimal saving rates and the role of fiscal policy will be discussed in the optimal saving rate chapter.

Secondly, the chapter investigated how the exchange rate impacts GDP. The empirical findings showed that exchange rate movements did not impact GDP. However, Oman operates under a fixed exchange rate system pegged to the US dollar, and Omani

[24] As would be expected, oil price movements impact micro sectors in Oman and other oil exporting countries in the region. See for example, Hammoudeh, S. and S. Al-Gudhea (2006). Pricing Risk, Oil and Financial Factors in Saudi Sector Index Returns. Chicago, Middle East Economic Association.

exports are heavily affected by the movements in the exchange rate of the US dollar in relation to non-US dollar currencies. Therefore, fiscal policy is the only available option that could reduce the impacts of a positive shock on the money supply to the domestic economy

Thirdly, we examined the Dutch disease and its possible impacts on the economy. In particular, the chapter examined the impacts of the oil boom on exchange rates, the manufacturing and service sector, and labour. The findings show that the booming mineral sector in Oman did not lead to *de-industrialization.* While it is true that the services sector, increased from 9% in 1967 to 37% in 2006, its growth rate over the last 40 years, was comparable to the manufacturing sector. Therefore, the oil sector boom in Oman, unlike that of the Netherlands, United Kingdom or Australia did not lead to *de-industrialization.*

The size of service sector could be attributed to several underlying factors. The income elasticity of demand for services has been high and the demand for basic food and manufactured products could be easily met by imports. In other words, the service market had no choice, but to produce its own requirements. Second, government policies of investing in social overhead capital and fiscal expansion promoted the expansion of service-based industries. Third, with the increased income and wealth, demand for services increased which induced, in the long run, local agents to produce more services.

The implications of our findings are particularly important for countries with a similar kind of economic structure. The overall findings showed that the oil sector has had a positive impact on other sectors of the economy, including the manufacturing sector. Although the traditional agriculture sector appears not to have benefited from the oil sector boom, the manufacturing sector experienced significant growth following oil discovery and oil price increases. Notwithstanding, heavy reliance on oil income calls for major structural reforms that would induce non-oil sector activities and promote non-oil sector growth in the long run.

CHAPTER 5.
THE OIL AND NON-OIL SECTORS INTERDEPENDENCY[25]

... we can find no evidence of a negative impact of natural resource abundance on growth. There is no resource curse.
(Lederman and Maloney 2007)

5.1 INTRODUCTION

Literature that examines the role of natural resources in economic development differs in defining what natural resource dependence is and the way dependence or independence should be measured. Some researchers define it as the dependence of an economy on revenues originating from export income. For example, Luke (1983), investigating the role of transnational oil companies in the economic development of the Arab OPEC states, defined dependence to mean significant economic dependence on the part of resource producers on demand for natural resources from the industrial countries. And despite economic growth and the increased standard of living resulting from increased export revenues, the economies of the Arab OPEC states have not experienced any significant technological transfer or industrialization. Luke, therefore argued, that the owners of natural resources, the Arab OPEC states, are placed in what described "a complex political economy of dependent development still underpins the economic growth of the Arab OPEC countries" (Luke 1983, p981) to the industrialised countries.

Other researchers have defined natural resource economic dependency from the point view of its contribution to the economy, using several variables such as the percentage contribution of natural resource sector to GDP, ratio of natural resource exports to total exports and the ratio of natural resource revenue to total government revenue. And by implication, the higher the contribution of natural resources in the economy's output,

[25] Part of this chapter was presented at the 1st International Conference on Applied Business and Economics at Sohar University in Oman (ICABE 2009) on May 2009, and subsequently submitted for consideration at the ICFAI *Journal of Applied Economics*.

export share and government revenues, the higher the dependency, while lower ratios indicate lower dependency. Askari (1990) used the percentage contribution of natural resources exports to GDP, ratio of natural resource exports to total exports and the ratio of natural resource revenue to total revenue to measure natural resource dependency. Sachs and Warner (1995) used a similar definition, by describing resource dependent economies as those with a high value of resource-based exports to GDP.

In the wake of the poor performance of many resource rich countries since the 1980s, researchers have also been defining natural resource economic dependence to mean poor economic performance and GDP growth. For example, Limi (2006) used Botswana's strong GDP growth of 7.8% during the years 1980 to 2006 as an indication of the country's success in decreasing its dependence on natural resources. Besides GDP growth rate, Rosser (2004) used the size of non-oil exports, government revenues from oil, poverty reduction and human development index indicators to show how Indonesia has successfully reduced its dependence on natural resources and avoided the "resource curse".

In recent years researchers at the International Monetary Fund use the Hotelling (1931) rule to differentiate between exhaustible natural resources, such as oil and coal, and non-exhaustible natural resources, such as fishing and agriculture. Askari and Jaber (1999) distinguished natural dependence by type of natural resource, expressing the view that dependence on exhaustible resources requires a different set of policies to compensate for resource depletion and that non-exhaustible natural resources face different challenges.

Drawing from the literature, we define dependency to mean the skewness of the productive structure of the economy towards the production of natural resources. The non-resource sectors either play a minor role or are highly dependent on revenues from the extraction and exports of natural resources. In addition, an important aspect of natural resource dependence is the lack of a self-sustaining productive base. This lack threatens the economies of resource dependent nations when revenues fall or when the stock of resources are exhausted. Examining the interdependency and interaction between the resource sector and the non-resource sector has, therefore, increased our understanding of the dynamics of natural resources and their impact on the different

sectors of the economy. Furthermore, we believe, measuring the intersectoral linkages between the resource sector and the non-resource sectors is a better indicator of economic dependency or independency on natural resources than the straightforward measure generally used by researchers.

This chapter is organised as follows. Section 5.2 specifies the objective of the chapter. Data and the methodology that have been used to establish the link between the oil sector and the non-oil sectors (manufacturing, services, and agriculture and fisheries) are discussed in Section 5.3. Section 5.4 presents the historical development of GDP sectors including the oil, manufacturing, agriculture and fisheries, and service sectors. The oil and non-oil sectors VAR and cointegration tests and results are presented in Section 5.5. Government income/expenditure and its association to non-oil GDP growth are discussed in Section 5.6. Section 5.7 discusses the Granger causality tests. The test establishes the statistical link and association between the oil sector and the non-oil sectors. Section 5.8 offers a summary of this chapter.

5.2 OBJECTIVES OF THIS CHAPTER

The overall aim of this chapter is to investigate the dependency between the oil sector and the non-oil sector in Oman. More specifically, the chapter examines the linkages and interdependency between the agriculture and fisheries, manufacturing and services sectors, and the oil sector. It shows which sector benefited most from the oil era boom and how sensitive the non-oil GDP sectors have been to oil resources fluctuations. In doing so, we tested how sensitive and dependent the agriculture and fisheries, manufacturing, and the service sector have been to oil sector and oil price change. Then, we investigated how our three variables (agriculture and fisheries, manufacturing, and the services sectors) increase or decrease in the face of changing government expenditure. The chapter answers the following major questions:

- What were the linkages between the oil and non-oil sectors and how have changes in one sector affected other sectors?
- What were the effects of oil price changes on government income and the agriculture and fisheries, manufacturing, and services sector?

- What were the linkages and interdependencies between the non-oil sectors and how did changes in one sector affect other sectors?

Last, but not least, in our opinion, this investigation is also relevant to the recent economic performance of GCC countries that is characterized by large fiscal and current account surpluses as a result of another oil price hike in 2003-2007, and to the revived interest in the impact of mineral resources on domestic output, fiscal policy and other macroeconomic indicators (Setser 2007; Strasky, Adolf et al. 2008).

5.3 DATA AND METHODOLOGY

The time series data used in this investigation was drawn from several sets of data. The research used data gathered from the IMF's International Financial Statistics, World Bank's World Development Indicators, Oman's Statistical Year Books, and various government and national institutions. The time series cover 1967 to 2006 for the following variables: sectoral oil and non-oil GDP, and government revenue. Data were further transformed from nominal to real terms using a price deflator index (consumer price index 2000). International oil prices were taken from Oman's Statistical Year Books and the Omani Ministry of Finance and compared with those from International Energy Agency (IEA) price information.

To investigate the interdependencies between the oil and the non-oil sectors, we applied a cointegration and error correction model technique. The method is popular in analysing time series data because it simplifies regression estimation by treating all variables equally without distinguishing between what is endogenous and what is exogenous. The procedure also addresses the stationarity requirement of economic time series. In pursuing this, we first examined the series properties of each variable by unit root testing. This is important since standard econometric methodologies such as ordinary least square (OLS) regression uses stationarity, while estimation of regression in the presence of non-stationary variable leads to spurious regression, especially when variables are not cointegrated (Granger and Newbold 1974; Ekanayake 1999).

Second, in order to investigate any type of casual relationship between two or more variables, cointegration properties of the variables under consideration should also be examined. One of the methods for testing for cointegration is vector autoregression

(VAR) and vector error correction (VECM) models. VAR models were developed to avoid the problems associated with the endogenous/exogenous assumptions (Sims 1980).[26] From earlier research such as Asteriou (2006), let us begin with a VAR framework of the following form:

$$y_{1t} = \beta_{10} + \beta_{11} y_{1t-1} + \alpha_{11} y_{2t-1} + u_{1t} \quad (5.1)$$

$$y_{2t} = \beta_{20} + \beta_{21} y_{2t-1} + \alpha_{21} y_{1t-1} + u_{2t} \quad (5.2)$$

$$y_{3t} = \beta_{30} + \beta_{31} y_{3t-1} + \alpha_{31} y_{1t-1} + u_{3t} \quad (5.3)$$

Equations (1) to (3) can be re-written and combined into:

$$\begin{pmatrix} y_{1t} \\ y_{2t} \\ y_{3t} \end{pmatrix} = \begin{pmatrix} \beta_{10} \\ \beta_{20} \\ \beta_{30} \end{pmatrix} + \begin{pmatrix} \beta_{11} & \alpha_{11} \\ \alpha_{21} & \beta_{21} \\ \beta_{31} & \alpha_{31} \end{pmatrix} \begin{pmatrix} y_{1t-1} \\ y_{2t-1} \\ y_{3t-1} \end{pmatrix} + \begin{pmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \end{pmatrix} \quad (5.4)$$

$$y_t = \beta_0 + \beta_1 y_{t-1} + u_t \quad (5.5)$$

In a first phase, the study undertook a multivariate temporal Granger causality analysis. To capture the long-run equilibrium, as well as short-run dynamics, an error correction term was added to the equation upon establishing the existence of cointegration. The investigation applied a Granger causality test in a bivariate VAR structure. This was mainly for the purpose of exploring two-way causation (interdependency) between variables.

Let us consider a VAR model where a random variable can be expressed (or explained) as a function of its own past values and past values of other variables in the system. Thus an appropriate formulation will be:

$$\begin{bmatrix} y_t \\ x_t \end{bmatrix} = \beta_0 + \beta_1 \begin{bmatrix} y_{t-1} \\ x_{t-1} \end{bmatrix} + \beta_2 \begin{bmatrix} y_{t-2} \\ x_{t-2} \end{bmatrix} + \ldots\ldots\ldots\ldots + \beta_s \begin{bmatrix} y_{t-s} \\ x_{t-s} \end{bmatrix} + \varepsilon_t \quad (5.6)$$

In the above equation, β_0 and $\beta_{i=1=2\ldots=s}$ are a vector of constant terms and matrices of coefficients to be estimated respectively, while ε_t is also a vector of error terms with zero mean. When the series is stationary, the hypothesis of x_t Granger causing y_t can be

[26] Such problems include the limits of economic theory to specify dynamic identities among the estimated variables, and the side of endogenous variables may be present in both sides of an equation

tested using a standard Wald test. However, if the series is non-stationary, such a causality test will not be valid unless a common trend exists among the variables (Engle and Granger 1987).

Pasaran and Smith (1995) have developed an alternative approach, the autoregressive distributed lag (ARDL), where causality and long-run relationships can be tested regardless of the order of integration of the variables. Earlier, although ARDL-type models have been applied, the introduction of unit root and cointegration requirements of the time series made their usage suspicious if not inappropriate. Only recently has the method been revived through the work of Pesaran et al. (2001) who demonstrated the possibility of using this approach for the purpose of estimation and identification. Since then a number of studies have recognized and used the ARDL model to test for Granger causality (Pacheco-Lopez 2005; Zachariadis 2006). It is now standard practice that once the times series properties of the variables are resolved, a vector error correction system is used where both short-run and long-run dynamics are captured. One specification of this type of formulation is given by:

$$\Delta y_t = \lambda_0 + a_1 \Delta y_{t-1} + a_2 \Delta x_{t-1} + a_3 (y - \gamma x)_{t-1} + v_t \qquad (5.7)$$

where Δ is the first difference operator, the component within brackets is estimated in the first step and later enters the error correction model, parameter a_3 is the adjustment coefficient of the long-run equilibrium, while the other parameters indicate the short-run adjustments and the error term v_t is ~ IN(0,σ^2).

Finally following Johansen and Juselius (1990), tequation (5.7) above can be simplified as in a VECM framework as:

$$\Delta Z_t = \vartheta + \Gamma(L)\Delta Z_{t-1} + \prod Z_{t-1} + \varsigma_t, \; t = 1, .., T \qquad (5.8)$$

given that $Z_t = (y_{1t}, y_{2t})'$ i.e. [AGFISH, MANUF, SERVICE, OILPRICE, OILSECTOR], the second last term which captures the adjustment of the system towards long-run equilibrium can be simplified as $\Pi = \alpha\beta'$, where α is a *mxr* matrix of speed of adjustments (feedback matrix) and β is a *mxr* vector of parameters which indicates the strength of cointegrating relationships (cointegrating matrix), $\Gamma(L) = \{\beta_{ij}\}$, and the error tern ς_t captures unanticipated movements in Z_t.

The VECM procedure (under equation (5.8)) is a VAR model with a restriction developed to be used with non-stationary time series that is cointegrated. VECM captures the changes of the short-run dynamics of the estimated variables while it restricts the long-run behaviour of the variables. Accordingly, the error correction mechanism or "equilibrium error" captures the speed of adjustment towards a long-run equilibrium state (Charemza and Deadman 1992). Since we investigated more than two variables in our models, we used a VECM Johansen maximum likelihood (ML) cointegration technique to determine the possible number of long-run relationships in our variables. The Johansen procedure makes use of the β coefficients to derive long-run equilibrium and the α coefficients or the error correction term that measures the speed of adjustment towards long-term equilibrium.

Before undertaking our empirical investigation and as a standard practice in the literature, we first test our variables for stationarity using the augmented Dickey Fuller (ADF) procedure. The ADF test is based on the following equation with constant and trend:

$$\Delta y_t = \alpha_0 + \beta t + (\rho - 1) y_{t-1} + \theta \sum_{i=1}^{m} \Delta y_{t-1} + e_t \qquad (5.9)$$

where $\Delta y_t = y_t - y_{t-i}$, y is the variable we are testing, m is the number of lags and e_t is stochastic error term. The ADF can also be constructed without constant or trend as:

$$\Delta y_t = \delta y_{t-1} + \theta \sum_{i=1}^{m} \Delta y_{t-1} + e_t \qquad (5.10)$$

where $\delta = (\rho - 1)$.

The hypothesis is: H0:δ = 0(unit root)

H1:$\delta \neq 0$

If t*>ADF critical value then we cannot reject null hypothesis, i.e. unit root exists. If t*<ADF critical value then we reject the null hypothesis, i.e. unit root does not exist.

After unit root testing, we investigated our variable for causality based on the Granger (1969) causality procedure. The method is based on estimating the past values of a variable Y and adding the lagged values of another variable, X; if the addition of the X

variable proves to be statistically significant, then it is said Y is Granger-caused by X. Following Gujarati (1995) the test uses the following equations:

$$Y_t = \sum_{i=1}^{n} \alpha_i X_{t-i} + \sum_{j-1}^{n} \beta_j Y_{t-j} + u_{1t} \qquad (5.11)$$

$$X_t = \sum_{i=1}^{n} \lambda_i Y_{t-i} + \sum_{j-1}^{n} \delta_j X_{t-j} + u_{2t} \qquad (5.12)$$

where the error terms u_{1t} and u_{2t} are assumed to not be correlated.

Equation (5.11) states that current Y is related to the past values of the variable itself and the past values of X. Similarly, equation (5.12) states that the current value of X is related to the past values of the variable itself and the past values of Y. There are four possible relationships based on the above two equations.

First a causality from X to Y is suggested if estimated coefficients on the lagged X in (5.11) are statistically different from zero as a group (i.e. $\sum \alpha_i \neq 0$) and the estimated coefficients on the lagged Y in (5.12) are not statistically different from zero (i.e. $\sum \delta_i = 0$). Second, a causality from Y to X is assumed if estimated coefficients on the lagged Y in (5.11) are statistically different from zero as a group (i.e. $\sum \alpha_i = 0$) and the estimated coefficients on the lagged Y in (5.12) are not statistically different from zero (i.e. $\sum \delta_i \neq 0$). Third, a bilateral causality is indicated when the X and Y coefficients are significantly different from zero in both equations. Fourth, no causality is indicated if the coefficients of X and Y are not statistically significant in both equations.

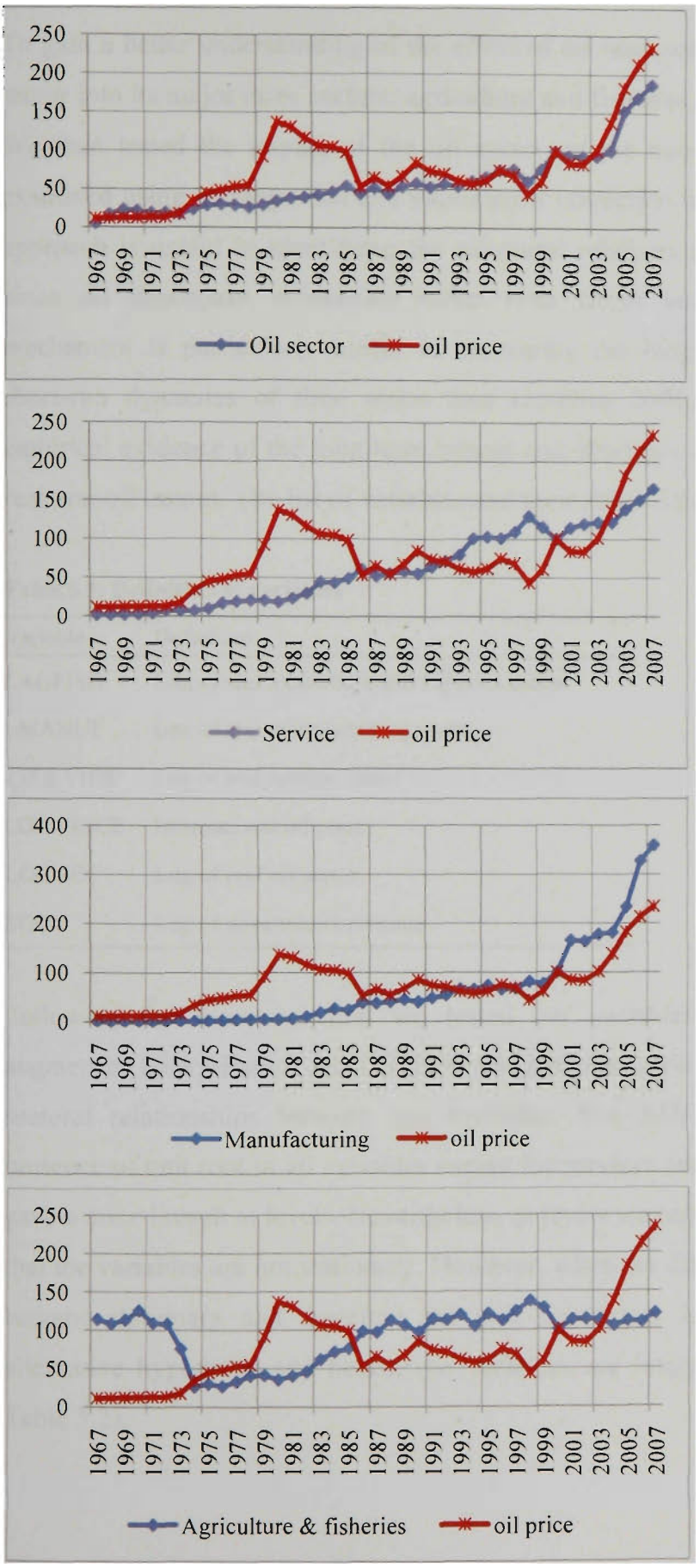
5.4 THE OIL AND NON-OIL GDP SECTORS

Figure 5.1 shows the evolution of the oil, service, agriculture and fisheries, manufacturing sectors, and oil price movements. The manufacturing and service sector follow closely the oil sector and oil price trends. Like the oil sector and oil prices, manufacturing and services experienced sharp increases during 1970-1980, followed by a period characterized by swings in the international oil price (1981 to 2000). The manufacturing and services sectors experienced another sharp increase during 2001-2006, again in line with the oil sector and oil prices trends. As mentioned previously

(Chapter 2, Section 2.4), the manufacturing sector share contribution to GDP increased, in particular during 2000-2007, mainly as a result of the start of liquefied natural gas production in Oman in 2000. As would be expected, the oil sector and oil prices are closely linked, more so than the rest of the economy, so when oil prices increase or decrease the sector follows the direction of the oil prices. For example, in 1998 oil prices experienced a sharp drop and consequently the oil sector declined, and when oil prices recovered during 2003-2007, the sector experienced a strong increase.

However, the agriculture and fisheries sector did not seem to have followed oil price movements. In fact, the sector experienced a sharp drop during 1970-1983, in response to the sharp increase in the oil sector and the international oil price movements, and the sector did not experience much change during the 2001-2007 oil sector and price increases. Overall, the agriculture and fisheries sector stagnated during the period 1967-2007.

Figure 5.1: Oil price and real oil and non-oil GDP sectors, 2000 = 100 (raw series), 1967-2007



Source: *Statistical Year Book*, Oman, various issues.

5.5 OIL RESOURCES AND NON-OIL GDP

To gain a better understanding of the effect of oil resources, we segregated the non-oil sector into its major three sectors: agriculture and fisheries, manufacturing and services. We then tested the impact of the oil sector on the non-oil sectors. The links were examined using cointegration and vector error correction models (VECM). The VECM approach is useful in identifying the structural relations in GDP sectors. In addition, since oil dependent economies suffer from boom and bust cycles, the VECM mechanism is particularly useful in examining the long-run relationship effect and short-run dynamics of time series data (Juselius 2006). Hence, the test provided empirical evidence of the long-term impact and short-run dynamics of oil resources on real non-oil output. The list of variables and their abbreviations is shown in Table 5.1.

Table 5.1: Definition of variables

Variable	Definition
LAGFISH	Log of real agriculture and fisheries sector
LMANUF	Log of real manufacturing sector
LSERVICE	Log of real service sector
LOILPRICE	International oil price
LOILSEC	Log of real oil sector
LGOV	Log of government revenue

Following the literature, first we tested our variables for stationarity using the augmented Dicky-Fuller (ADF) (1979) test and then used the results to look for inter-sectoral relationships between our variables. The ADF test results suggested the presence of unit root in all variables except for services and oil exports earnings, which gave a mixed result at levels. Nevertheless, at levels we cannot reject the null hypothesis that the variables are not stationary. However, when we differentiate our variables, they become stationary and therefore the null hypothesis is rejected in favour of the alternative hypothesis and hence, our variables are integrated of first order $I(1)$ (see Table 5.2).

Table 5.2: Dickey Fuller unit root tests

	Constant and trend	Constant	None
Levels	1	2	3
LAGFISH	-1.99	-1.38	-0.17
LMANUF	-1.40	-1.24	0.82
LSERVICE	-2.52	-3.93	3.47
LOILPRICE	-1.98	-1.27	1.55
LOILSEC	-2.48	-2.51	1.20
LGOV	-4.96	-2.92	2.76
5% critical value	-3.54	-2.96	-1.95
First difference			
LAGFISH	-5.18*	-5.18*	-5.25*
LMANUF	-5.22*	-5.34*	-5.43*
LSERVICE	-3.97**	-3.52**	-6.18*
LOILPRICE	-5.37*	-5.36*	-4.99*
LOILSEC	-5.35*	-5.44*	-0.60
LGOV	-7.9*	-8.17*	-6.95*
5% critical value	-3.56	-2.95	-1.95

Notes: * and ** donates significance at 1% and 5% levels.

5.5.1 VAR and Cointegration: Oil and Non-oil GDP

First, we tested the impact of oil prices on non-oil GDP. We performed the Johansen (1991) cointegration trace and the maximum Eigenvalue procedure to determine the possible number of long-run cointegrating vectors, and then we introduced restrictions to our cointegrating vectors to estimate the relationship in our variables. The unrestricted cointegration rank trace and maximum Eigenvalue for non-oil GDP sectors and oil price is reported in Table 5.3.

Table 5.3: Unrestricted cointegration rank test (trace)

Series: LAGFISH LMANUF LSERVICE LOILSEC LOILPRICE

Hypothesized no. of CE(s)	Eigenvalue	Trace statistic	0.05 critical value	Prob.**
None *	0.65*	90.24	69.82	0.00
At most 1 *	0.61*	53.32	47.86	0.01
At most 2	0.33	20.78	29.80	0.37
At most 3	0.18	6.87	15.50	0.59
At most 4	0.00	0.02	3.84	0.88

Notes: * denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.
Trace test indicates 2 cointegrating equations at the 0.05 level.

Maximum eigenvalue test (unrestricted cointegration rank tests)

Hypothesized no. of CE(s)	Eigenvalue	Max-eigen statistic	0.05 critical value	Prob.**
None *	0.65*	36.92	33.88	0.02
At most 1 *	0.61*	32.53	27.58	0.01
At most 2	0.33	13.91	21.13	0.37
At most 3	0.18	6.85	14.26	0.51
At most 4	0.00	0.02	3.84	0.88

Notes: * Denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.
Max-eigenvalue test indicates 2 cointegrating equations at the 0.05 level.

The trace statistics for testing cointegration and the maximum Eigenvalue indicate that there are two long-run relationships in our variables. Since we are interested in understanding the effect of oil the sector and oil prices on the non-oil sectors, in the first equation we normalized the β-vector for the manufacturing sector and restricted the β-vector for the agriculture and fisheries sector and services to zero; and in the second regression, we normalized the β-vector for services and restricted the β-vector for manufacturing and agriculture and fisheries to zero.[27] In line with the recent literature, we treated oil prices and oil GDP as weakly exogenous variables or as 'long-run forcing' variables that have a direct impact on output, but oil price and oil GDP variables are not affected by non-oil sector variables in any of the two regressions (Garratt, Lee et al. 2003).

Initially, we estimated single equations of an ordinary least squares (OLS) estimation for the manufacturing, service, and agriculture and fisheries sectors. This is for the purpose of initial inspection as to the relationship between oil and non-oil sectors, before moving to a more powerful modelling framework that can capture the long and

[27] Unrestricting non-oil independent variables produced unreasonable long-run equilibrium conditions for our regression results.

short-term cycles that can tend to occur in stationary data. Following this we obtained the following equations:

$$manuf_t = 2.42oil\,\mathrm{sec}_t + 0.92oilprice_t - 16.32 \quad (5.13)$$

$$service_t = 1.37oil\,\mathrm{sec}_t + 0.15oilprice_t - 2.57 \quad (5.14)$$

$$agfish_t = 0.55oil\,\mathrm{sec}_t + 0.024oilprice_t - 1.17 \quad (5.15)$$

The estimation results indicate that both oil sector and international oil prices significantly affect the manufacturing and service sectors. We also inferred from the coefficients of both the equations that manufacturing and service sectors have been susceptible to oil income and oil prices increases, where one percentage point increases in oil prices enhanced manufacturing output by 0.92 percentage points and raised the services sector's output by 0.15 percentage points over the current levels.

The fact that we found two cointegrating vectors from the tests implies that we can formulate and estimate error correction models that capture the short-run and long-run dynamics. In Table 5.4, we report the long-run equilibrium relationships, while estimating manufacturing and service sectors equations initially.

Table 5.4: Long-run equilibrium, oil sector and oil price and non-oil GDP sectors

Cointegrating equation	Cointegration equation 1	Cointegration equation 2
LAGFISH (-1)	0	0
LMANUF (-1)	1	0
LSERVICE (-1)	0	1
LOILSEC (-1)	-2.15***	-1.67***
	(-0.27)	(-0.16)
	[-7.99]	[-10.76]
LOILPRICE(-1)	-0.93***	-0.51***
	(-0.25)	(-0.14)
	[-3.74]	[- 3.56]
C	14.19	3.89

Notes: Standard errors in ( ) and t-statistics in [ ].
***Indicates statistical significance at 1% level.
Note also that when written in proper equation order, the sign of the variables will reverse. This should be taken into account for correct interpretation. Figures given directly reflect results taken from the program.

Oil sector and oil price increases have had positive impacts on the manufacturing and service sectors. The first long-run equation (column (3)) states that a 1% increase in the oil sector caused a 2.2% increase in the manufacturing sector, and a 1% increase in oil

prices caused a 1% increase in the manufacturing sector also. In the second vector (column (3)), the results show that a 1% increase in the oil sector caused a 1.7% increase in the service sector and one percentage point increase in oil prices caused 0.5% growth in the services sector. The impact of the oil sector and oil price change on the manufacturing and services sectors was strong and the signs were expected. In all diagnostic tests we carried out, as shown below, the manufacturing and service sectors, rather than the agriculture and fisheries sector seem to have benefited most from the oil boom. The results imply high interdependencies between these two sectors and the oil sector and oil price changes.

We tested the long-term as well as short-term linkages between agriculture and fisheries sectors and the results are reported in Table 5.5. There is evidence of higher oil prices and oil revenue having had a positive growth effect on the agricultural sector. However, it is important to note that the long-run coefficients are much lower compared to the results (coefficients) evidenced in Table 5.4. Overall, it is clear that the oil sector has enormous linkage potentials in Oman's economy. Specifically, we see long-run positive externalities in relation to the agriculture and fisheries industry in Oman, probably through directly encouraging investment and indirectly through enhancing infrastructural support.

Table 5.5: Long-run equilibrium relationship between agricultural sector and oil

Cointegrating equation	Cointegration equation 1	Cointegration equation 2
LAGFISH (-1)	1.00	0.00
LMANUF (-1)	0.00	1.00
LOILSEC (-1)	-0.52***	-3.38*
	(0.30)	(0.30)
	[-1.73]	[-11.36]
LOILPRICE(-1)	-0.05***	0.06**
	(0.02)	(0.02)
	[-1.92]	[2.30]
C	-0.02	20.01

Notes: Standard errors in ( ) and t-statistics in [ ].
*, ** and *** indicate statistical significance at the 1%, 5% and 10% levels respectively.
Note also that when written in proper equation order, the sign of the variables will reverse. This should be taken into account for correct interpretation. Figures given directly reflect results taken from the program.

5.5.2 Short-run Dynamics

We are interested in the short-run relationships among variables as well as the direction of causality. We applied the short-run mechanism where the inclusion of the error correction term (ECT) represents an additional channel of detecting causality. The estimation results reveal that the ECT term is negative and statistically significant for both equations (manufacturing and services), hence the cointegration regressions support our previous results (see Table 5.6). The reported error correction parameters are -0.23 and -0.17 for manufacturing and service equation, respectively. This indicates that at time t (current period), more that 23% of the deviation from the long-run equilibrium at time t-1 (previous period) in the manufacturing sector is corrected. The error coefficient for the service sector shows a 17% movement back towards equilibrium following an oil sector and oil price shock. In addition, our test suggests that a 10% oil price movement upwards in the short run was associated with a 0.83% increase in manufacturing output, confirming the close dependency of the sector on oil income. On the other hand, the short-run effect of oil income on the manufacturing sector was found to be positive and weakly significant. Thus a 10% change in oil revenue has been associated with 3% change in Oman's level of manufacturing output in the estimated short-run model.

In the first column of Table 5.7, we assume that the two cointegrating vectors are agriculture and manufacturing sectors, so we estimated their output functions. As expected, the error correction (ECT) coefficients were negative and statistically significant, validating the use of the VECM framework. The respective coefficients indicated that around 39% and 26%, respectively, of the deviation from the long-run equilibrium value was corrected within a one-year period and convergence was achieved in the long run. It is also not surprising that in this type of error correction model, the R-square is just above 50%, given that the dependent variable is differentiated (Keele 2004).

Table 5.6: VECM, short-run equilibrium, oil sector, non-oil sectors and oil price

Independent variable	D(LMANU)	D(LSERVICE)
Cointegration equation 1	-0.23***	-0.17***
	(-0.07)	(-0.05)
	[-3.41]	[-3.61]
Cointegration equation 2	-0.04	-0.06
	(-0.09)	(-0.06)
	[-0.39]	[-0.90]
D(LAGFISH(-1))	0.09	-0.18
	(0.18)	(-0.14)
	[0.49]	[-1.32]
D(LMANUF(-1))	-0.22	-0.20
	(-0.16)	(-0.12)
	[-1.33]	[-1.58]
D(LSERVICE(-1))	0.37	-0.01
	(0.26)	(-0.20)
	[1.43]	[-0.07]
D(LOILSEC(-1))	0.30*	-0.10
	(0.151)	(-0.24)
	[1.99]	[-0.42]
D(LOILPRICE(-1))	0.08**	-0.29
	(0.04)	(-0.17)
	[2.38]	[-1.68]
C	-0.19*	-0.16*
	(-0.05)	(-0.04)
	[3.67]	[3.89]
R-squared	0.61	0.504
Adj. R-squared	0.51	0.370
Sum sq. residuals	0.63	0.384
S.E. equation	0.16	0.122
F-statistic (p. value)	8.87 (0.00)	6.77 (0.00)

Notes: Standard errors in ( ) & t-statistics in [ ].
***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.
We treated oil prices and oil GDP as weakly exogenous variables and that allows us to add them to the same system.

In the short-run elasticities of the two models, the agriculture and fisheries sector is strongly responsive to oil sector income. From the first column, the coefficient of the lagged dependent variable is also significantly positive, implying that past activity is beneficial to current levels of output. The manufacturing output term was negative and significant, meaning that the relationship between the two sectors was clearly not complementary, but rather competitive in nature.

While acknowledging the limitation of using only a few variables and the possibility of improving the results by adding some more variables in the VAR/VECM structure, we nevertheless consider the results to be sufficiently robust to suggest that Oman should implement a proper strategic plan and policies to deal with short-term oil price fluctuations. The results of our study also indicate that future work needs to be done to reduce serious and long-run dependency on energy income.

Table 5.7: Short-run equilibrium, oil sector and oil price change, and agriculture and fisheries sector

Vector error correction model (VECM)		
	D(LAGFISH)	D(LMANUF)
Cointegration equation 1	-0.39*	-0.26***
	(0.11)	(0.15)
	[-3.37]	[-1.71]
Cointegration equation 2	-0.16***	-0.18**
	(0.08)	(0.09)
	[-1.99]	[-2.01]
D(LAGFISH(-1))	0.09	0.18
	(0.17)	(0.19)
	[0.54]	[0.93]
D(LAGFISH(-2))	0.37**	-0.02
	(0.18)	(0.20)
	[2.12]	[-0.11]
D(LMANUF(-1))	-0.32**	-0.21
	(0.150)	(0.17)
	[-2.13]	[-1.22]
D(LMANUF(-2))	-0.06	0.054**
	(0.16)	(0.03)
	[-0.37]	[2.03]
D(LOILSEC(-1))	0.20***	0.81**
	(0.10)	(0.43)
	[1.90]	[2.04]
D(LOILSEC(-2))	0.05	0.15
	(0.20)	(0.23)
	[0.25]	[0.64]
D(OILPRICE(-1))	-0.03*	0.02**
	(0.01)	(0.01)
	[-2.83]	[2.10]
D(OILPRICE(-2))	-0.00	0.00
	(0.01)	(0.01)
	[-0.16]	[0.37]
C	0.09	0.20*
	(0.07)	(0.08)
	[1.23]	[2.59]
R-squared	0.54	0.52
Adj. R-squared	0.48	0.44
Sum sq. residuals	0.85	1.06
S.E. equation	0.18	0.20
F-statistic (p value)	5.05 (0.001)	4.55 (0.002)
LM(2)- $\chi^2(2)$	4.37 (0.113)	3.49 (0.105)
ARCH (2)	3.88 (0.234)	3.94 (0.128)
JB (2)	2.05 (0.114)	2.29 (0.116)

Notes: Standard errors in ( ) and t-statistics in [ ].
*, ** and *** indicate statistical significance at the 1%, 5% and 10% levels respectively. For further details on the diagnostics, see Table 4.6.

5.6 OIL, GOVERNMENT INCOME AND SECTORAL OUTPUT GROWTH

Another aspect of oil dependent economies is the importance of government income in economic output. Government income has strong influence on the domestic economy and overall economic output. Oil proceeds accrue directly to the government and through government, oil income is distributed to the rest of the economy. Government income, therefore, has a strong influence on the level of GDP growth. In this section we estimate how government income has determined sectoral GDP growth in the long and short run. We particularly examine how sectroral GDP (as in manufacturing, service and agriculture sectors), government revenue and oil prices are related, where the latter is treated as a non-modelled exogenous variable. We are interested in how changes in the level of government income have influenced the manufacturing, services, and agriculture and fisheries sectors.

Our diagnostic testing shows that oil price has been positively influencing real government revenue, both in the long and short run (see Table 5.8). The results indicate that real government revenue is the main determinant of sectoral GDP (manufacturing, services and agriculture). For example, when there is a one percentage point increase in government revenue, there will be 2.52%, 1.5% and 0.38% increase in manufacturing, services, agriculture and fisheries sectors' output, respectively, in the long-run equilibrium.

In the short-run, the estimation results reveal that the error correction term (ECT) is negative and statistically significant for manufacturing, services and agriculture equations and, therefore, the cointegration regressions support our previous results. The reported error correction parameters are -0.06, -0.10 and -0.23 for the manufacturing, services and agriculture equations, respectively. [28] The error coefficient for manufacturing, services and agriculture shows a 6%, 10% and 23% movement back towards equilibrium, following a government income shock. In addition, our test suggests that a 10% government income movement upwards in the short run has been associated with 0.18%, 1.8%, and 2.75% increase in manufacturing, services, and

[28] Note that various diagnostic test were also conducted to check for autocorrelation and heteroscedasticity problem. The estimated model passed these tests and these results are not reported but are available upon request from the author.

agriculture and fisheries output, respectively, confirming the close dependency of the GDP sectors on government income. It is interesting to note that the agriculture and fisheries sector coefficient has been much lower in comparison to the manufacturing and service sectors. This result is similar to the long-run findings observed earlier (see Table 5.5), confirming that the sector is not well integrated into the oil sector activities or the government development programmes.

Table 5.8: Long-run and short-run analysis of the relationship between sectoral GDP, government revenue and oil price variables

Equation →	LMANUF		LSERVICE		LAGFISH		LGOV
LGOV(-1)	+2.524*	LGOV(-1)	+1.50752*	LGOV(-1)	+0.382*	OILPRICE(-1)	+0.0054*
	[+8.675]		[+7.719]		[+4.110]		[+0.292]
Constant	-15.693	Constant	-4.759157	Constant	-1.734	Constant	+7.993
Error correction model							
	D(LMANUF)		D(LSERVICE)		D(LAGFISH)		D(LGOV)
CointEq1	-0.057***	CointEq1	-0.101*	CointEq1	-0.231*	CointEq1	-0.306*
	[-1.872]		[-3.214]		[-3.793]		[-4.453]
D(LMANUF(-1))	0.121	D(LSERV(-1))	-0.062	D(LAGFISH(-1))	0.431***	D(LGOV(-1))	-0.289***
	[0.746]		[-0.465]		[1.813]		[-1.695]
D(LMANUF(-2))	0.029	D(LSERV(-2))	0.139***	D(LAGFISH(-2))	-0.238**	D(LGOV(-2))	-0.207
	[0.183]		[1.803]		[2.013]		[-1.242]
D(LGOV(-1))	0.018**	D(LGOV(-1))	0.182*	D(LGOV(-1))	0.275***	D(OIL(-1))	0.014***
	[2.143]		[2.766]		[1.924]		[1.791]
D(LGOV(-2))	0.385*	D(LGOV(-2))	0.337*	D(LGOV(-2))	-0.1421	D(OIL(-2))	0.007
	[3.285]		[4.691]		[-0.873]		[0.690]
Constant	0.093	Constant	0.005	Constant	-0.041	Constant	0.175*
	[1.658]		[0.186]		[-0.975]		[3.156]

Note: *, ** and *** indicate statistical significance at the 1%, 5% and 10% levels respectively.
T-statistics are in square brackets.

5.7 GRANGER CAUSALITY TEST

In the previous section we examined the long-run inter-sectoral relationships between the oil sector and the non-oil GDP and the results suggest that the non-oil sectors have been positively linked to the oil sector.[29] Further, our cointegrating system implied that there has been a one way direction or causality running from the oil sector to the rest of the economy. For the purpose of reconfirming the earlier results, particularly the existence of a material relationship among the variables, and testing the direction of

[29] Except for the agricultural and fisheries sector.

causality linkages and their degree of integration, we used the Granger causality test. The standard Granger causality test may also be applied in the cases where Y and X are not cointegrated, and where there could be short-run equilibrium (relationship) (M.Miller and Russek 1990; Gelper, Lemmens et al. 2007). The test is useful, particularly when the inter-sectoral relationships among variables are not clear (Litterman 1984; Doan, Litterman et al. 1986).

5.7.1 VAR Granger Causality: Non-oil GDP and the Oil Sector

From the previous section, we have established that sectoral GDP, government income and international oil prices have been related. To confirm the previous results, we estimated one-to-one relationships between the variables using Granger causality. The bivariate autoregressive system of the first difference series shed light on the directions of causality. This technique also specifically helped us identify direction of causality among variables. These Granger causality tests were based on equations (5.11) and (5.12). With stationarity and cointegration confirmed initially, we adopted the standard practice that the optimal lag orders of the VAR system investigated. Ibrahim (2001) and Ahmed (2007) argued that the choice of lag length of the VECM/VAR model is critical. The results of the relevant test are reported in Table 5.9. From four out of the five appropriate criteria, our lag order selection was chosen on the basis of AIC and SC model selection criteria. Thus the most appropriate lag structure according to these criteria is lag one. For further discussion on how to choose the most appropriate lag, see Lütkepohl (1993).

Table 5.9: VAR lag order selection criteria

Endogenous variables: AGFISH MANUF SERVICE OILSEC
Exogenous variables: C
Sample: 1967-2006

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-73.006	NA	0.000	4.162	4.337	4.224
1	77.595	260.499*	5.26e-07*	-3.113*	-2.243*	-2.806*
2	88.676	16.771	7.09e-07	-2.847	-1.280	-2.295
3	104.594	20.651	7.76e-07	-2.843	-0.579	-2.045

Notes: * Indicates lag order selected by the criterion. NA = not available.
LR: Sequential modified LR test statistic (each test at 5% level).
FPE: Ainal prediction error.
AIC: Akaike information criterion.
SC: Schwarz information criterion.
HQ: Hannan-Quinn information criterion.

Second, we used the VAR Granger causality/block exogeneity Wald tests to show the inter-sectoral relationships between non-oil GDP and the oil sector. The results are reported in Table 5.10. From the first regression (part A), it is interesting to note that the agriculture and fisheries sector performance has not been stimulated by oil revenue. Thus, the overall evidence from both, the joint significance of lagged coefficients of the β_{ij}'s and the error correction term does not support the Granger causality between agricultural and fisheries output growth and oil income, or between agriculture sector performance and growth in other sectors, such as manufacturing and services. This finding seems to support the observation made by Metz (1993), that "the agricultural sector has been affected by rural-urban migration, in which the labour force has been attracted to the higher wages of industry and the government service sector, and by competition from highly subsidized gulf producers"(Metz 1993).

Furthermore, oil wealth enabled the imports of agricultural products that competed directly with Omani agricultural products. Therefore the sector has not been integrating to the mainstream economy. Although the authorities have pursued specific policies to promote the agriculture and fisheries sector in recent years, including advice on modern irrigation, technology choice and budgetary support, more needs to be done. In particular, it is important to enhance the competitiveness of the sector such as: improved market access concessions for its agricultural and fishery products; operationalization and development of a common market and better marketing practices for agricultural products; and offering targeted subsidies (subsidized loans) to purchase machinery and other equipment.

In addition, the rapid imports of electric and other water pumps, with no regulation on their use, has had a negative impact on the sector's output. As a result of excessive pumping of fresh ground water, sea water has intruded into farms, with devastating impact on agriculture in some parts of the country.

From the manufacturing sector regression, we could not reject the null hypothesis that oil income Granger-caused manufacturing GDP, nor that manufacturing GDP Granger-caused oil income (both at the 1% level of significance). The reported results also provide evidence of cointegration and unidirectional Granger causality running from services to manufacturing activities (statistically significant at the 5% level). Thus

improvements in the services sector should have encouraged manufacturing. The findings tend to show that somehow manufacturing and services may have mutually reinforced each other. Wong and Tang (2008) observed that a strong complementary services sector could encourage more manufacturing activities, while diversifying to high value chain activities could also generate intermediate demand for services ranging from logistics and ports, to business and finance.

Table 5.10a: VAR Granger causality/block exogeneity Wald tests, GDP sectors

Dependent variable (regression): AGFISH				
Variable	Chi-sq.	Lags taken	Prob.	ECM term
MANUF	2.04	(2, 0)	0.16	-0.22
SERVICE	2.47	(1, 1)	0.12	0.42
OILSEC	3.03	(2, 1)	0.11	-0.10
Dependent variable: MANUF				
Excluded	Chi-sq.	Lags taken	Prob.	ECM term
AGFISH	0.51	(2, 2)	0.47	-0.82
SERVICE	0.71	(2, 1)	0.40	-0.28**
OILSEC	12.71	(2, 1)	0.00	-0.19***
Dependent variable (regression): SERVICE				
Excluded	Chi-sq.	Lags taken	Prob.	ECM term
AGFISH	1.88	(3, 1)	0.17	0.11
MANUF	0.05	(2, 1)	0.83	-0.32*
OILSEC	8.88	(2, 0)	0.00	-0.41**
Dependent variable (regression): OILSEC				
Excluded	Chi-sq.	Lags taken	Prob.	ECM term
AGFISH	1.32	(3, 1)	0.25	-0.0.82
MANUF	18.85	(2, 2)	0.00	-0.17**
SERVICE	7.96	(2, 1)	0.00	-1.01**

Table 5.10b: VAR Granger causality/block exogeneity Wald tests, GDP sectors

Pairwise Granger causality			
Null Hypothesis:	Obs.	F-statistic	Prob.
LMANUF does not Granger cause LAGFISH	38	2.47	0.11
LAGFISH does not Granger cause LMANUF		1.76	0.19
LSERVICE does not Granger cause LAGFISH	38	1.30	0.29
LAGFISH does not Granger cause LSERVICE		0.40	0.67
LSERVICE does not Granger cause LMANUF	39	4.93**	0.05
LMANUF does not Granger Cause LSERVICE		0.01	0.92
OILSEC does not Granger Cause LAGFISH	39	2.91	0.10
LAGFISH does not Granger cause OILSEC		1.06	0.31
LOILSEC does not Granger cause LMANUF	38	7.36***	0.002
LMANUF does not Granger cause LOILSEC		3.86*	0.06
LOILSEC does not Granger cause LSERVICE	39	4.07**	0.03
LSERVICE does not Granger cause LOILSEC		2.07	0.14

Notes: ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

5.8 CONCLUSTIONS AND IMPLICATIONS

This chapter investigated how the oil sector affects the macroeconomic dynamics of the economy in Oman. The study used an integrated econometric approach that distinguished between short run dynamics and long-run equilibrium relationships. Initially time-series properties of the data were investigated and cointegration among variables determined, in order to avoid spurious results. Further, we examined dynamic causal relationship using multivariate time-series procedures (multivariate Granger causality approach) to investigate direction(s) of causality among variables.

Firstly, the tests revealed that – not surprisingly – government revenue (which is significantly associated with oil revenue) positively and significantly affects non-oil sector real GDP growth in Oman. Our results confirmed strong dependency on oil income for development, found in many oil-based economies such as the GCC countries and Russia. It was also observed that oil prices and oil revenue have direct impact on real sectoral GDPs, while indicating that variation in energy resources and associated revenue are of increasing importance in explaining future national growth. From a different dimension, the close relationship between oil income and non-oil sectors could drive expenditure patterns. To avoid this, it is necessary to have strict fiscal rules. Thus: (i) there has to be expenditure control strategies to moderate spending growth during boom cycles; and (ii) authorities should also put into place more formal strategies to direct a significant proportion of oil revenue to a specialized stabilization oil fund (reserve fund), to weaken long-term oil dependency, and facilitate structural link between government spending and non-oil activities. A move towards this has been implemented in some of the GCC countries, including Oman, to prepare for sustained growth and enable the non-oil sectors to achieve scale economies and generate employment.

Moreover, Oman needs to have a long-term strategy that will drive economic growth beyond oil. This can be achieved through structural reforms, including policy and institutional reforms that will liberalize trade, encourage foreign investment, and make the business environment more transparent and business friendly. The trade policy might be geared towards encouraging the import of capital goods instead of consumer goods that would not add value to output.

Secondly, the results from the VECM and Granger causality tests indicated, with regards to the relationship between oil income and agriculture output, that we accept the null hypothesis that oil revenue does not Granger-cause agriculture and fisheries GDP. This shows that the sector is not integrated in the mainstream economy and contributing only about 2.8% of GDP by 2006. Diminishing employment preference has significantly affected the agriculture and fisheries sector as prospective workers are attracted to more remunerative employment opportunities in services and manufacturing. There has also been no specific programme for manpower development focusing on critical skills needed by the sector. Furthermore, the sector seemed to be suffering from competition from imported agricultural products and with little protection, the combination of labour preference and competition from the international market, the sector's contribution to national output dropped significantly.

Thirdly, the long-run cointegration tests for the manufacturing and services sector indicate that both sectors are positively correlated to changes in the oil sector. In addition, we used VAR Granger causality test to estimate the inter-sectoral relationship between the manufacturing and services sectors and the GDP sectors, and the overall results indicated that there was a unilateral causality running between the oil sector and the former two sectors.[30] Further, it was observed that there was evidence supporting interdependencies between different sectors of the economy, particularly between services and manufacturing.

Fourthly, the overall results suggest that oil sector activities still played an important role in inducing non-oil output growth. The productive structure was still dependent on oil sector activities and had not diversified away from oil dependency. Reliance on natural resources, in turn, threatens the economies of resource dependent nations when revenues fall or when the stock of resources are exhausted. Such results confirm the view that, mineral industries do not create strong linkages in the economy. In addition, Oman's pre-oil economic activity, that is agriculture and fishing did not seem to have been affected by oil resource activities. This suggests that, despite the oil wealth, the

[30] This conclusion is based on the overall results. Although figures in Table 5.10 show weak causality running from manufacturing to oil, it is clear that there is a unilateral causality from oil to manufacturing when we select different lag lengths.

agriculture and fisheries sector has not accumulated much capital and is still a labour intensive activity.

CHAPTER 6.
FACTOR INPUTS AND OPTIMAL FISCAL POLICY

...governments in resource abundant countries that have financed public investment using resource revenues have avoided the resource curse. There is stronger evidence that those governments in resource abundant countries that have consumed the proceeds of this abundance are those that, on average, have experienced a significant resource curse. This was found for the relationship between resource depletion and government consumption, in general, and spending on public wages and salaries in particular.
(Atkinson and Hamilton 2003)

6.1 INTRODUCTION

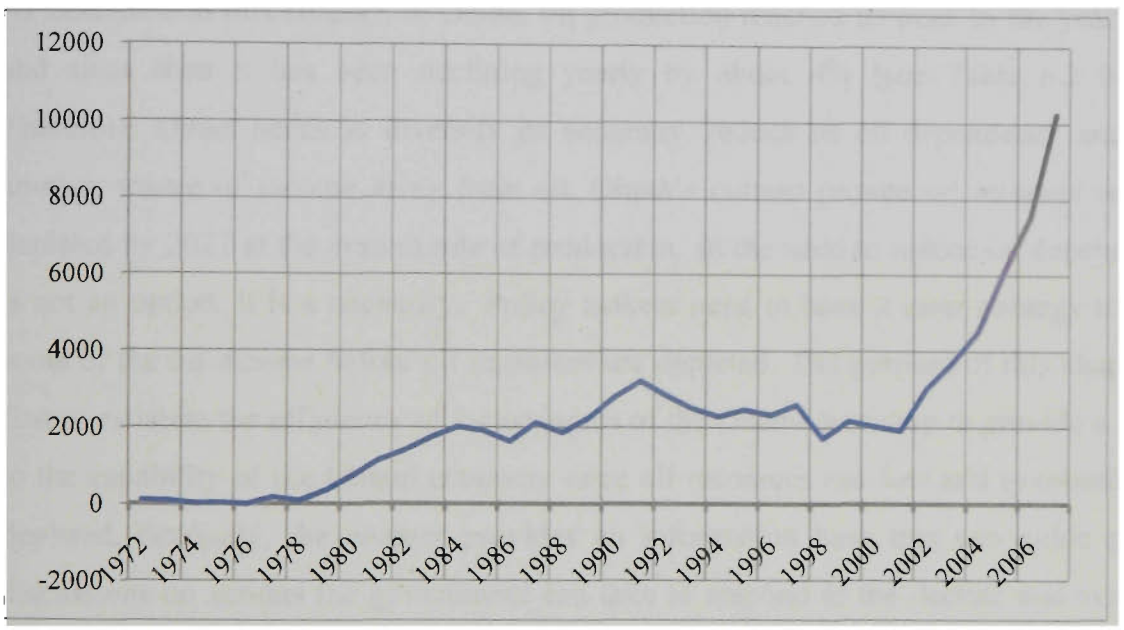
The economies of mineral dependent countries, such as Oman, depend heavily on one source of income, namely oil. Crude oil exports are the main source of foreign exchange earnings, the non-oil economic activities are dependent on oil sector activities and most of government revenue is from oil income. For Oman, the value of oil exports to total exports was 65% in 2007 (see Table 6.1). In the same year, the ratio of oil exports to GDP was 47% and the ratio of oil revenues to total government revenues was 79%. To overcome the high dependency on oil income, Oman, like many other oil exporting countries, introduced ambitious development programmes and adopted a policy of accumulating foreign assets. The level of foreign assets has been a function of the volatile nature of oil income. So when oil receipts increased, reflecting better oil prices, the government accumulated more foreign assets and, when oil receipts were low, the government withdrew some of its financial assets to be able to finance its expenditure. In 1993-2001, Oman's net foreign assets declined, reflecting depressed oil receipts. However since 2002 Oman's foreign assets have been increasing, mainly due to increased oil receipts. In 2007 Oman's foreign assets were 10.2 billion USD (see Figure 6.1).

Table 6.1: Dependence on oil, 1970-2006

Year	Ratio of oil exports to total exports	Ratio of oil exports to GDP	Ratio of oil revenue to government revenue
1970	99	52	98
1980	96	60	92
1990	91	46	85
2000	82	43	78
2006	78	40	77
2007	65	47	79

Source: *Statistical Year Book*, Oman, various issues.

Figure 6.1: Net foreign assets (million USD), 1972-2007



Source: *World Development Indicators*, World Bank.

Besides resources reliance, oil economies have an additional source of uncertainty about the future of the economy. This uncertainty stems from the inability to predict future income because of the volatile nature of the oil price. It is also because oil extraction activities are not sustainable as oil is an exhaustible resource: the more oil is pumped out of the ground today, the less there is for the future. This uncertainty about the future of the economy is actually a concern about the ability of oil economies to maintain their current consumption levels and standard of living when oil resources decline in the short run, and when they are depleted in the long run.

The third characteristic of oil dependent economies is the importance of fiscal policy for economic output. Fiscal policy is a more important influence on the domestic economy than in most other economies. The oil windfall accrues directly to the government and through its fiscal policy oil income is channelled to the private sector. The government, therefore, has direct influence on the investment and development pattern of the non-oil economy. This is even more the case in Oman and other Arab Gulf countries because of the underdeveloped non-oil economic sectors prior to oil discovery. The pre-oil era economic activities in the Arab Gulf region were based on fishing, pearl fishing and subsistence agriculture, and did not produce any significant wealth.

As described in this chapter, in Oman, oil production reached its peak in the year 2000 and since then it has been declining yearly by about 4% (see Table 6.2 below) Therefore, Oman needs to diversify its economy, reduce its oil dependency and find another source of income away from oil. Oman's current proven oil reserves will be depleted by 2027 at the current rate of production, so the need to reduce oil dependency is not an option, it is a necessity. Policy makers need to have a clear strategy to save some of the oil income before oil resources are depleted. The purpose of this chapter is first to estimate the efficiency of factor inputs of the Omani economy to provide a guide to the capability of the Omani economy once oil resources run low and eventually are depleted. Secondly, the chapter provides an information base that can guide policy discussions on actions the government can take to respond to the decline and eventual depletion of oil resources.

This chapter is organised as follows. Section 6.2 specifies the objectives of the chapter. An overview of government oil policy, of government oil income and expenditure and of issues related to fiscal sustainability is provided in Section 6.3. Section 6.4 reviews the two policy options for resource dependent nations: either converting natural resource income into human and physical capital or saving enough wealth to compensate for resource depletion. Section 6.5 evaluates economic efficiency in Oman by estimating Oman's TFP for the period 1967-2007 and discusses issues related to TFP interpretation. The chapter then uses OLS regression and historical data to interpret economic efficiency in Oman and the possible role of government policy in inducing such efficiency. Fiscal sustainability and Permanent Income Model (PIM) options for Oman are discussed in Section 6.5. Section 6.6 offers a summary of this chapter.

6.2 OBJECTIVES OF THIS CHAPTER

Oman has achieved sustained real GDP growth of about 9% per annum over the past forty years.[31] This has been possible because of the oil sector boom and its multiplier effect on other sectors of the economy and government expenditure on education, health, services, and infrastructure development. Furthermore, the findings in this thesis (see Chapters four and five) show that the oil sector and government expenditure played a significant role in inducing non-oil sector growth. The persistence of mineral dependency, however, threatens the ability of the economy to sustain GDP growth when oil income runs low and when oil resources are depleted. In this chapter we first examine the sources of growth in the Omani economy by estimating the total factor productivity of the Omani economy (TFP). This is very important for several reasons. First, it reveals important information about the contributing factors to GDP growth and how they have evolved throughout the past four decades of the oil era. Secondly, it shows how efficient economic agents have been in using factor inputs. Thirdly, and most importantly, TFP analysis shows if GDP growth in Oman was a function of capital and labour accumulation or whether it was also the result of the increasingly efficient use of factors inputs and of technological progress. We are interested is finding out how the TFP contribution to GDP growth developed throughout the years. As will be discussed, a negative TFP is not necessarily an indication of an increasingly inefficient use of factor inputs and lack of technological progress. It could also reflect a major capital injection into the Omani economy that was made possible by the discovery of oil, with delays in achieving full output from the resulting capital stock. Notwithstanding this issue, a positive TFP development would also be an indication of Oman's ability to sustain GDP growth in the eventual exhaustion of oil resources.

Several factors influence the long-term economic growth of an economy and its sustainability, including its per capita income, geographic location, saving rates, institutions and fiscal balance (Sachs and Warner 1997). Other factors that influence long-term growth include human capital and education (Aghion and Durlauf 2005). This chapter will also assess fiscal policy and debt sustainability in Oman. It seeks to provide additional insights into the discussion regarding oil dependency/independency

[31] Real GDP increased by an average of 8.8% over 1967-2007, but over the first half of the period (1967-86) grew by 12.0% and over 1986-2007 by 6.0%. Over the last decade or so (1996-2007) the growth rate has been 7.2% (see also Table 2.1).

and how the government can sustain a viable expenditure policy when oil income runs low.

Oman's oil income is finite and will eventually be depleted. Unlike renewable resources, income that accrues to the government from oil resources is temporary and will cease altogether once the oil resources are exhausted. Chief among the policy challenges that the government faces is finding an optimal government expenditure level that takes into account the expected stream of oil income and the eventual depletion of oil revenues as resources are being depleted. Omani government expenditure policy has so far focused on fiscal expansion, building basic infrastructure and providing services. This strategy served the country well in delivering economic growth and improving the standard of living. However, these policies are not sustainable because of their strain on the country's financial assets and they compromise future generations' share of oil resources. To sustain the level of development that has been achieved so far, the government needs to rethink its past fiscal policy and save some of the income that is accruing from the exploitation of oil resources for future generations.

Some of the questions we seek to answer include (for the first part of the chapter): What are the sources of growth in the Omani economy? How should we interpret TFP contribution to output growth in Oman? Does negative TFP in an endowment economy with a very low level of development mean inefficient use of factor inputs? For the second part of the chapter, the following questions are asked: How can the government respond to the likely cessation of oil production in a responsible way that would protect the position of future generations? What are the different expenditure options available to policy makers to sustain a viable level of expenditure when oil income ceases? These questions have particular importance because of the continuous reliance on oil income to finance government expenditure, despite the expected depletion of the proven oil reserves within about two decades. In addressing these issues, it is important to understand how the past fiscal expansionary policies contributed to GDP growth and to identify the sustainable level of expenditure from of oil resources.

6.3 OIL AND GOVERNMENT POLICY: HISTORICAL OVERVIEW

6.3.1 Government Oil Policy

In 1962 a joint venture of western companies, Petroleum Development Oman (PDO) was given a concession to explore for oil in Oman. Oil was discovered in 1964 and shipment of crude oil started in 1967; about 21 million barrels of oil were shipped in that year. Oil exports increased to 121 million barrels in 1970 and then decreased to 106 million barrels in 1974. In 1974, the Omani government acquired 60% of the company and in 1980 PDO was registered as an Omani company.[32]

In 1976, the Omani government realized that the country was not endowed with as much oil as its immediate neighbours like Saudi Arabia (SA) or United Arab Emirates (UAE). For example in 2006, UAE's daily oil production was 2.6 million barrels and SA produced 9.2 million barrels a day, while Oman produced a modest 687 thousand barrels a day only. According to the published estimates, in 2006 Oman had 5.6 billion barrels of proven reserves while, UAE had 97.8 billion barrels and SA 264.3 billion barrels. In fact, when the government was planning its First Five-year Development Plan in 1976, it was estimating that by 1977, oil production would start to decline gradually and by 1987 Oman would have exhausted most of its oil, unless there were new discoveries (Development Council 1976).

However, since 1975 oil production and proven reserves increased and continued to increase to the year 2000. Oil fields in Oman produced 350 million barrels in 2000 and its estimated reserves were 5.8 billion barrels, but since 2000 oil production has been declining and in 2007 Omani oil fields produced 259 million barrels, a yearly drop of about 4% over that period (see Table 6.2).

The drop in oil production in Oman was due mainly to technical difficulties faced by an oil company. In April 2004, the New York Times published a report about how Royal Dutch has overestimated its oil reserves worldwide and in Oman in particular (Gerth and Labaton 2004). The report claimed that proven oil reserves may be less than the

[32] The rest of the company is owned by the following: Royal Shell owns 34%, Compagnie Française des Petroles (Total) 4% and Partex 2%. These shares have remained unchanged to the present day.

published data. According to the report, Shell documents suggested that Oman's oil reserves have been overestimated by 40%. It also reported that the enhanced oil recovery technique (EOR) has failed to get more oil out of the ground.

Table 6.2: Oman's oil production, estimated reserves, and life of reserves, 1967-2007

Year	Production (Million barrels)	Reserve (Million barrels)	Life of reserve (Years)
1967	21	1800	86
1968	88	1800	20
1969	120	1800	15
1970	121	1800	15
1971	107	1800	17
1972	103	1800	17
1973	107	1800	17
1974	106	1800	17
1975	125	1800	14
1976	134	1329	10
1977	124	1280	10
1978	115	1379	12
1979	108	1514	14
1980	104	2493	24
1981	120	2908	24
1982	123	2991	24
1983	142	3500	25
1984	152	2852	19
1985	182	4026	22
1986	204	3972	19
1987	213	4088	19
1988	227	4119	18
1989	234	4269	18
1990	250	4361	17
1991	259	4471	17
1992	271	4748	18
1993	285	4970	17
1994	297	5138	17
1995	313	5172	17
1996	325	5238	16
1997	330	5400	16
1998	328	5700	17
1999	330	5848	18
2000	350	5843	17
2001	349	5900	17
2002	328	5706	17
2003	299	5572	19
2004	285	5572	20
2005	283	5572	20
2006	269	5572	21
2007	259	5572	22

Sources: Reserves from 1976 to 1979 are from *Oman Development Book* (1981-1985). Reserves from 1980 to 2006 are from *OPEC Annual Statistical Bulletin.*
Oil production is from *Statistical Year Book*, Oman, various issues.

The reserve estimates are further complicated by the fact that there is a mis-match between the actual oil production rates and the rule of limiting oil production to 6% of

total reserves, as specified in the five-year development plan (Development Council 1997). Oil production has been less than the 6% rule, except in 1996 and 1997 (see Table 6.3). This again emphasizes the view that Oman's oil reserves may be less than what has been published. On the other hand, it is important to note that the level of oil reserves is not a physical constant, but that recoverable reserves are a function of the price of oil, as a higher oil price makes it economic to recover more oil from a given reservoir. Thus rising oil prices in recent times may have tended to offset these factors, by increasing the proportion of oil in the ground that is economically recoverable.

Table 6.3: Actual oil production and what production should have been under the 6% rule (million barrels), 1996 - 2007

Year	What production should have been under the 6% rule	Actual production
1996	314	325
1997	324	330
1998	342	328
1999	351	330
2000	351	350
2001	354	349
2002	342	328
2003	334	299
2004	334	285
2005	334	283
2006	334	269
2007	334	259

Source: *Statistical Year Book*, Oman, various issues.

Oman's oil policy has been determined by the Development Council which is chaired by the Sultan of Oman. The Ministry of Petroleum and Minerals supervises the daily running of the sector and provides technical expertise and assistance to the Council. The Second Five-year Development Plan (1981-1985) specified the following policies for the oil sector (Development Council 1981):

1. Increase oil production to 330,000 barrels per day and maintain this level throughout the plan period.
2. Maximize the best possible export price for Omani crude.
3. Seek technical ways and means that will maximize and enhance recovery of oil producing wells.
4. Promote further oil exploration by international companies.

5. Build a refinery that will meet domestic market requirements of petroleum products.[33]
6. Strengthen the technical expertise of the Ministry of Oil and Minerals.

In the Fifth Five-year Development Plan (1996-2000), the Council specified a target for prolonging the life of the reserves by limiting the production rate. The plan called for limiting the production rate to 6% of total oil reserves (Development Council 1997). The government also pursued an active programme of exploration. Unlike several countries in the region, Oman has allowed foreign investment in the oil sector. Several companies were given concessions to explore different parts of the country including PDO, ELF Group, ELF Sumitomo Group, Quintana International Group, and Oman Sun Oil Company. In addition, the oil sector was not nationalized to make it even more attractive for international oil companies to invest in the sector and increase oil production in the country.

Enhancing oil recovery techniques was another policy that the government pursued since the early stages of exploiting oil resources. This is consistent with the third objective with regards to the oil sector in the second five-year development programme, to find ways that will maximize oil recovery from the existing oil fields. The motivation for such a policy was driven by the relatively small quantity of oil discovered in Oman.

With expanding and increasing government expenditure and in order to meet its short-term financial needs, the government needed more revenue. Increased revenue could be achieved by oil export income, so the government sought to increase oil production as much as possible. But it is not clear if this policy was primarily motivated by economic considerations or influenced by foreign partners, who are more motivated by increasing shareholder value. Oman has never been a member of Organization of the Petroleum Exporting Countries (OPEC), and having an independent oil policy that reflects the best interest of the country, rather than the interests of OPEC, was probably the best policy option for the country.

[33] Refinery products were also used for exports.

6.3.2 Utilisation of Oil Income and Government Debt

Because the country was lacking basic infrastructure and services, fiscal policy priority was focused towards promoting development and economic growth. The provision of physical and social infrastructure was a necessary requirement for economic development. And with relatively depressed oil earnings over the period after 1981, there was a substantial gap between government expenditures and revenue in every year but two over the period 1982-2001 (see Table 6.5). However, between 2002 and 2007, both revenue and expenditure experienced a significant increase, doubling in five years. This big increase in expenditure was driven by the unexpected oil windfalls resulting from higher international oil prices. It was also reminiscent of the past, as between 1974-1979 and 1980-1987 government expenditure experienced similar spikes in response to unexpected oil windfalls.

Similarly, non-oil revenues doubled in size between 2002 and 2007 as the economy grew strongly. During 1980-2007, oil revenue increased on average by about 10%, while non-oil revenue increased by 14% from a low base. Nevertheless, the ratio of non-oil revenue to oil revenues is still small (see Table 6.6). In 2007, non-oil revenue comprised about 21% of total government revenue. Custom duties and other revenue (including service revenues such as electricity and water charges and other fees charged by the government) increased by an average of about 12% per year between 1980 and 2007, while corporate income tax increased by 14%, perhaps reflecting better collection. It is also important to note that although expenditure has more than doubled between 2000 and 2007, inflation has remained stable, increasing 1.21% yearly (see Table 6.4). Clearly, the increased expenditure has not been in response to inflationary pressures. The increased expenditure was the result of the unexpected oil windfall, as already mentioned before, and of government policies in response to that windfall.

Table 6.4: Consumer price inflation (percent change), 2000-2007

2000	2001	2002	2003	2004	2005	2006	2007
-1.20	-0.84	-0.33	0.17	0.67	1.85	3.44	5.89
Average							1.21

Source: IMF, 2008.

Table 6.5: Government expenditure and revenue (current millions USD), 1970-2007

Year	Oil revenue*	**Oil revenue + estimate transfers to SGRF	Non-oil revenue	Expenditure	Surplus/Deficit	Surplus/Deficit adjusted to transfers to SGRF
1970	54.69		0.00	54.69	0.00	
1971	130.47		0.00	119.79	10.68	
1972	138.02		0.00	186.46	-48.44	
1973	178.65		0.00	238.80	-60.16	
1974	789.58		0.00	858.07	-68.49	
1975	1009.64		0.00	1290.36	-280.73	
1976	1269.01		0.00	1513.02	-244.01	
1977	1355.47		0.00	1392.45	-36.98	
1978	1308.33		108.85	1458.59	-41.41	
1979	1802.60		138.80	1693.75	247.66	
1980	2889.32		204.17	2473.44	620.05	
1981	3540.10	3770.46	309.11	3186.98	662.24	892.59
1982	3215.10	3485.03	258.33	3679.43	-205.99	63.93
1983	3379.43	3614.99	328.39	4028.39	-320.57	-85.01
1984	3486.98	3754.06	453.65	4584.11	-643.49	-376.40
1985	4027.86	4347.71	597.66	5021.61	-396.09	-76.24
1986	2517.71	2809.54	661.46	4913.54	-1734.38	-1442.54
1987	3213.28	3629.61	724.22	4190.36	-252.86	163.47
1988	2702.60	3019.22	546.35	4081.25	-832.29	-515.68
1989	3235.68	3632.61	624.22	4324.74	-464.84	-67.91
1990	4562.24	5043.81	750.00	4915.10	397.14	878.71
1991	4074.22	4787.19	769.79	4864.84	-20.83	692.14
1992	4135.94	4789.59	888.80	5882.03	-857.29	-203.64
1993	3618.49	4136.00	945.83	5839.58	-1275.26	-757.75
1994	3680.73	4155.10	1024.48	5864.84	-1159.64	-685.26
1995	3890.36	4414.99	1088.54	6070.31	-1091.41	-566.78
1996	4127.60	4686.22	1200.52	5869.01	-540.89	17.73
1997	4849.74	5431.31	1203.13	6008.85	44.01	625.59
1998	3559.38	4105.15	1398.44	5785.42	-827.60	-281.83
1999	3429.17	4199.16	1398.44	5908.85	-1081.25	-311.25
2000	4864.06	5528.16	1291.67	6918.49	-762.76	-98.66
2001	5266.15	5926.38	1539.06	7448.44	-643.23	17.00
2002	6129.43	6986.32	1906.25	7654.95	380.73	1237.62
2003	6485.42	7455.73	2348.96	8304.43	529.95	1500.26
2004	8494.27	9465.62	2302.08	9921.61	874.74	1846.09
2005	9259.11	10435.87	2486.98	10957.29	788.80	1965.56
2006	11561.72	12139.81	2925.00	11640.10	2846.61	3424.71
2007	12580.40	13209.42	3281.56	15313.5	548.39	1177.48

Notes: * Oil revenue = oil revenue – transfers to SGRF. SGRF transfers are not declared. Hence, oil revenue is more than what is published in the yearly statistical book.
**By including estimates of transfers to SGRF the data suggests that the deficit and the surplus are deflated in the published data.
Inflation rate during 2000-2007 was 1.21%.
Source: *Statistical Year Book*, Oman, various issues.

Table 6.6: Government non-oil revenue (current million USD), 1970-2007

Year	Custom duties	Corporate income tax	Other revenues	Total non-oil revenues	% non-oil revenue
1970	NA	NA	NA	NA	NA
1971	NA	NA	NA	NA	NA
1972	NA	NA	NA	NA	NA
1973	NA	NA	NA	NA	NA
1974	NA	NA	NA	NA	NA
1975	NA	NA	NA	NA	NA
1976	NA	NA	NA	NA	NA
1977	NA	NA	NA	NA	NA
1978	NA	NA	108.85	108.85	7.68
1979	NA	NA	138.80	138.80	7.15
1980	22.40	16.93	164.84	204.17	6.60
1981	29.43	27.34	252.34	309.11	8.03
1982	38.28	29.69	190.36	258.33	7.44
1983	56.51	48.70	223.18	328.39	8.86
1984	82.29	53.13	318.23	453.65	11.51
1985	107.03	68.75	421.88	597.66	12.92
1986	96.35	66.67	498.44	661.46	20.81
1987	70.05	55.21	598.96	724.22	18.39
1988	77.08	60.94	408.33	546.35	16.82
1989	76.56	41.67	505.99	624.22	16.17
1990	84.90	37.50	627.60	750.00	14.12
1991	102.86	47.66	619.27	769.79	15.89
1992	124.48	51.82	712.50	888.80	17.69
1993	113.54	61.46	770.83	945.83	20.72
1994	108.07	78.13	838.28	1024.48	21.77
1995	111.98	85.94	890.63	1088.54	21.86
1996	101.56	91.15	1007.81	1200.52	22.53
1997	106.77	96.35	1000.00	1203.13	19.88
1998	111.98	101.56	1184.90	1398.44	28.21
1999	111.98	106.77	1179.69	1398.44	28.97
2000	119.79	109.38	1062.50	1291.67	20.98
2001	153.65	101.56	1283.85	1539.06	22.62
2002	156.25	143.23	1606.77	1906.25	23.72
2003	205.73	153.65	1989.58	2348.96	26.59
2004	216.15	190.10	1895.83	2302.08	21.32
2005	239.58	205.73	2041.67	2486.98	21.17
2006	272.14	217.97	2434.90	2925.00	20.19
2007	316.67	378.96	2585.94	3281.56	20.69

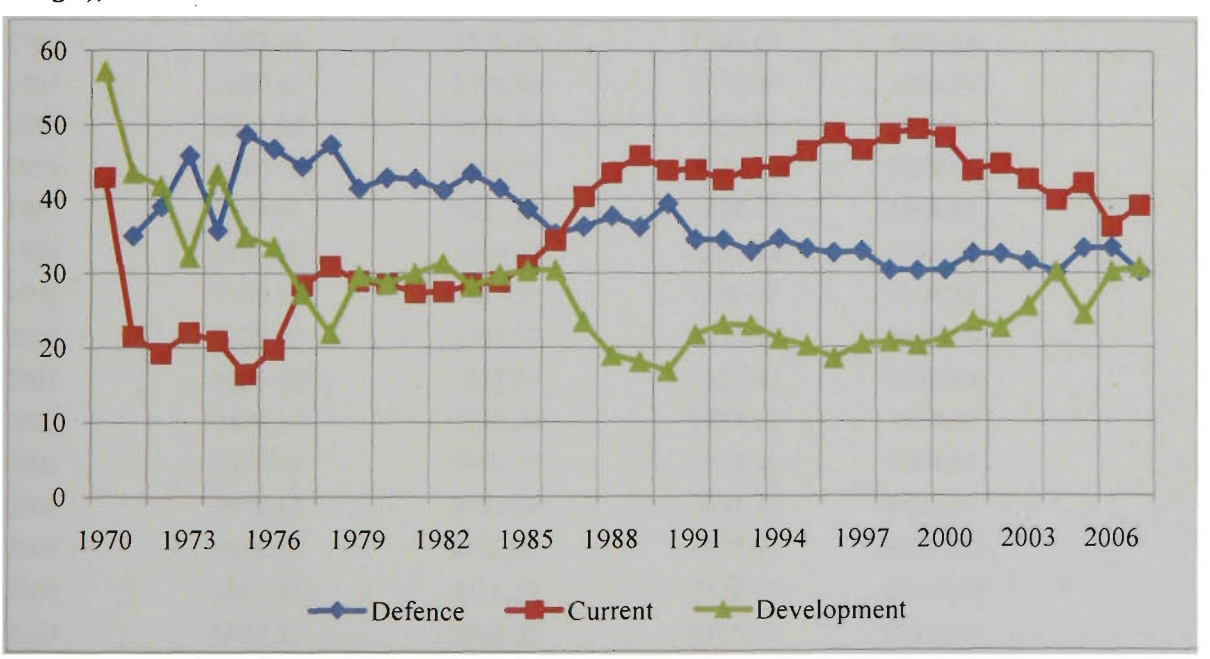
Note: NA = not available.

Source: *Statistical Year Book*, Oman, various issues.

The increase in public consumption has been noted by many researchers as one of the features of many resource dependent economies (Auty 1993; Pearce and Barrier 2000; Auty 2001). At times of favourable resource prices, governments tend to increase expenditure and when resource prices fall governments find it difficult to cut back expenditure.

In the case of Oman, public expenditure was driven mainly by recurrent and defence expenditure (see Figure 6.2 and Table 6.7). However, between 2000 and 2007, development expenditure also experienced very fast growth, increasing from 20% to 30% of total government expenditure, while, current expenditure decreased from 50% to 40%. In order to reduce the public debt, the fifth development plan pledged to control government expenditure and stated that "During this period the government will strive to achieve a balance between revenue and expenditure by the end of the plan period [2000]" (Development Council 2001). The unexpected oil windfall, particularly after 2002, not only helped the government to realize a balanced budget but also to build surpluses.

Figure 6.2: Government defence, recurrent, and development expenditure (as a percentage of the budget), 1971-2007



Source: *Statistical Year Book*, Oman, various issues.

Table 6.7: Government defence, recurrent, and development expenditure (million USD), 1971-2007

Year	Defence	Current	Development	Total
1970		23.44	31.25	54.69
1971	41.93	25.78	52.08	119.79
1972	72.66	35.94	77.86	186.46
1973	109.38	52.60	76.82	238.80
1974	306.51	179.43	372.14	858.07
1975	627.60	212.24	450.52	1290.36
1976	706.51	298.44	508.07	1513.02
1977	617.45	395.05	379.95	1392.45
1978	688.80	450.26	319.53	1458.59
1979	700.52	490.36	502.86	1693.75
1980	1059.38	706.25	707.81	2473.44
1981	1359.11	872.66	955.21	3186.98
1982	1513.80	1012.76	1152.86	3679.43
1983	1746.61	1147.40	1134.38	4028.39
1984	1896.35	1320.83	1366.93	4584.11
1985	1939.84	1559.90	1521.88	5021.61
1986	1732.81	1688.02	1492.71	4913.54
1987	1519.79	1688.80	981.77	4190.36
1988	1534.38	1775.78	771.09	4081.25
1989	1564.06	1980.47	780.21	4324.74
1990	1933.07	2155.73	826.30	4915.10
1991	1675.26	2134.64	1054.95	4864.84
1992	2025.52	2501.30	1355.21	5882.03
1993	1922.40	2576.56	1340.63	5839.58
1994	2029.43	2598.96	1236.46	5864.84
1995	2021.09	2821.35	1227.86	6070.31
1996	1918.75	2866.93	1083.33	5869.01
1997	1978.65	2801.56	1228.65	6008.85
1998	1759.90	2824.48	1201.04	5785.42
1999	1789.58	2921.09	1198.18	5908.85
2000	2105.73	3341.93	1470.83	6918.49
2001	2429.69	3267.71	1751.04	7448.44
2002	2494.53	3427.08	1733.33	7654.95
2003	2629.17	3550.78	2124.48	8304.43
2004	2978.13	3952.08	2991.41	9921.61
2005	3656.77	4622.92	2677.60	10957.29
2006	3895.42	4225.27	3519.11	11639.80
2007	4620.77	5982.23	4709.05	15312.06

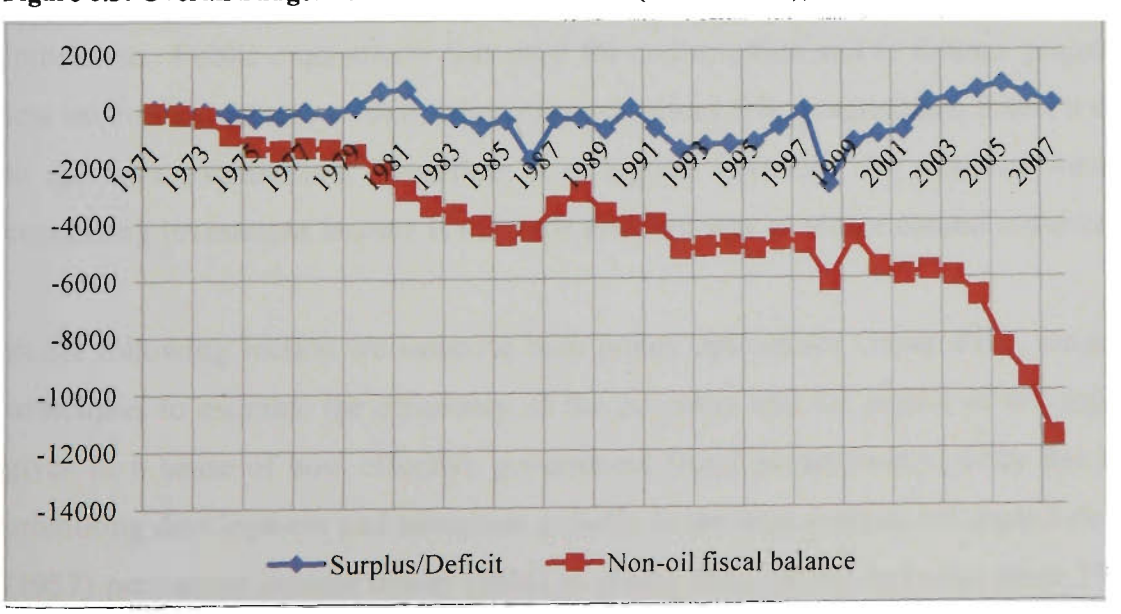
Source: *Statistical Year Book*, Oman, various issues.

6.3.3 Fiscal Sustainability for Resource Dependant Economies

Public debt in Oman was never an unmanageable problem and it has not been subject to IMF or World Bank (WB) adjustment programmes and there has never been any rescheduling of official or commercial government debt. However, we still put forth the question, is the current fiscal policy sustainable? What are the implications of the decline in oil production and as a consequence oil revenue on fiscal policy?

While it is common to use the ratio of public debt to GDP to assess fiscal policy vulnerability, for resource dependant economies the literature uses the ratio of non-resource deficit to expenditure to evaluate fiscal sustainability. The non-resource deficit is the difference between net government expenditure and its non-resource revenues (Shiell and Busby 2008). In other words, non-oil fiscal deficit is a hypothetical, constructed measure. So, although the overall fiscal position may register surpluses, such as the case in Oman since 2002, the non-oil fiscal deficit, the hypothetical, may be negative. In Oman, the non-oil balance has been negative since 1974 (see Figure 6.3), but there are several reasons to treat this measure with caution. One is that, as mentioned in notes to Table 6.5, oil revenues included in the budget do not include the unpublished oil revenues transferred direct to the SGRF. The figures on net foreign assets in Figure 6.1 suggest that over the period since 2002 these transfers may have been comparable to the increase in the non-oil deficit shown in Figure 6.3.

Figure 6.3: Overall budget deficit and non-oil deficit (million USD), 1971-2007



Source: *Statistical Year Book*, Oman, various issues.

6.4 NATURAL RESOURCES AND FISCAL SUSTAINABILITY

Researchers investigating the implication of natural resource discovery on fiscal policy differ on what is the best policy option for resource utilization. There are two major policy alternatives available for governments dependent on natural resource income. The first option is to maximise resource extraction and use the proceeds to build physical and human capital. The maximum extraction policy is based on the theories of Stiglitz (1974) and Solow (1974) that human and physical capital has a higher marginal productivity than natural resources and hence by maximising the extraction rate future generations will benefit from the accumulation of human and physical capital. The development experiences of many Western countries and the United States were based on the utilization of natural resources that were successfully converted into productive physical and human capital (Rostow 1990).

The second policy option also calls for the extraction of natural resources but prescribes converting the income accrued into financial assets. The government can then consume the annuity/profits from the financial assets leaving the principal in the form of financial assets constant, to ensure financial sustainability and intergenerational sharing of resource wealth. Given the poor economic performance of many developing countries, including resource rich countries since 1970, researchers have suggested that natural resource extraction activities did not result in a successful accumulation of factors of production to compensate for the depleted resources (Gelb 1988). And one of the reasons for economic underperformance that is often cited is the public budget imbalance. Public expenditure was used for consumption and to finance projects with low investment returns so that, when resource prices fell, governments found it difficult to cut back expenditure. Therefore, it is argued, investing the resource wealth and consuming investment income is the most efficient way to utilize natural resources.

In the following section we examine both policy options for Oman. First, we use TFP techniques to estimate the efficiency of the economy and the results of this estimation gives us a sense of how effective government fiscal expansionary policy has been in promoting development and economic growth. In the next section, we apply Friedman's (1957) permanent income model (PIM) to assess fiscal policy in Oman since 1970 and to explore the different expenditure options available for the government. Finally, we

estimate the consumption level that is sustainable given the proven level of oil reserves, production rate, and technology.

6.5 TOTAL FACTOR PRODUCTIVITY AND OUTPUT GROWTH IN OMAN

There is much uncertainty about the causes of economic growth in Oman. Has GDP growth been mainly the function of capital and labour employment? And what is the contribution of technological progress and efficient use of resources in GDP growth? Analysis of factor input contributions to GDP growth will reveal if growth has been mainly a function of accumulating capital and labour or of total factor productivity (TFP). If GDP growth has been mainly the function of capital and labour accumulation resulting from oil wealth, then reduced oil wealth could have a sharply negative impact on GDP growth. In that scenario, it would be difficult to employ labour and to accumulate capital stock, so growth could stagnate.

On the other hand, if GDP growth has been mainly a function of TFP, then the absence of oil income could have less impact on GDP growth. Growth led by TFP may suggest increasing efficiency in the use of factor inputs and indicate that output has been becoming less dependent on oil income. Positive growth in TFP could also be an indication of successful government development policy in making good use of oil income and turning oil wealth into productive assets. The neoclassical production function is used to decompose the growth rates of aggregate output into the contribution inputs and improvements in total factor productivity. By doing so, the aim is to look for sources of growth in the Omani economy, and to examine the contribution of labour, capital, and TFP to GDP growth.

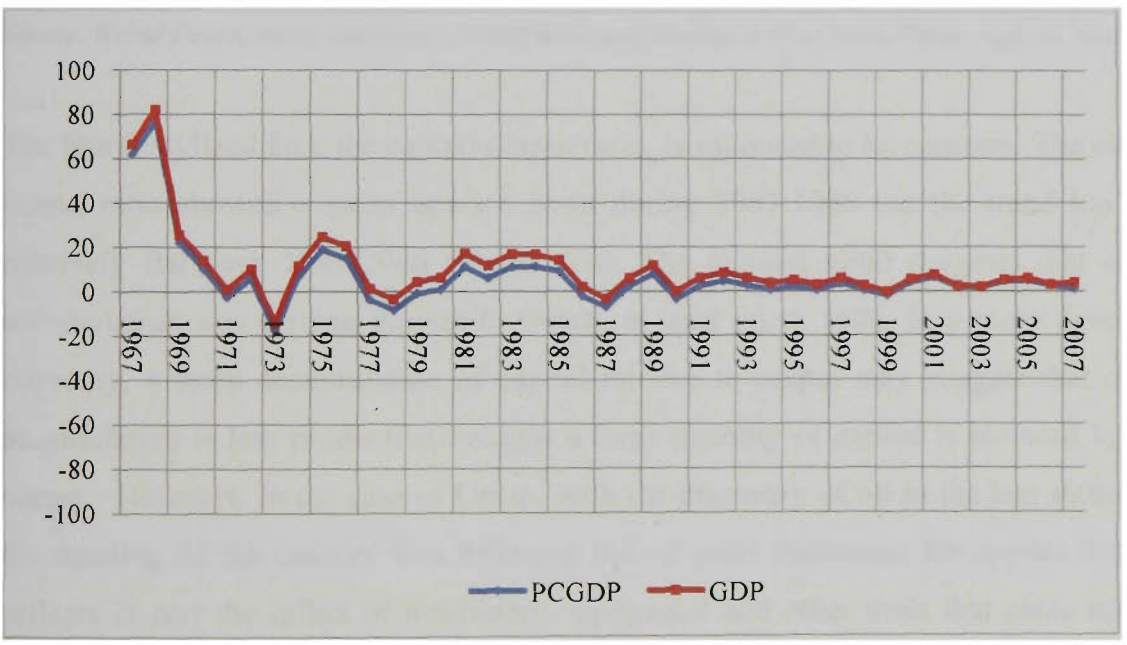
6.5.1 Kaldor Stylized Facts

Before measuring TFP, it is worthwhile to consider the state of long-run equilibrium growth for Oman, using some stylised facts of economic development proposed by Kaldor (1957). A view of the Omani economy in the light of Kaldor's stylized facts should help us understand TFP and the long-term determinants of economic growth. The stylized facts are:

1. Constant output and per capita output growth for developed countries but a rapid rate of real growth is observed in a developing economy.
2. Average capital/labour ratio (K/L) grows overtime.
3. Average labour productivity (Y/L) grows overtime.
4. Average capital productivity (Y/K) is constant.

Figure 6.4 shows the growth rate of output and per capita output from 1967-2007 of a very large scale, given the high rates of growth achieved in the early oil years. The period from 1967-1989 was characterized by exceptional swings in both variables, reflecting the impact of resource discovery in 1967 and favourable terms of trade, particularly between 1974-1975 and 1979-1985. Since 1990, both variables still experienced swings but the peaks were flattened. Stylized fact (1) is therefore a typical feature of a growing developing economy, i.e. strong output growth and income gains.

Figure 6.4: Per capita GDP and GDP growth rate, 1976-2007

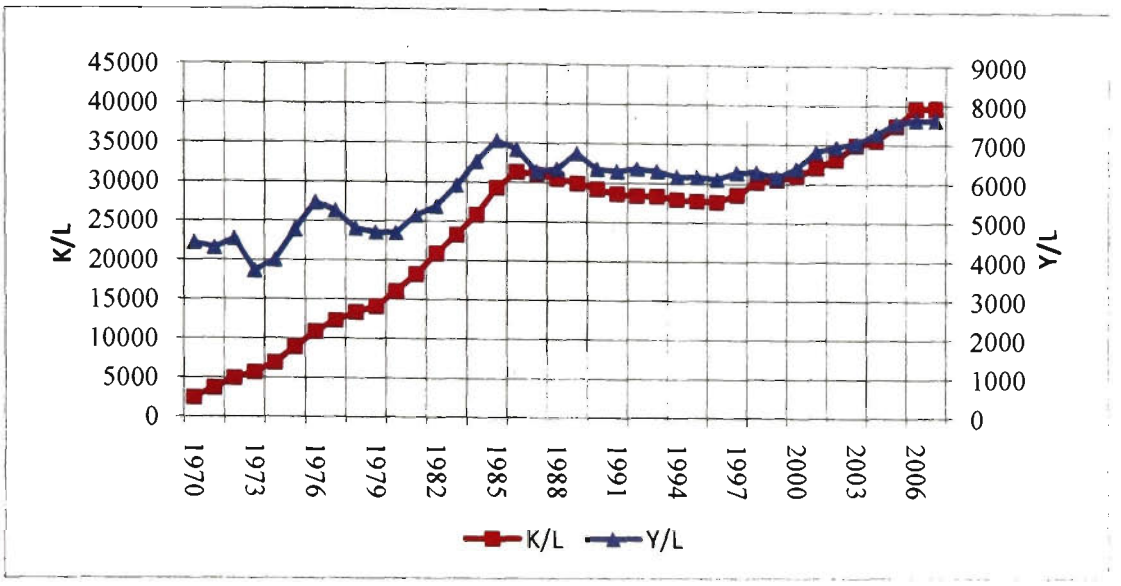


Source: *World Development Indicators*, World Bank.

Figure 6.5 plots the average capital/labour ratio and average labour productivity from 1970 to 2007. The average for both variables clearly shows upward trend. However, the capital/labour ratio growth is about 8% per year compared to labour productivity growth of just 2% per annum. There are also three distinct periods evident in both data series: strong growth up to about 1985, stagnation or even a period of decline through to about

200, and renewed growth after 2000. Nevertheless, stylized facts (2) and (3) are clearly confirmed by our historical data set over the period as a whole.

Figure 6.5: Capital/labour ratio and labour productivity, 1970-2007

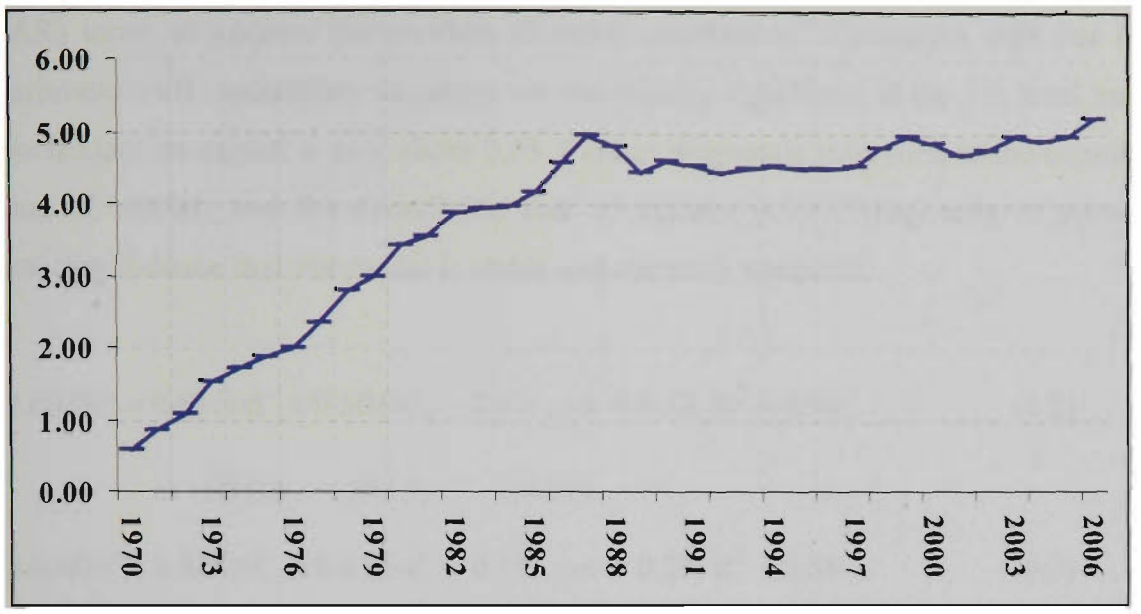


Notes: K is capital, L is labour, and Y is output.

Source: *World Development Indicators*, World Bank and *Statistical Year Book*, Oman, various issues.

The fourth stylized fact, the capital-output ratio, is supposed to be constant. The capital-output ratio showed a steep upward trend during 1967-1986 but the trend has been relatively flat over 1987-2006 (Figure 6.6). The upward trend suggests that capital accumulation was driving growth in Oman, at least up to 1986. In a more developed economy, a steep accumulation of capital relative to output may suggest that capital accumulation is less productive because a large quantity of capital is invested to raise output. However, in the case of Oman, with the discovery of oil in the late sixties and the opening of the country that followed the oil price increases, the capital intensity reflects in part the influx of machinery, equipment and other tools that came into the country. In addition, since oil extraction and exports are capital intensive, a high capital-output ratio is expected because of the high intensity nature of the capital which remained underutilized in the initial stages of the investment. Furthermore, the changing relationship in capital-output ratio after 1987 strongly supports the view expressed above, that capital is becoming more efficiently utilized. The fourth stylised fact, i.e. constant average capital productivity, is not apparent in the early years but is apparent in the flattening of the capital-output ratio from 1987.

Figure 6.6: Capital-output ratio, 1967-2006



Source: *World Development Indicators*, World Bank.

6.5.2 Capital and Labour Coefficients and TFP Estimation

In this section capital, labour, and technology coefficients are estimated, using the standard Cobb-Douglas (Cobb and Douglas 1928) production function $Y_t = A_t F(K_t L_t)$ where Y, K, L are output (GDP), capital, and labour respectively, and A is the technology term. First, we ran the log linear production function to estimate labour and capital coefficients and time trend (t) that captures technological change in Oman for the period 1967-2006. GDP data was sourced from the Oman Statistical Year Books (various issues) and deflated to constant 2000 prices. Gross capital stock was estimated from the Penn World Tables (Mark 6.2) data and various issues of the Oman Statistical Year Books (see section 6.5.3.3). Labour data were sourced from the Oman Statistical Year Books for the period 1970-1979 and from World Bank Data for the period 1980-2007. We use the following regression:

$$LnGDP_t = \beta_1 LnK_t + \beta_2 LnL_t + \beta_3 t + \varepsilon_t \qquad (6.1)$$

We report two regression results. For the first equation, (6.2) and the first regression in Table 6.8, the post-estimation diagnostics of the results reveal the presence of serial correlation. This is confirmed by the Durbin-Watson test, which examines the serial correlation of the error term. In the presence of serial correlation, the strict exogeneity assumption is violated, leading to a biased coefficient estimates. In the second equation,

(6.3) and the second regression in Table 6.8, we introduced first order autoregressive (AR) terms to address the problem of serial correlation.[34] Consistent with our initial estimation, all explanatory variables are statistically significant at the 1% level and the coefficient on capital is now about 0.63. Further diagnostic tests such as the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMsq) tests of parameter stability indicate that our model is stable and correctly specified.

$$LnGDP_t = 0.83LnK_t + 0.50LnL_t - 0.02t, \text{ ser} = 0.33, R^2 = 0.96 \qquad (6.2)$$

$$(0.10) \quad (0.14) \quad (0.01)$$

$$LnGDP_t = 0.63LnK_t + 0.67LnL_t - 0.19t, \text{ ser} = 0.22, R^2 = 0.88 \qquad (6.3)$$

$$(0.18) \quad (0.24) \quad (0.40)$$

The results of both regressions showed that capital and labour exhibit increasing returns to scale, suggesting a "catch-up growth" scenario, where capital and labour accumulation drove growth while trend t was negative.[35] This result could be interpreted in two ways. First, the marginal accumulation of labour and capital outstripped all other factor inputs in Oman. This was possible because of the unprecedented and rather unexpected capital inflow as a result of oil revenue windfall. That in turn enabled the deployment of more capital and labour in production. Secondly, factor inputs were being less efficiently used over time. Therefore, it could be argued, growth in Oman was based on a rapid large accumulation of capital and labour rather than efficient utilization of resources. In addition, as can be seen from the regression statistics, weights of 0.8 and 0.6 for capital are contrary to the expectation of a developing country. In addition, the sum of the coefficients of the capital and labour was more than one, suggesting an increase returns to economies of scale.

[34] In brackets are the standard errors.
[35] Makdsi et al. (2000) and Alhiraika and Hamad (2001) found similar results.

Table 6.8: GDP and factor inputs, 1967-2007

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCapital	0.823***	0.105	7.910	0.000
LLabour	0.497***	0.137	3.621	0.000
@Trend	-0.016*	0.009	-1.876	0.0686
R-squared	0.958			
Adjusted R-squared	0.956			
Durbin-Watson stat	0.455			
Estimation with first order autoregressive term				
LCapital	0.626***	0.180	3.468	0.040
LLabour	0.672***	0.238	2.817	0.067
@Trend	-0.191***	0.074	-2.566	0.083
AR(1)	0.170	0.398	0.426	0.670
R-squared	0.938			
Adjusted R-squared	0.876			
Durbin-Watson stat	2.488			
Inverted AR roots	0.17			
Estimation with first order autoregressive term and using sub-sample 1967-1986				
LCapital	0.777***	0.1107	7.050	0.000
LLabour	0.5847***	0.1467	3.989	0.002
@Trend	-0.0037***	0.026	-0.129	0.899
AR(1)	0.6057***	0.1416	4.2849	0.020
R-squared	0.990			
Adjusted R-squared	0.988			
Durbin-Watson stat	2.206			
Inverted AR Roots	0.610			
Estimation with first order autoregressive term and using sub-sample 1988-2007				
LCapital	0.271***	0.050	5.450	0.000
LLabour	0.814***	0.130	8.561	0.000
@Trend	0.061**	0.030	2.031	0.049
AR(1)	0.838***	0.086	9.782	0.000
R-squared	0.985			
Adjusted R-squared	0.982			
Durbin-Watson stat	1.839			
Inverted AR Roots	0.450			

Notes:***, ** and * denote statistical significance at the 1%, 5% and 10% levels respectively.

To further address this issue, we re-ran the log linear production function to estimate labour and capital coefficients and the *t* trend for output growth in Oman but this time we broke the regression data into two period sets as suggested by the analysis above,

namely 1967-1987 and 1988-2006. The purpose of this data segmentation and re-estimation was to look for any structural shift in the economy and the changing dynamics in the Omani economy. More specifically, we are interested in the negative trend variable observed in equation (6.3). The results are reported in the third and fourth panels of Table 6.8.

In the first period, 1967-1987, with the exception of *t* term, capital and labour and the AR term variables were statistically significant at the 1% (see Table 6.8). The *t* term for the first period 1967-1987 is negative but not statistically significant. If taken literally this suggests that, during the initial years of the economic development, economic efficiency was declining and there was no contribution of technological change to economic output. In addition, the negative trend implies that the capital in Oman was underutilized during that period.

On the other hand, the estimation for the period 1988-2006, provided evidence for rising efficiency in the economy (see Table 6.8). The results also indicated that technological change contribution to GDP growth was increasing. In the second period, the computation results showed that capital, labour, and AR terms were statistically significant at 1%, while the trend, *t*, variable was positive and statistically significant at 5%. The *t* coefficient of .06, though small, showed that during 1987-2006, increasing efficiency and technology contributed positively to GDP growth in Oman. Furthermore, capital and labour coefficients in Table 6.9 are converging to constant returns to scale and that is additional evidence of increasing efficiency in the output growth of the economy in Oman in later years, compared to past years of GDP growth.

6.5.3 Capital, Labour and TFP Coefficients: Calculating Actual Coefficients

Following estimation of capital and labour contribution in Section 6.5.2, in this section, we use actual data and apply growth accounting techniques to examine factor contributions – capital, labour, and TFP – to output growth. We compute the actual shares of capital and labour to income to estimate the sources of GDP growth in the Omani economy. In doing so, first we specify the marginal product and estimated capital and labour shares to output, and then we measure labour and capital inputs.

Finally, we estimate TFP, using the log linear neoclassical production function and solve for TFP.

6.5.4 Marginal Products and Capital and Labour Shares to Output

Using the Cobb-Douglas production function and following Mankiw (Mankiw 2002), first we specify the marginal product of labour and capital respectively as:

$$MPL = (1-\alpha)Y / L \qquad (6.4)$$

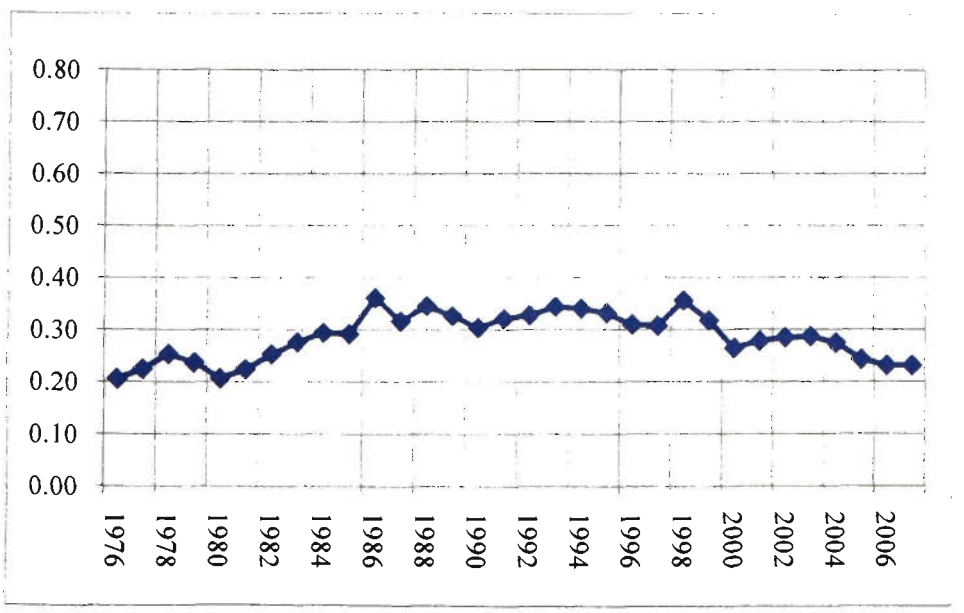
$$MPK = \alpha Y / K \qquad (6.5)$$

Where Y, K, L, are output, capital and labour respectively.

Equation (6.4) states that the marginal product of labour (MPL) is proportional to output per worker and equation (6.5) states that that the marginal product of capital (MPK) is proportional to output per unit of capital. Using Oman's national income accounts data we calculated capital and labour shares to output $(1-\alpha)Y$ or $MPL^{*}L$ in Oman from 1976-2007.

Figure 6.7 shows the ratio of labour to total income in Oman over the period 1976-2007. On average the labour share of output is about 0.3 and using constant returns to scale (CRT) capital's share of output, therefore, should be 0.7. This result is quite close to the regression result we obtained earlier in equation (6.3).

Figure 6.7: Ratio of Labour income to total income, 1976-2007



Source: Calculated from Oman National Income Account Data, Ministry of National Economy.

Second, we specified the Cobb-Douglas production function as follows:

$$Y_t = A_t F(K_t L_t) \tag{6.6}$$

where Y, K, L are output (GDP), capital, and labour respectively, and A is the TFP. Differentiating the production function with respect to time and decomposing the model to estimate the growth rates of the production function into sources of growth we obtain the following:

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + \frac{mp_k K}{Y}\frac{\dot{K}}{K} + \frac{mp_l L}{L}\frac{\dot{L}}{L} \tag{6.7}$$

where *mpk* and *mpl* are the marginal product of capital and labour, respectively under the assumption of competitive factor markets, constant returns to scale, and technological progress. Then, mp_kK/Y and mp_lL/Y are the shares of compensation to capital (αk) and labour $((1-\alpha)l)$ in aggregate output respectively.

Assuming constant returns to scale, the growth rate of the economic output is decomposed into TFP growth and the weighted sum of the growth of capital and labour.[36] This can be expressed as:

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + \alpha\frac{\dot{K}}{K} + (1-\alpha)\frac{\dot{L}}{L} \tag{6.8}$$

Rearranging equation (6.8) and solving for TFP we obtained the following:

$$TFP = \frac{\dot{A}}{A} = \frac{\dot{Y}}{Y} - \alpha\frac{\dot{K}}{K} - (1-\alpha)\frac{\dot{L}}{L} \tag{6.9}$$

6.5.5 Measures of Factor Inputs (Labour)

There are three methods used to measure labour input. The first method uses the number of hours worked and the second method uses the number of workers in an economy, see Dalgaard (2005). The third method uses either the first or the second method adjusted to the number of schooling years completed by the population. This latter method, which includes the education level, is also called human capital stock and it is used because of

[36] A sensitivity analysis on the degree of scale economies will be carried out in subsection 6.5.8

the positive impact of education on worker quality and/or efficiency, see (Maudosa, Pastora et al. 1999). Only time series data on the number of people working in Oman are available, so it is the method we have to used to measure labour input.

6.5.6 Measures of Factor Inputs (Capital)

There are several methods of estimating capital stock, using a "direct method" from stock survey results or an "indirect method" using yearly investment data from the national accounts. The indirect method of estimating capital stock in turn uses two alternative methods. The first method is called the benchmark-year method and it estimates capital stock by direct observation, through surveys, for a benchmark year. The second indirect method uses a discounted accumulated value of historical investments up to a benchmark year and it is called the perpetual inventory method (Albala-Bertrand 2001). We use the perpetual inventory method to calculate Oman's capital stock. Following Khan (2005) and (Ahmed and Suardi 2007) the method is as follow:

$$K_t = (1-\delta)K_{t-1} + I_t \qquad (6.10)$$

where K is the capital stock and I is value of investment and δ is the rate of depreciation.

The series of capital stock from an initial *K(0)* is the initial capital stock plus the weighted sum of past investments, adjusted for depreciation. This can be expressed as:

$$K_t = (1-\delta)^t K(0) + \sum_{i=0}^{t-1} I_{t-i}(1-\delta)^i \qquad (6.11)$$

The initial capital stock is estimated as follow:

$$K_0 = \frac{I_0}{(g+\delta)} \qquad (6.12)$$

where g is GDP growth. The depreciation rate is subjective and researchers use a rate between 4 to 10%. We have chosen an average of 7%.

Another important aspect in measuring capital stock is labour productivity with respect to capital intensity. This measure estimates labour efficiency in using capital input. An increase in capital intensity indicates a decrease in the efficiency use of capital and a decrease in labour productivity. And a decrease in capital intensity indicates increased

capital efficiency and an increase in labour productivity (Abramovitz 1993). Capital intensity is estimated as:

$$\frac{(1-\alpha)(K/L)}{Y/L} \qquad (6.13)$$

where $(1-\alpha)$ is capital weight, K is capital, L is labour, and Y is GDP.

Using equation (6.13), capital intensity estimates in Table 6.9 imply that capital stock efficiency has been declining and, therefore, labour productivity has been decreasing in Oman. However, for an oil dependent economy, an increase in capital intensity also reflects the transmission of the oil windfall into the economy in the form of increased capital stock purchases, which may appear to suggest a decline in capital stock efficiency.

Table 6.9: GDP, capital, employment and population growth rates, and capital intensity, 1971-2006

	1971-75	1976-80	1981-85	1986-90	1991-95	1996-00	2001-07
Real GDP growth	6	6	15	3	6	3	5
Real capital growth	35	19	20	5	5	5	6
Employment growth	4	6	6	5	6	3	1
Population growth	4	5	5	4	3	2	1
Capital intensity, (levels)							
Capital intensity	0.47	0.89	1.29	1.50	1.50	1.60	1.60

Note: Capital intensity is calculated using equation (6.13).
Source: GDP and employment from *World Development Indicators*, World Bank.

The neoclassical growth model suggests that economic output will grow by the accumulation of labour and capital until the marginal return to capital is equal to the marginal return on labour. However, to achieve sustainable growth, technology, knowledge and skills must be increased. More specifically, the TFP contribution to GDP, also known in the literature as "Solow residual", must increase and lead GDP growth. Applying the production function to estimate Oman's TFP, we use the log linear function of the production function and solve for TFP as follows:

$$LnTFP_t = LnY_t - (\alpha)LnK_t - (1-\alpha)LnL_t \qquad (6.14)$$

6.5.7 TFP Test Results

Following the specification of equation (6.14) the results indicate that, on average, the capital contribution to GDP growth in the period 1970-2006 was 143% and that of labour was 24%, but that the TFP contribution to output growth was negative 65% (see Table 6.10). Our results are similar to Makdisi, Fattah and Limam (2000). According to those authors, with the exception of Egypt, Morocco, Tunisia and Turkey, all Middle East and North Africa (MENA) countries included in their sample had negative TFP growth. Elhiraika and Hamad (2001) also found that the TFP of the United Arab Emirates (UAE) was negative and labour contribution to GDP growth was very significant at 104%. The authors suggested that the negative TFP observed in the MENA countries reflects inefficient use of factor inputs and that GDP growth for the oil exporting countries in the region has been mainly a function of capital and labour accumulation.

However, this simple interpretation of the negative TFP could be misleading and does not paint a factual picture of the development process of factor inputs in Oman. As discussed above, upon segregating the data into two periods, 1967-1987 and period 1988-2007, we estimated the production function for the Omani economy and observed that the trend for the first period 1967-1987 was negative and not statistically significant but the trend term for the period 1988-2007 was positive and statistically significant (significant at the 5% level). In addition, the historical data for Oman (see Figure 6.7) supports the proposition that there was excess capacity in the economy as a result of the large import of capital and machinery following the oil sector boom and that capital usage became more efficient and better utilized with time.

Furthermore, the combination of very strong real capital growth of 25% during 1971-1985 and employment and population growth of 5%, suggests that capital and labour growth outstripped all other inputs, i.e. efficiency and technology, in deriving output growth (see Table 6.10). And the fact that the TFP trend line showed a positive upward sloping pattern since 1998 indicates changes in the dynamics of factor inputs in the economy over this period (see Table 6.11 and Figure 6.8). This seemingly suggests that

Table 6.10: GDP growth and the production function, 1971-2007

Year	ΔlnY	ΔlnK	ΔlnL	αΔlnK	(1-α)ΔlnL	ΔlnTFP
1971	0.01	0.55	0.04	0.37	0.01	-0.37
1972	0.10	0.40	0.04	0.27	0.01	-0.19
1973	-0.14	0.20	0.04	0.13	0.01	-0.29
1974	0.11	0.26	0.04	0.17	0.01	-0.07
1975	0.24	0.35	0.04	0.23	0.01	0.00
1976	0.21	0.29	0.05	0.19	0.02	0.00
1977	0.01	0.19	0.05	0.13	0.02	-0.13
1978	-0.04	0.14	0.05	0.10	0.02	-0.15
1979	0.04	0.12	0.06	0.08	0.02	-0.06
1980	0.06	0.21	0.06	0.14	0.02	-0.10
1981	0.17	0.21	0.07	0.14	0.02	0.00
1982	0.12	0.22	0.07	0.15	0.02	-0.06
1983	0.17	0.18	0.06	0.12	0.02	0.02
1984	0.17	0.17	0.06	0.12	0.02	0.03
1985	0.14	0.20	0.05	0.13	0.02	-0.01
1986	0.02	0.13	0.05	0.08	0.02	-0.08
1987	-0.03	0.04	0.05	0.03	0.02	-0.08
1988	0.06	0.03	0.05	0.02	0.02	0.03
1989	0.12	0.03	0.05	0.02	0.02	0.08
1990	0.00	0.04	0.06	0.02	0.02	-0.04
1991	0.06	0.05	0.07	0.03	0.02	0.01
1992	0.08	0.06	0.07	0.04	0.02	0.02
1993	0.06	0.07	0.07	0.05	0.02	-0.01
1994	0.04	0.05	0.06	0.03	0.02	-0.01
1995	0.05	0.04	0.05	0.03	0.02	0.00
1996	0.03	0.04	0.04	0.02	0.01	-0.01
1997	0.06	0.06	0.03	0.04	0.01	0.01
1998	0.03	0.08	0.02	0.06	0.01	-0.04
1999	0.00	0.03	0.02	0.02	0.01	-0.03
2000	0.05	0.03	0.02	0.02	0.01	0.03
2001	0.07	0.04	0.01	0.03	0.00	0.04
2002	0.03	0.04	0.01	0.03	0.00	0.00
2003	0.02	0.06	0.01	0.04	0.00	-0.02
2004	0.05	0.04	0.02	0.02	0.01	0.02
2005	0.06	0.07	0.02	0.05	0.01	0.00
2006	0.04	0.09	0.03	0.06	0.01	-0.03
2007	0.05	0.05	0.05	0.03	0.02	0.00
Average	0.06	0.13	0.04	0.09	0.01	-0.04
Factor Input contribution to growth				1.43	0.24	-0.66

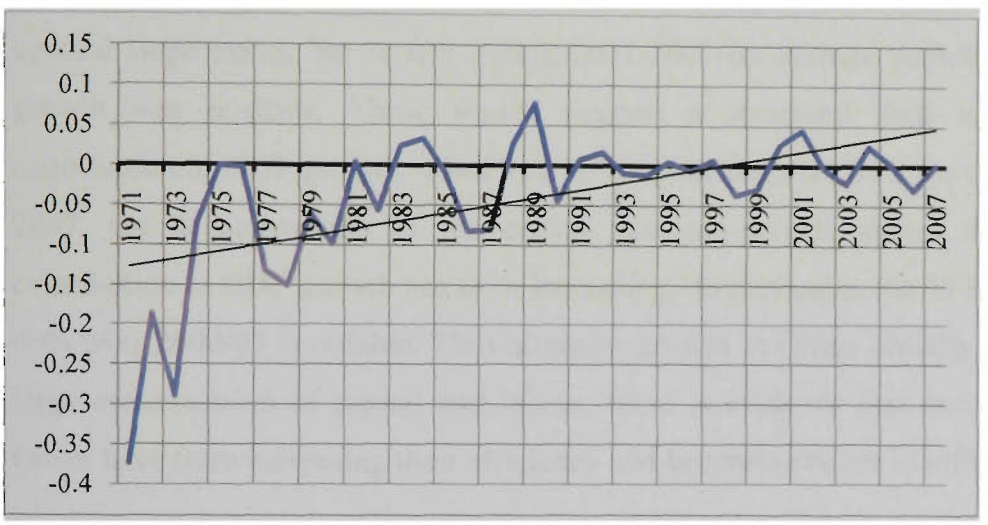
Source: Author calculation.

factor inputs are becoming more efficient and that the economy is becoming more like 'inspiration' than 'perspiration', using Krugman (1994) description of the development experience of 'the Asian miracle'. The interpretation of the negative TFP concluded by

many observers could be incorrect and does not completely explain the dynamics of the economy, its factor interrelationships and the economic evolution in Oman, and perhaps in the other oil exporting countries in the region.

Moreover, one must also note that, TFP calculation must be affected in part by oil sector activities as well as activities dependent on it. Therefore, the high contribution of capital observed must reflect in part resource rent windfall, that is capital inflow plus rent residual to capital and as a result low calculation of TFP growth as a residual.

Figure 6.8: TFP trend, 1971-2007



Source: Author calculation.

To uncover the trend in factors contributing to GDP growth in Oman during 1970-2007, we decomposed economic output into seven periods (see Table 6.11). The purpose of this decomposition was to look for trends in our variables that could have been masked by the previous aggregation in Table 6.11.

Table 6.11: GDP growth and the production function (sub-periods), 1971-2007

Period	$\alpha\Delta\ln K$	$(1-\alpha)\Delta\ln L$	$\Delta\ln TFP$
1971 - 1975	3.64	0.21	-2.85
1976 - 1980	2.25	0.33	-1.58
1981 - 1985	0.87	0.13	-0.10
1986 -1990	1.10	0.54	-0.64
1991 - 1995	0.62	0.36	0.20
1996 - 2000	0.98	0.25	-0.23
2001 - 2007	0.82	0.14	0.40

Source: Author calculation.

In the first four periods the capital stock contribution to GDP growth was exceptionally high, especially during 1971-1980. In the first and second period, capital stock contributed 364% and 225% to GDP growth respectively. This high percentage contribution of capital stock to output growth was expected, for two reasons. As it has already been observed above, the first reason was related to the initial effect of underutilized capital stock brought into the country by the major oil companies. The second reason was the unprecedented levels of wealth accruing to the country as a result of the oil export boom. Moreover, it is clear from our decomposition that not only has the negative TFP trend has been flattening and therefore the trend is an upward slope curve, but in fact during 2001-2007 its average contribution to output growth was positive. These results suggest a structural shift in factors input contribution to GDP growth. Therefore, despite the negative TFP for the period 1970-2007, the decomposition of the period into sub-periods shows that total factor contribution to GDP growth has been increasing. In particular, the TFP contribution of 40% over 2000-07 is notable. Thus although growth in Oman initially was based on a large accumulation of capital and labour, there is evidence that economic agents in Oman have been increasing their efficiency and becoming better in utilizing resources.

6.5.8 Sensitivity of TFP Growth Estimate

Last, but not least, since the TFP coefficients are affected by the assumptions we make about the elasticity of capital and labour, it is suggested that TFP sensitivity analysis must be estimated with different assumptions on the weight of the fastest growing factor of production, α, and about the degree of economies of scale in order to check for the robustness of TFP results (World Bank 2000). So in the next exercise we changed the weight of α and the degree of scale economies. The results are reported in Table 6.12. Part (A) of the table, reports the computation results for the whole period, 1971-2007. The sensitivity results are robust to our initial estimates that on average the TFP in Oman in 1971-2007 was negative. TFP was negative under all assumption of economies of scale.

We also report the sensitivity results for sub-periods, parts (B), (C), and (D) of the table. The sensitivity results support the positive progression found in Tables 6.9 and

6.12 and that the economy has become more efficient and that technological change has contributed positively to GDP growth in Oman during 2002-2007. In addition, under the assumption of different degrees of economies scale and at $\alpha = 0.7$ TFP is positive.

Table 6.12: Sensitivity of TFP growth estimates, 1970-2007 (A)

Returns to scale	α=0.7	α=0.8	α=0.9
Constant returns to scale (CRT) = 1	-0.66	-0.85	-0.99
Increasing returns to scale (IRT) = 1.2	-0.85	-0.99	-1.13
Decreasing returns to scale (DRT)= 0.9	-0.56	-0.7	-0.27

Sensitivity of TFP growth estimates, sub-periods (B)

Returns to scale*	α=0.7	α=0.8	α=0.9
1971-1975	-2.85	-3.00	-4.33
1976-1980	-1.58	-1.50	-2.00
1981-1985	-0.10	0.00	-0.50
1986-1990	-0.64	-0.33	-0.33
1991-1995	0.20	0.00	0.00
1996-2000	-0.23	-0.17	-0.17
2001-2007	0.40	0.00	-0.17

Note: *Constant returns to scale (CRS) = 1.

Sensitivity of TFP growth estimates, sub-periods (C)

Returns to scale*	α=0.7	α=0.8	α=0.9
1971-1975	-3.37	-3.89	-4.33
1976-1980	-1.75	-1.97	-2.17
1981-1985	-0.29	-0.52	-0.67
1986-1990	-0.52	-0.52	-0.5
1991-1995	-0.19	-0.17	-0.17
1996-2000	-0.23	-0.27	-0.33
2001-2007	0.04	-0.09	-0.17

Note:*Increasing returns to scale (IRS) = 1.2.

Sensitivity of TFP growth estimates, sub-periods (D)

Returns to scale*	α=0.6	α=0.7	α=0.8
1971-1975	-2.67	-3.17	-3.67
1976-1980	-1.17	-1.5	-1.67
1981-1985	0.17	0.00	-0.17
1986-1990	-0.33	-0.33	-0.33
1991-1995	0.17	0.17	0.17
1996-2000	0.00	-0.17	-0.17
2001-2007	0.17	0.01	0.00

Notes:*Decreasing returns to scale (DRS) = 0.9.
Alpha (α) is the coefficient of capital while ($1-\alpha$) is the coefficient of labour.
Source: Author calculation.

This positive result is particularly important from another dimension too. The resource export boom during this period, 2002-2007, is reminiscent of the resource export boom experienced during 1974-1983, however, in the latter period its impact on factor inputs was different. The resource export boom did not decrease the efficiency of the economy. The positive TFP found during 2001-2007, is an evidence of increasing efficiency and better use of factor inputs in economic output. Therefore, the overall negative TFP found during 1971-2007 can hide important information about the evolution of the economy and the contribution of factor inputs to GDP growth. This becomes apparent when the data are disaggregated.

6.6 PERMANENT INCOME MODEL AND FISCAL SUSTAINABILITY

There are several expenditure policies that the government could adopt to utilize its existing wealth and future oil income. One option is to maximize its oil income and spend all of the oil proceeds to build physical and human capital in the hope that these, with their potential for higher marginal productivity than natural resources, will enable future generations to benefit from the accumulation of human and physical capital. Such a policy option is risky because it may not necessarily result in sufficient economic growth to generate enough tax income for the government to replace oil income. Another, less risky policy option may include saving some of the oil income and converting it into financial assets that could sustain a viable level of expenditure once oil income is depleted. We have examined this option and suggest an expenditure path that is not too far from the current consumption levels but would require expenditure cuts that would help in the adjustment process towards a non-oil economy, while at the same time insuring intergenerational equity share of oil wealth.

Friedman's (1957) permanent income model (PIM) has often been used as the principal guiding policy for countries that rely heavily on exhaustible natural resources. This model has been adopted by the IMF as a policy prescription for resource based economies (Barnett and Ossowiski 2002). The permanent income hypothesis is used to identify the optimum level of expenditure that can be financed, given the size and expected income from the known stock of natural resources.

Oil wealth is defined as "the present discounted value of future oil revenue" (Davis, Ossowski et al. 2003). Fiscal planners in an oil based economy face two major concerns. The first concern is how much to spend now and how much to save for future generations. The second concern is how to convert oil wealth into permanent income. The framework of the PIM model has been used to set the path for the optimal level of government expenditure available from its wealth. The model assumes that government wealth is the discounted net present value of future flows of income available to the government. The PIM model can be used to provide expenditure options, given an initial level of wealth, an expected stream of income from mineral resources and investment returns. Fiscal policy can set an expenditure plan that will help in accumulating financial assets to compensate for resource depletion and at the same time save some of the resources for future generations.

Given the above discussion and the expected depletion of oil resources in 2027, fiscal policy can put in place an expenditure path that will sustain government expenditure beyond oil income. This can be done by reducing expenditure from oil income while maintaining oil assets to finance future expenditure. In this research we offer two types of approach to solve the problem. The first type, Plan 1, suggests that the government implement a long-term reduction in expenditure from oil revenue/wealth, at a constant absolute amount (a rising percentage reduction) so as to bring such expenditure to zero in 2050, and to finance part of the continued expenditure after 2027 from accumulated oil wealth. The second type, Plan 2, is that the government cut expenditure from oil revenue over the remaining life of the oil (to 2027), so as to create a situation in which, by 2027, the NPV of the accumulated oil wealth is equal to the NPV of continued oil spending, at the 2027 rate, to 2050. The challenge is to find a level of oil expenditure that will spread oil income for current consumption and future generations when oil income stops and the economy adjusts to being a non-oil economy.

More specifically, we define government oil income as the present value of the stream of cash flows that will be earned during the life of reserves, say until time T. This can be estimated by using the following relationship:

$$W_t = W_{t-1} + O_t + rW_{t-1} - \overline{C} \qquad (6.15)$$

where W_t is government resource wealth at period t, O_t is income from oil sale at time t, and r is real interest rate, $\bar{C}$ is government consumption/expenditure at time t.

The government's permanent expenditure is the function of its initial financial assets plus the sum of oil sales, including interest earned, over time T, this can be expressed as:

$$\bar{C} = \frac{W_0}{T} + \sum_{t=1}^{T} \frac{Y_t}{T} \tag{6.16}$$

Assuming that non-resource income consumption equals non-resource income earned by the government, then total government expenditure can be expressed as:

$$\bar{C} = \frac{W_0}{T} + \sum_{t=1}^{T} \frac{Y_t + NR_t}{T} \tag{6.17}$$

where NR_t is the non-resource income consumption.

Substituting equation (6.17) into equation (6.15), government wealth is:

$$W_t = W_{t-1}(1+r) + O_t - \frac{W_0}{T} - \sum_{t=1}^{T} \frac{Y_t + NR_t}{T} \tag{6.18}$$

6.6.1 The Application of the Model to Oman

Government oil revenue is oil revenue used by the government in its yearly budget plan and does not include oil revenues transfers to the State General Reserve Fund (SGRF). The SGRF yearly transfers are not declared by the Fund and government expenditure is fixed to 85% of expected oil revenue at a stated and declared oil price. The remaining 15% of the expected revenue is transferred to the SGRF. In addition, if the oil price is above the stated budget price, the additional revenue is transferred to the Fund. However, the oil price is quite volatile and actual government revenue is different from the planned revenue. Furthermore, in years where revenues drop below expectation or government expenditure increase above the stated plan, not only were government transfers well below the 15% of actual oil revenue, but the government withdrew from the fund to cover for the drop of oil revenue and the increased expenditure. Hence, government oil revenue used in this exercise is an estimate based on actual oil revenue

(the 85%) used by the government in its yearly budget plan plus estimate of transfers to the SGRF. The SGRF was not established until 1980 and therefore during 1970-1980 we used oil revenues from Oman Yearly Statistical Books, and during 1986-1991 and 1999-2000 there were no transfers to the SGRF because of the decrease in oil income due to the depressed international oil prices. Finally, during 1992-1998 and 2001-2003, only 5% of oil revenues were transferred to the SGRF. However, the inclusion of estimated revenues transferred to SGRF is a factor to be kept in mind in interpreting the results below.

6.6.2 The Model Results

Using equations (6.16) to (6.17), we estimated government consumption for 2008 to 2050. We are using the 2006 average oil price of $56 per barrels for Omani crude oil to estimate government revenues from oil.[37] We estimated current government financial assets including the State General Reserves Fund (SGRF) assets around 12.24 billion USD.

Specifying the estimate variables we have the following:

- Oil income (O_t) as the yearly oil income accruing to the government from oil sales.
- Government wealth (W_t) equals oil income (O_t) plus government initial wealth (W_0) and interest earned minus total permanent spending.
- Interest $W_{t-1}(1+r)$ is defined as interest earned from government wealth (W_t).
- Spending from base is spending from government initial wealth (W_0) over the time horizon (T).
- Income spending ($\sum Y_t/T$) equals the sum of interest income plus the accumulated oil income (O_t) and government wealth on the final year of time horizon.
- Non-oil income (NR_t) is the yearly non-oil income accrued to the government.
- Total permanent spending equals spending from base plus spending from income, $(W_t\text{-}1/43) + (\sum Y_t + NRt/T)$.

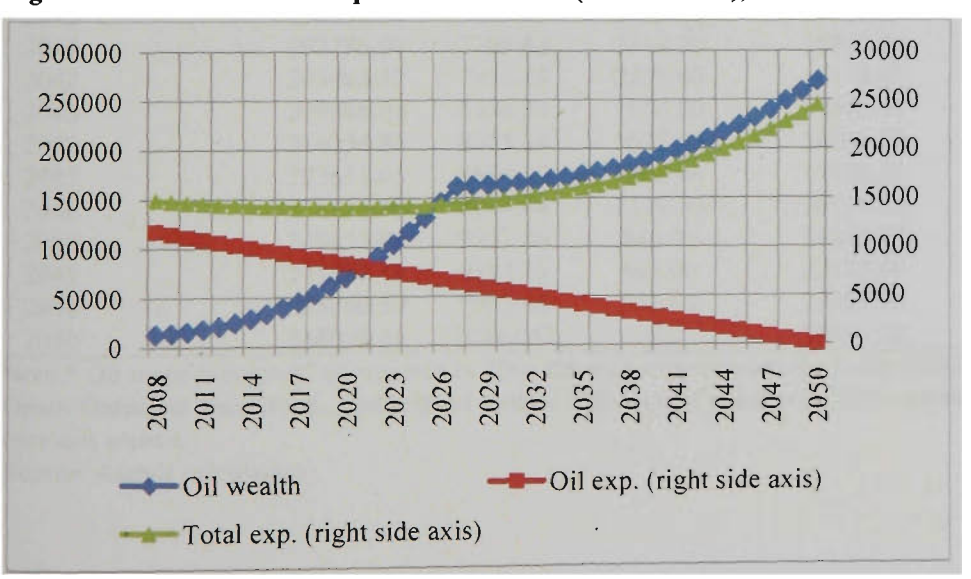
[37] Average crude oil price forecast for 2005-2030 by Energy Information Administration is $57.

6.6.3 Government Expenditure Plan 1.1

Using actual figures for government expenditure and oil income in 2006, we model and forecast an optimal government expenditure path.[38] The results are shown in Table 6.13 and Figure 6.9. Our assumptions are that oil income will increase yearly by 2% while government expenditure from oil is to be reduced by a constant absolute amount equalling 279 million USD (a rising percentage reduction) so as to bring oil expenditure to zero in 2050. We also assume that non-oil revenue to grow 5% annually. Actual non-oil revenue increased 14% annually in 1978-2007 (see Tables 6.5 and 6.6). Therefore, 5% real non-oil income is achievable. The Plan 1 option reported in Table 6.13 and Figure 6.9 shows that total government wealth will decrease by 0.48% per annum to year 2020 but then will start to increase, with the average increase being 1.88% during 2016-2050. Total government expenditure would increase 1.2% during 2008-2050.

As can be seen from the data provided in Table 6.13, there is still a significant level of wealth in 2050 even though spending from oil revenue has been reduced to zero. At the end period, in 2050, government oil wealth is valued 268.9 billion USD (see Figure 6.9). This means that there is room for additional spending and this gives the government of the day an adjustment mechanism where some changes could be made along the way.

Figure 6.9: Oil wealth and expenditure Plan 1.1(million USD), 2008-2050



Source: Author calculation.

[38] We did not use 2007 actual government oil income and expenditure because oil prices, and oil income, peaked in 2007 and could not be sustained.

Table 6.13: Government expenditure Plan 1.1 (real million USD), 2008-2050

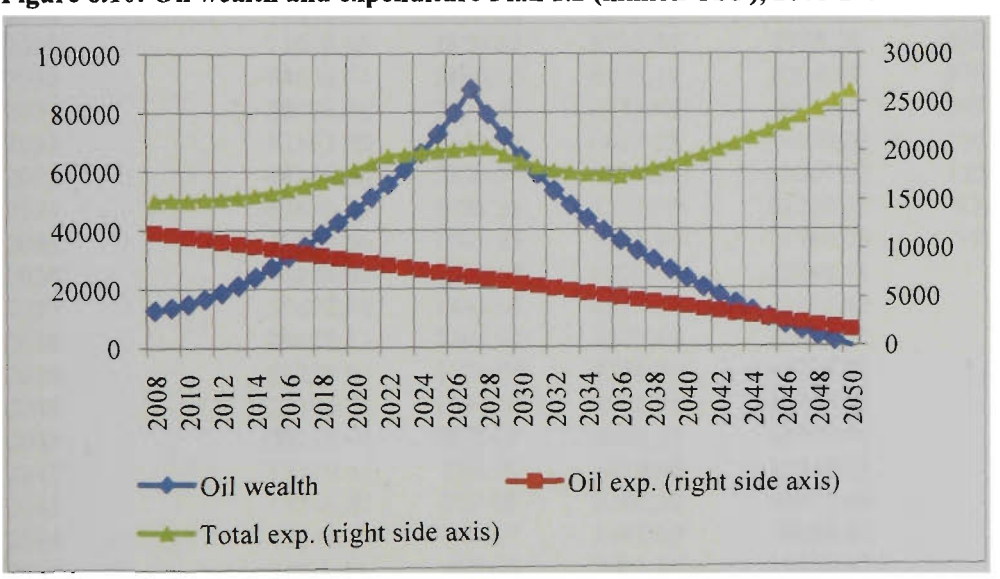
	Oil income increasing 2%	Oil wealth	Interest rate 4%	Oil exp. constant reduction	Non-oil income increasing 5%	Total expenditure
	11561.72*	12240.000		12000.000	3000.000	15000.000
2008	11792.95	12801.55	489.60	11721.00	3150.00	14871.00
2009	12028.81	13900.43	512.06	11442.00	3307.50	14749.50
2010	12269.39	15562.84	556.02	11163.00	3472.88	14635.88
2011	12514.78	17816.13	622.51	10884.00	3646.52	14530.52
2012	12765.07	20688.85	712.65	10605.00	3828.84	14433.84
2013	13020.37	24210.77	827.55	10326.00	4020.29	14346.29
2014	13280.78	28412.99	968.43	10047.00	4221.30	14268.30
2015	13546.40	33327.90	1136.52	9768.00	4432.37	14200.37
2016	13817.33	38989.35	1333.12	9489.00	4653.98	14142.98
2017	14093.67	45432.59	1559.57	9210.00	4886.68	14096.68
2018	14375.55	52694.44	1817.30	8931.00	5131.02	14062.02
2019	14663.06	60813.28	2107.78	8652.00	5387.57	14039.57
2020	14956.32	69829.13	2432.53	8373.00	5656.95	14029.95
2021	15255.44	79783.73	2793.17	8094.00	5939.79	14033.79
2022	15560.55	90720.64	3191.35	7815.00	6236.78	14051.78
2023	15871.76	102685.23	3628.83	7536.00	6548.62	14084.62
2024	16189.20	115724.83	4107.41	7257.00	6876.05	14133.05
2025	16512.98	129888.81	4628.99	6978.00	7219.86	14197.86
2026	16843.24	145228.61	5195.55	6699.00	7580.85	14279.85
2027	17180.11	161797.86	5809.14	6420.00	7959.89	14379.89
2028		162128.77	6471.91	6141.00	8357.89	14498.89
2029		162751.92	6485.15	5862.00	8775.78	14637.78
2030		163679.00	6510.08	5583.00	9214.57	14797.57
2031		164922.16	6547.16	5304.00	9675.30	14979.30
2032		166494.05	6596.89	5025.00	10159.06	15184.06
2033		168407.81	6659.76	4746.00	10667.02	15413.02
2034		170677.12	6736.31	4467.00	11200.37	15667.37
2035		173316.21	6827.08	4188.00	11760.39	15948.39
2036		176339.85	6932.65	3909.00	12348.41	16257.41
2037		179763.45	7053.59	3630.00	12965.83	16595.83
2038		183602.99	7190.54	3351.00	13614.12	16965.12
2039		187875.10	7344.12	3072.00	14294.82	17366.82
2040		192597.11	7515.00	2793.00	15009.57	17802.57
2041		197786.99	7703.88	2514.00	15760.04	18274.04
2042		203463.47	7911.48	2235.00	16548.05	18783.05
2043		209646.01	8138.54	1956.00	17375.45	19331.45
2044		216354.85	8385.84	1677.00	18244.22	19921.22
2045		223611.05	8654.19	1398.00	19156.43	20554.43
2046		231436.49	8944.44	1119.00	20114.25	21233.25
2047		239853.95	9257.46	840.00	21119.97	21959.97
2048		248887.11	9594.16	561.00	22175.96	22736.96
2049		258560.59	9955.48	282.00	23284.76	23566.76
2050		268900.01	10342.42	3.00	24449.00	24452.00

Note:* Oil income is actual oil revenue in 2006 (less oil income transfers to the SGRF) published by Oman Statistical Year Book. And non-oil income is the actual number in 2006 and obtained from the previous source.
Source: Author calculation.

6.6.4 Government Expenditure Plan 1.2

Given that there would still be oil wealth valued 130 billion USD in 2050 in Plan 1, we consider a scenario, still of the Plan 1 type, where such balance is adjusted so that wealth is reduced to zero by the year 2050 in our modelling. For this case we add to the spending in Plan 1.1 a rising percentage increment on total spending over 15 years, with that reduced back to zero over 15 years, and the model is solved for the percentage (of increment and decrement) that would bring wealth back to about zero in 2050. In this case total spending would be relatively flat until 2014 but then would start to grow again (assuming 5% yearly growth in non-oil revenues). Table 6.14 reports the results (see also Figure 6.10 for oil wealth and the expenditure plan). Under this plan, average government expenditure would be 2.5 billion USD higher, per annum, than Plan 1.1, during 2008-2036 but total expenditure would converge during 2037- 2050. In this plan total government expenditure would increase 1.4%, per annum, during 2008-2050.

Figure 6.10: Oil wealth and expenditure Plan 1.2 (million USD), 2008-2050



Note: Expenditure path is the right side axis.

Source: Author calculation.

The cases modelled here are only two of many cases of the Plan 1 type that could be examined, on a range of different assumptions. But these two cases do indicate that there are feasible paths for government spending, inevitably more constrained than in the past, that allow a rising path of spending to 2050 in spite of the depletion of oil reserves by 2027.

Table 6.14: Government expenditure Plan 1.2 (real million USD), 2008-2050

	Oil income increasing 2%	Oil wealth	Interest rate 4%	Oil exp. constant reduction	Non-oil income increasing 5%	Add. exp.	Total expenditure
	9997.000	12240.000		12000.000	3000.000		15000.000
2008	11792.95	12684.02	489.60	11760.57	3150.00	77.97	14988.54
2009	12028.81	13537.46	507.36	11521.14	3307.50	161.59	14990.23
2010	12269.39	14807.93	541.50	11281.71	3472.88	258.70	15013.29
2011	12514.78	16495.44	592.32	11042.28	3646.52	377.31	15066.11
2012	12765.07	18592.10	659.82	10802.85	3828.84	525.38	15157.07
2013	13020.37	21082.15	743.68	10563.42	4020.29	710.59	15294.30
2014	13280.78	23942.17	843.29	10323.99	4221.30	940.05	15485.34
2015	13546.40	27141.60	957.69	10084.56	4432.37	1220.09	15737.02
2016	13817.33	30643.43	1085.66	9845.13	4653.98	1556.03	16055.14
2017	14093.67	34405.16	1225.74	9605.70	4886.68	1951.99	16444.37
2018	14375.55	38379.87	1376.21	9366.27	5131.02	2410.77	16908.06
2019	14663.06	42517.52	1535.19	9126.84	5387.57	2933.76	17448.17
2020	14956.32	46766.25	1700.70	8887.41	5656.95	3520.88	18065.23
2021	15255.44	51073.75	1870.65	8647.98	5939.79	4170.61	18758.39
2022	15560.55	55388.60	2042.95	8408.55	6236.78	4880.10	19525.43
2023	15871.76	60367.24	2215.54	8169.12	6548.62	4939.56	19657.30
2024	16189.20	66042.42	2414.69	7929.69	6876.05	4999.01	19804.76
2025	16512.98	72458.56	2641.70	7690.26	7219.86	5048.28	19958.40
2026	16843.24	79672.14	2898.34	7450.83	7580.85	5077.17	20108.85
2027	17180.11	87752.62	3186.89	7211.40	7959.89	5075.12	20246.41
2028		79259.89	3510.10	6971.97	8357.89	5030.86	20360.72
2029		71658.66	3170.40	6732.54	8775.78	4039.08	19547.41
2030		64836.63	2866.35	6493.11	9214.57	3195.26	18902.94
2031		58698.36	2593.47	6253.68	9675.30	2478.06	18407.04
2032		53162.50	2347.93	6014.25	10159.06	1869.54	18042.86
2033		48159.60	2126.50	5774.82	10667.02	1354.58	17796.42
2034		43630.26	1926.38	5535.39	11200.37	920.33	17656.09
2035		39523.66	1745.21	5295.96	11760.39	555.85	17612.20
2036		36048.07	1580.95	5056.53	12348.41		17404.94
2037		32672.89	1441.92	4817.10	12965.83		17782.93
2038		29402.13	1306.92	4577.67	13614.12		18191.79
2039		26239.97	1176.09	4338.24	14294.82		18633.07
2040		23190.76	1049.60	4098.81	15009.57		19108.38
2041		20259.01	927.63	3859.38	15760.04		19619.43
2042		17449.41	810.36	3619.95	16548.05		20168.00
2043		14766.87	697.98	3380.52	17375.45		20755.97
2044		12216.45	590.67	3141.09	18244.22		21385.31
2045		9803.44	488.66	2901.66	19156.43		22058.10
2046		7533.35	392.14	2662.23	20114.25		22776.49
2047		5411.88	301.33	2422.80	21119.97		23542.77
2048		3444.98	216.48	2183.37	22175.96		24359.34
2049		1638.83	137.80	1943.94	23284.76		25228.71
2050		-0.13	65.55	1704.51	24449.00		26153.52

Source: Author calculation.

6.6.5 Government Expenditure Plan 2

The second expenditure option would be to reduce expenditure from oil revenues so that by the year 2027 there should be an oil wealth fund account equal to the net present value (NPV) (at the assumed interest rate) equivalent to the flow of spending in 2027 extended each year to 2050, with a residual of ten times expenditure in 2050. The model is solved by iteration to calculate the rate of reduction in annual oil-related expenditure that would be consistent with this condition being meet, and it turns out to by a reduction of 1.31% per annum until 2027. The accumulated value of oil wealth in 2027 is 168.08 billion USD (Table 6.15). This would allow 9.21 billion USD of continuing annual expenditure, the 2027 level of expenditure, to 2050, with a residual after 2050 of 10 times that level of expenditure. In this second case annual government expenditure would remain flat to 2015, but then would start to rise from there on. Annual government expenditure would rise 0.72% in 2008-2027. This option is much more stringent than the Plan 1 cases, with lower spending to 2027 and higher wealth in that year.

Table 6.15: Government expenditure Plan 2 (real million USD), 2008-2050

	Oil income increasing 2%	Oil wealth	Interest rate 4%	Oil exp. decreasing 1.31%	Non-oil income increasing 5%	Total expenditure
	11561.72	12240.00		12000.00	3000.00	15000.00
2008	11908.57	12795.88	489.60	11842.29	3150.00	14992
2009	12265.83	13886.88	511.84	11686.66	3307.50	14994
2010	12633.80	15543.08	555.48	11533.07	3472.88	15006
2011	13012.82	17796.12	621.72	11381.51	3646.52	15028
2012	13403.20	20679.23	711.84	11231.93	3828.84	15061
2013	13805.30	24227.38	827.17	11084.32	4020.29	15105
2014	14219.46	28477.29	969.10	10938.65	4221.30	15160
2015	14646.04	33467.53	1139.09	10794.89	4432.37	15227
2016	15085.42	39238.63	1338.70	10653.02	4653.98	15307
2017	15537.98	45833.14	1569.55	10513.02	4886.68	15400
2018	16004.12	53295.74	1833.33	10374.86	5131.02	15506
2019	16484.25	61673.31	2131.83	10238.51	5387.57	15626
2020	16978.78	71015.06	2466.93	10103.95	5656.95	15761
2021	17488.14	81372.64	2840.60	9971.17	5939.79	15911
2022	18012.78	92800.20	3254.91	9840.12	6236.78	16077
2023	18553.17	105354.57	3712.01	9710.80	6548.62	16259
2024	19109.76	119095.33	4214.18	9583.18	6876.05	16459
2025	19683.05	134084.96	4763.81	9457.24	7219.86	16677
2026	20273.55	150388.95	5363.40	9332.95	7580.85	16914
2027	20881.75	168075.96	6015.56	9210.30	7959.89	17170

Notes: NPV = 168075.96 or oil wealth in year 2027.
Oil expenditure = NPV extended to 2050.
Annual expenditure from oil year 2028 to year 2050 = 9210.30.
Source: Author calculation.

Compared to plans 1.2 and 1.1, this forecasting of wealth approach (in Plan 2) would result in higher expenditure cuts and higher wealth in 2027. In Plan 2, annual government expenditure would increase 0.69%. In comparison, in Plan 1.2, government expenditure would increase 1.6% annually in 2008-2027.

6.7 CONCLUSION

Oman has achieved significant economic growth since oil was discovered in 1964. Since the early days of oil dependence, the productive structure made a modest shift from heavy reliance on oil activities to important contributions by other sectors in economic output. As seen in Table 6.11, the ratio of oil exports to total exports dropped from almost 100% in 1970 to 65% in 2007, and during the same period the ratio of oil exports to GDP decreased from 52% to 47%, and the ratio of oil revenue to government revenue dropped from 98% to 79% in 2007.

Nonetheless, unless further oil is discovered, most of the country's proven oil reserves, estimated at 5.6 billion barrels in 2006, will be depleted by the year 2027 at the current extraction rates. It is unlikely that non-oil revenue will be able to replace oil income in the next twenty years. Fiscal policy has to adopt a long-term policy that will save enough oil wealth for the post-oil period. To do that, the government needs to save oil income in the form of financial assets, human capital, and infrastructure. However, spending oil income on education and basic infrastructure will not necessarily result in sufficient economic growth that could generate enough tax income for the government to replace oil income. Fiscal policy must, therefore, find an alternative form of investment and we recommend that the alternative is to convert the income into financial assets.

By converting future streams of oil income, it is possible to project future oil wealth, assuming that oil prices, oil production, and interest rates are known. We have developed a model based on the assumptions about these factors. It is difficult to predict future oil prices. The 2006 average crude oil price of 56 USD/barrel which we used in

our model is one dollar less than what forecasted by the Energy Information Administration for 2005-2030, but much lower than prices prevailing at the time at which this thesis is being finalised. Small changes in assumed oil prices can result in large changes in the forecasted oil income. New oil discoveries and technological improvements, production rates, and interest rates also affect estimates of income. Therefore, policy makers must frequently adjust their estimates according to the changing circumstances of oil income, reserves, production rates, and interest rates. It is also to be noted that our model does not include oil revenue passed directly to the SGRF, the precise magnitude of which is not known.

This chapter attempted to appraise the efficiency of the Omani economy and its fiscal sustainability in Oman. The questions that were first raised in the chapter are about the sources of growth in the Omani economy and how to read the TFP for Oman and perhaps for other mineral resource economies. To answer these questions, we applied the neoclassical growth model to estimate TFP and found that during 1970-2007 TFP contribution to GDP growth on average was negative 66%. However, our review of the long-run equilibrium growth for Oman in Section 6.5.1, as in Kaldor stylized facts, showed two interesting results. First, on average, labour share of capital and labour productivity trends were positive. Second, though the capital-output ratio was very low during 1970-1987, the ratio increased during 1988-2007, and seemed to be converging towards constant capital productivity. Furthermore, the average regression for the period 1970-2007, did not capture several interesting developments in factor inputs contribution to GDP growth in Oman that were observed by data. So we segregated our data into two periods, 1970-1987 and 1988-2007, and re-estimated the TFP to capture the dynamics and the evolving relationships in factor inputs and their contribution to GDP growth. The estimation results for the period 1970-1987, as expected, indicated that the TFP was negative but for the period 1988-2007, the TFP contribution to GDP growth was positive and statistically significant. The positive TFP contribution to GDP growth was further supported by the actual estimation of capital and labour coefficients (see Section 6.5.3.4) and the sensitivity tests carried out (see Section, 6.5.3.5). In short, the estimation results for the period 1988-2007 support the proposition that technology and efficiency have induced GDP growth in Oman. This was particularly so if we consider that the oil sector boom of 2002-2007 did not decrease the efficiency of the economy, on the contrary, the TFP contribution to GDP growth in 2000-2007 was 48%.

The results also indicate that data aggregation masked important information about the development of factor inputs. This could mean that for resource rich economies with very low initial level of development, TFP interpretation requires further decomposition of the data. In addition, it is worth noting that TFP calculation could be reflecting in part a bias towards capital estimation, that is, capital inflow plus rent residual to capital and as a result low calculation of TFP growth as a residual.

The questions that were also raised in this chapter are about how fiscal policy can put in place an expenditure plan that is sustainable beyond oil income and what are the different expenditure options that can be considered. To answer these questions we used the PIM model to evaluate Oman's fiscal sustainability. The model estimated how the government can manage its income from natural resources in a way that enables it to save some of it for future generations. Researchers in the field have prescribed that the government's expenditure should be confined to real interest rate income from its financial assets from oil and non-oil income. Should the current expenditure exceed investment income, consumption would result in a decline in total wealth over time. Further, to keep per capita wealth constant, savings would have to adjust to the population growth and inflation. According to the official forecast, the population in Oman will grow by 2% annually, and if the real interest rate is 4% then government savings have to grow by at least 2% to keep per capita wealth constant.

Our model offers several expenditure options for the oil income. These options include, consume current wealth and future income from oil to allow spending from oil to reduce gradually to zero by 2050, or reducing expenditure so that oil wealth is equal to NPV in 2027, the level of 2027 consumption is extended to 2050. The results of these options have been provided above. In addition, the simple model we used to set an expenditure path for the government has very powerful properties to control and guide fiscal policy beyond oil income. What is clear is that the government needs to restrain expenditure in the near future to create a sustainable fiscal path for the period of falling oil output, but that there are many options for defining that path and many variables that affect the characteristics of the preferred path.

Until Oman develops a competitive advantage in a specific sector, as a result of the government's investment in physical and human capital, the lowest risk strategy is to invest in a wealth fund, at least until its investments in the local economy bears fruit. It is essential for the government to review this strategy on a regular basis.

Further, while the government needs to increase non-oil revenue and lower its expenditures, in particular recurrent and defence expenditure, it needs to increase its development expenditure. The emphasis on development expenditure is very important, because in the long run it would have positive impact on non-oil GDP growth and eventually, it has the potential of replacing oil revenues. This seems to be the position that government has taken, but an overall fiscal strategy needs to be adopted to preserve the position of future generations.

CHAPTER 7.
CONCLUSION AND THE WAY FORWARD

7.1 INTRODUCTION

The overall aim of this thesis was to investigate linkages and interdependencies between the oil and the non-oil economies in Oman. The study focused on the linkages of oil price and oil sector activities and their impacts on the non-oil sectors. In addition, the research examined the impact of oil revenues on fiscal policy and the impact of government expenditure on non-oil GDP output and growth. This was done through four interrelated themes: (i) the linkages of oil resources and their effect on economic development in Oman, by investigating the inter-sectoral linkages of the national output and testing the linkage and interdependency between the agriculture and fisheries, manufacturing, services sectors, and the oil sector, (ii) government revenues and expenditure linkages that came about as a result of the oil export boom and the effect of government expenditure on non-oil GDP growth and (iii) examine economic efficiency and the changing dynamics of factor inputs and their contribution to GDP growth (iv) exploration of an optimal fiscal policy that can be sustained in the short run and induce economic growth in the long run, when oil resources are exhausted.

This study used time-series data from Oman to examine the linkages and interdependencies between the oil and the non-oil sectors from 1967 to 2007. The thesis results make an important contribution to knowledge for several reasons. First, despite the heavy reliance on oil revenue in the Arab oil exporting countries (AOEC), there is little work on the impact of oil prices on the macroeconomic dynamics of the AOEC including the GCC countries. In fact, there is no work that we are aware of that looked into how the oil sector boom could impact GDP growth, exchange rates, or government revenue in Oman. This thesis attempted to fill this gap in the literature.

Second, this study has direct relevance to other countries in the region because of the similarities between Oman and many of the other Arab oil exporting countries. Oman

and AOEC rely heavily on oil income and the contribution of the industrial sector to the national output is small. They have relatively small populations and their labour markets depend on foreign expatriates, and at times of favourable oil prices they benefit from high economic growth. In addition, Oman's political institutions are similar to the political institutions in the other AOEC member countries and hence, the thesis results would be relevant for them as well. Further, it is likely that the economic policies practiced in Oman would be similar to that of the other Arab oil exporting countries. For these reasons, the study of Oman in relation to oil extraction activities is relevant beyond Oman.

This thesis differs from most of the other earlier work on the relationship between oil extraction activities and economic development. First, instead of the straightforward methods used to estimate oil linkages, we used advanced statistical techniques, VAR and cointegration models, to estimate the linkages between the oil sector and the non-oil sectors. In addition, past studies used input-output tables to look for linkages between economic sectors and that proved to be complicated. For many developing countries, where input-output tables are not available, it was hard to estimate linkages between economic sectors. Second, VAR and cointegration models can also be useful to identify directions of causality between economic sectors. Understanding such dynamics is very useful for countries that try to diversify their economies and reduce dependence on oil income.

We believe that the results of this study will have important policy implications not only for Oman, but also for other countries that rely on mineral resources for revenue and foreign exchange. For example, the advice that is offered by many researchers on the importance of counteracting the Dutch disease and resource curse by investing oil revenue outside the economy might be misplaced, at least in some cases, such as for Oman, as the economy could benefit more from resource management that increases direct productive activities. A long-run strategy should include structural reforms that would promote economic diversification away from oil dependence.

The preceding chapters of this thesis have shown that oil prices and oil sector activities have major impacts on non-oil sector activities and on fiscal policy. While oil resources contributed significantly to the growth of the manufacturing and services sectors, the

agriculture and fisheries sector has not benefited from the oil sector boom. Further, our diagnostic test showed that fiscal policy influenced non-oil output growth.

This concluding chapter summarises the findings of the thesis in the context of the government's policy, which has had as one of its objectives is to diversify the sources of income and ensure sustainable growth once oil resources are exhausted. Following this introduction the chapter is organized in the following manner. Section 7.2 describes the main characteristics of the Omani economy. Section 7.3 summarizes the role of oil price change and its impact on GDP, government revenue, exchange rate and relationship between oil price increases and the exchange rate, the manufacturing sectors, and the labour market. Section 7.4 summarizes the inter-sectoral linkages and interdependency of the economic sectors and provides statistical evidence of the importance of the oil sector in Oman's economic growth. Section 7.5 summarizes the optimal fiscal policy from oil resources and makes recommendation on how the government can smooth expenditure to year 2050. The way forward is presented in Section 7.6, where lessons from this study are discussed. Section 7.7 highlights the recommendations and policy implications.

7.2 THE MAIN CHARACTERISTICS OF THE OMANI ECONOMY

The role of the oil export boom in transforming the economy of Oman cannot be overestimated. Income from oil exports played a pivotal role in developing the economy and deriving GDP growth. In addition, income from oil enabled the government to spend on basic infrastructure, such as building roads, ports, and electricity and provide services and utilities such as health care and education. Since 1967 the oil sector has dominated the GDP sectors and the productive structure of the economy. Our research has shown that Oman should reduce its dependence on oil and diversify its sources of income for several reasons. First of all, the oil sector boom is the function of oil price and volume of production. Oil prices are volatile and such fluctuations in income, according to many studies, have negative impact on mineral dependent economies. Oil resources are finite and as discussed previously, oil production has been declining since 2000 despite the use of a more sophisticated and expensive technology in the mature fields, such as enhanced oil recovery techniques (EOR). There have been no major oil

discoveries in the country since 1990s and the effort has been to increase oil reserves by using more sophisticated technologies, which are also more expensive.

In addition, the thesis argued that despite the increasing role of the service sector, it is very unlikely that it is going to lead economic growth in Oman. The service sector in Oman has not played a similar role as it has in developed and transition economies. The service sector's contribution to total exports in Oman has been very small. Further, the service sector has been indirectly linked to oil income. For example, government services alone made up between 30% and 48% of the service sector between 1970 and 2007. Other service sectors were directly linked to foreign trade and had no value added or local content. Wholesale and retail trade and transportation and communication sectors constituted between 29% and 45% of the service sector. The fourth most important service sector was real estate and this is a non-traded sector. Therefore, the service sector in Oman at this stage cannot become the main growth driver.

The contribution of non-oil exports to total exports has been small. In 2007, non-oil exports comprised a third of total exports, while two thirds of total exports consisted of oil. In addition, the indirect contribution of oil related activities to non-oil exports has also been significant. For example, refined oil exports have been directly linked to oil production in Oman. According to Al-Marhubi (1998), a diversified export based is associated with faster economic growth. And therefore, and in order to diversify the sources of income and reduce oil reliance, policy makers need to adopt policies that will promote export base industries.

In summary, the main characteristics of the Omani economy have been as follows:

- Heavy reliance on oil sector activities.
- The service industry at this stage has not developed to a stage where it can lead economic growth in Oman.
- Omani exports have not been diversified and oil exports constituted 85% of Oman's source of foreign exchange earnings.
- The government has relied heavily on oil income to finance its expenditure and development programmes.

- The Omani economy has relied on foreign expatriates and labourers to meet labour market demand and enhance productivity growth, while at the same time the number of its citizens seeking jobs opportunities has increased.

7. 3 OIL PRICE, GDP, GOVERNMENT REVENUE, EXCHANGE RATE, AND THE DUTCH DISEASE

As discussed in Chapter 3, researchers differ on what role natural resources play in an economy. The classical view is that natural resource abundance is associated with faster economic growth because income earned from natural resources allows higher level of consumption, increased ability to import capital goods, and enables higher levels of savings. Many other studies examined also noted the indirect economic impact of natural resources on the economy, through the multiplier effect of the resource activity on the economy. This multiplier impact is channelled to the economy through linkages, forward and backward linkages resulting from resource extraction activities. Linkage theory economists try to estimate the backward (the supplying industry) and forward linkages (the demand industry) to natural resource sector activities.

However, large numbers of studies since the 1980s have contradicted the positive role of natural resource abundance identified by other researchers and provided empirical evidence of its adverse impact on many resource abundant economies (Chapter 3, Section 3.4). These studies provide evidence of how natural resource booms have de-industrialized the manufacturing sector and harmed the export industry. Furthermore, other studies have showed that in many developing countries, resource abundance has resulted in civil conflicts, wars, and corruption and bad management of natural resource income.

In relation to Oman and in order to understand the impact of the oil discovery and the oil sector boom, we examined how oil price movements have affected the national output and government revenues and exchange rates (Chapter 4). We applied a cointegration and error correction model technique that capture long-run and short-run dynamics of the investigated variables. Further, we investigated the possible negative impacts of oil the sector boom on other sectors of the economy, the exchange rate, the manufacturing, and the labour market. According to the Dutch disease theory, countries

that experience a natural resource boom, minerals in particularly, suffer from four major ailments; first exchange rate appreciation, second, a decline in the manufacturing sector, third, a boom in the service sector, and fourth, a labour shift from the manufacturing sector to the service sector and the resource extraction sector.

The results of our study showed that oil price movements have had a significant impact on GDP and government revenues. In the long-run a 10% increase in oil prices caused 2.6% growth in GDP and 5.6% increase in government revenues. The results were expected, given the importance of the oil sector in Oman. In addition, our diagnostic test suggested that a 10% oil price movement upwards in the short run is associated with 1.7% increase in government revenue, implying a close dependency of government revenue on oil income

As for the possible negative impact of the oil sector boom on other sectors of the economy, we examined the time series data of the exchange rate, the manufacturing and services sectors, and labour movements for the period 1970 to 2007. The results of our study showed that the booming oil sector in Oman did not result in real exchange rate appreciation, de-industrialization, or labour movement from other sectors of the economy to the booming oil sector. The non-oil sectors growth rates, over the last 40 years, were comparable to the booming oil sector. The manufacturing and services sectors grew by an average of 14%, per annum, in 1967-2007.[39] Therefore, the oil sector boom in Oman, unlike that of many developed countries such as the Netherlands, United Kingdom, or Australia did not lead to *de-industrialization.*

In summary:

- Oil price movements have had a significant impact on GDP and government revenues. The overall findings showed that the oil price movements have been positively correlated to output and government revenue. In the long run, a 10% increase in oil prices caused 2.6% growth in GDP and 5.6% increase in government revenues. In the short run, a 10% oil price movement upwards was associated with 1.7% increase in government revenue.

[39] During the same period the agriculture and fisheries sector experience negative growth of 3%. Therefore, it could be argued that the booming oil sector harmed the agriculture and fisheries sector.

- The booming oil sector in Oman did not result in an exchange rate appreciation, de-industrialization, or labour movement from other sectors of the economy to the booming oil sector. In other words, Oman has not suffered from the Dutch disease.
- Over the long term, Oman's economic growth and government revenue will depend on many other factors. Such factors include fiscal management of oil revenue and the success of current diversification policies.

7. 4 INTERSECTORAL LINKAGES AND INDEPENDENCIES

Our empirical investigation showed that oil price movements have been positively correlated to output and government revenue and that the Omani economy has not been suffering from the Dutch disease. However, the results did not answer many other questions. Such questions include which sectors benefited most from the oil sector boom? If Oman has not suffering from the Dutch disease, why did the service sector become the second most important sector after the oil sector? In short, the inter-sectoral linkages and interdependencies between the oil and the non-oil sectors were not clear. The other transmission channel of the oil sector boom is through government revenue/expenditure. And, hence, understanding how oil revenue and the associated expenditure impact non-oil GDP growth is an important aspect of understanding the effect of the oil sector boom and the relationships between the oil economy and the rest of the economy.

To understand the inter-sectoral linkages and interdependencies between the oil sector and the non-oil sectors in chapter 5 we investigated the inter-sectoral linkages and interdependencies between the oil and non-oil GDP: namely the agriculture and fisheries, manufacturing, service sectors, and oil sector. We applied the VAR and cointegration technique to examine the long-run relationships and short-run dynamics of the GDP sectors. Next, we used a multivariate Granger causality approach to investigate causal relationships among variables and looked for direction(s) of causality among GDP sectors. In addition, we used the VAR and cointegration technique to understand how government expenditure influenced agriculture and fisheries, manufacturing, and the services sectors growth.

Firstly, our investigation showed that the manufacturing and service industries were positively associated with changes in the oil sector industry. The results state that a 1% increase in the oil sector caused 2.2% increase in the manufacturing sector and a 1% increase in oil prices caused 1% increase in the sector (the manufacturing). And 1% increase in the oil sector caused 1.7% in the service sector, and 1% increase in oil prices caused a 0.5% growth in the service sector. In addition, the VAR Granger causality test indicated that there was a unilateral causality running between the oil and manufacturing and services sectors. Such results suggest that there were close relationships and interdependencies between different sectors of the economy, particularly between services and manufacturing and the oil sector.

Secondly, the results from the VECM and Granger causality tests indicate that oil revenue did not Granger-cause agriculture and fisheries GDP. The results imply that the sector was not integrated into the mainstream economy and only contributed 2.8% to GDP by 2007 (in comparison, its contribution in 1967 was 37% of GDP). Several underlying factors contributed to the decline and the marginal contribution of the agriculture sector. The sector appears to have been significantly affected by labour shifts to better paying jobs in services and manufacturing.[40] The sector has also been affected by lack of manpower development and training for critical skills needed to develop the sector from a traditional and subsistence agriculture sector to a modern and commercially based activity. Furthermore, the sector appears to have been affected by competition from imported agricultural products. With little protection, the combination of labour preference and competition from the international market, the sector's contribution to national output dropped significantly. In short, the oil sector boom appears to have harmed the agriculture sector in Oman.

Thirdly, the tests indicated that non-oil GDP growth was positively and significantly correlated to government expenditure. In the long run, the results of our tests showed that a 1% increase in government expenditure was associated with 2.52%, 1.51%, and 0.38% increase output in the manufacturing, services agriculture and fisheries, respectively. In addition, the results also show that a 10% increase in government

[40] The historical data shows that a significant drop in the number of people employed in the agriculture sector in 1992-1996.

expenditure in the short run has been associated with a 0.18%, 1.8%, and 2.75% increase in output in manufacturing, services, and agriculture and fisheries, respectively. Furthermore, the results are similar to experiences of many oil based economies in the region such as the GCC countries where there is strong dependency on government oil income for development.

The existence of a multilateral relationship between the oil and non-oil economy, especially between the oil sector and the manufacturing and services sectors, suggest that there is potential for diversification and increased value added activities. In return, increased economic activities will increase profitability and that would induce technological progress and further productivity. With such improvements in productivity, output would further foster growth in economic sectors through increased demand for inputs and consumer goods. These assumptions are based on our empirical findings. The Granger causality tests showed the existence of two-way relationships between the oil sector and the manufacturing and services sector. This result suggests the existence of the necessary stimulus for accelerated growth potential. The government can invest in DPA to stimulate industrial activities and growth such as LNG which increased the share of the industrial sector from less than 5% to 10%.

Higher and sustained GDP growth rates can be achieved by increasing DPA and private industry initiatives, and by opening up and promoting foreign investment, international trade, and competition. Such measures would promote non-oil sector activities including industrial production and agricultural participation in the main economic activities.

In summary:

- The overall results suggest that Oman was still dependent on oil and the productive structure of the economy was the function of oil extraction activities.
- The manufacturing and services sectors have relied heavily on oil sector activities and have not diversified away from oil dependency. Dependence on natural resources, in turn, threatens the economies of resource dependent nations when revenues fall due to reduction in demand and/or prices or when the stock

of resources is exhausted. Furthermore, mineral industries appear to create one direction of dependency running from the oil sector to the rest of the economy.

- The manufacturing and services sectors had strong and significant links to oil sector activities.
- Non-oil GDP growth was positively associated to government expenditure.
- Oman's traditional economic activity, which is agriculture and fishing, did not seem to be linked to oil sector activities. This is reflected in the finding that, despite the oil wealth, the agriculture and fisheries sector had not accumulated much capital and was still a labour intensive activity.

7.5 OPTIMAL FISCAL POLICY

Oman's economic achievements and development have been significant from different perspectives. Indeed, oil resources allowed the government to implement ambitious development programmes that transformed the life of Omanis, while achieving an impressive real annual GDP growth of nearly 9% between 1967 and 2007. Literacy rates increased from less than 30% in 1967 to 81% in 2007, life expectancy increased from 47 years in 1967 to 76 years in 2007, the average per capita GDP increased from 1,773 USD in 1967 to 10,506 USD in 2007, (at constant 2000 prices), and the productive structure made a modest shift from heavy reliance on oil activities to increasing contributions by other sectors. For example, the ratio of oil exports to total exports dropped from almost 100% in 1970 to 65% in 2007. During the same period the ratio of oil exports to GDP decreased from 52% to 47%, and the ratio of oil revenue to government revenue dropped from 98% to 76% in 2007.

Oman stands at a crossroad in terms of its future and the way forward. According to estimates made in 2006, most of the country's proven oil reserves, estimated at 5.6 billion barrels, could be depleted by the year 2027 at the current extraction rates. There are no major oil discoveries and it is unlikely that the government's non-oil revenues would match oil income in the next twenty years. Besides investing in human capital and infrastructure, decision-maker in Oman can adopt a long-term policy that would save enough oil wealth for the post-oil period and convert the savings into assets that will sustain government expenditure.

Under the assumption of a pre-determined oil price, oil production, and interest rates we recommend that the government adopt a policy that will smooth expenditure during a given lifespan for its financial resources. Such policy should be dynamic and flexible enough to accommodate the changing circumstances of the oil industry. Small changes in oil prices could result in large changes in the forecasted oil income. Factors relating to demand and supply, new oil discoveries, and technological improvements, and production rates also affect the income, as does interest rates. Therefore, policy makers would frequently have to adjust their estimates according to the changing circumstances of oil income, reserves, production rates, and interest rates.

In Chapter 6 we raised several questions, which aimed at assessing economic efficiency, fiscal policy, and debt sustainability in Oman. Initially, we used factor inputs to assess economic efficiency by looking for sources of growth in the Omani economy and investigating the contribution of labour, capital, and total factor productivity (TFP) to GDP growth. We applied the neoclassical production function to decompose the growth rates of aggregate output into the contribution inputs and improvements in TFP. The results showed positive development in factor input contribution to GDP growth despite the fact that TFP was negative 65% for the period 1970 to 2007. The negative result was linked to underutilization of the capital inflow associated with equipment brought into the country. Segregation of the data into two periods, 1970-1987 and 1988-2007, confirmed the proposition that the marginal contribution of capital and labour to output growth outstripped the TFP. And during the latter period, 1988-2007, the estimation provided evidence of increased efficiency in the economy and positive technological change contribution to factor inputs. Estimation of actual data coefficient showed that, in 2000-2007 TFP contribution to GDP growth was a positive 0.48. Increased efficiency reflected, partially, the success of the government development's policies. Moreover, TFP calculation could be reflecting in part a bias towards capital estimation. Future research into productivity could look into how to solve this bias towards capital in estimating the efficiency of the economy.

The other question that was raised in chapter 6 was whether the Omani government can sustain the current consumption level without compromising the position of future generations. To answer this question, based on the PIM model, we developed a model to

evaluate Oman's fiscal sustainability. The model estimated how the government can manage its income from natural resources and how it can save some of the oil in a way that enables it to save some of it for future generations. Our results showed that the government can maintain a viable level of consumption beyond the time of oil income depletion but needs to exercise constraints in its expenditure pattern, to avoid sudden expenditure spikes, similar to the recent blow-out during 2002-2007. The model offers several expenditure options for the oil income. These options include spending from current wealth and future income from oil while ensuring that spending from oil reduces gradually to zero by 2050, or to reduce expenditure so that oil wealth in 2027 is equal to the NPV of the 2027 real level of expenditure over 2027-2050, plus a residual in 2050.

The simple model we used to set an expenditure path for the government, has very powerful properties to control and guide fiscal policy until and beyond the time of oil depletion. While plans 1.1 and 1.2 would allow initial higher levels of consumption and, therefore, lower levels of expenditure cuts, Plan 2 would require higher initial expenditure cuts, but would allow higher expenditure levels when oil stops. In Plan 1.1, total government wealth would decrease by 0.48% per annum to year 2020 but would then start to increase, with an average of 1.88%, per annum, during 2016-2050. In Plan 1.2, average government expenditure would be 2.5 billion USD higher, per annum, than Plan 1.1, during 2008-2036 but total annual expenditure would converge during 2037-2050. In this Plan 1.2, total government expenditure would increase by 1.4%, per annum, during 2008-2050.

In Plan 2, oil expenditure would be reduced by 1.89% yearly to 2027 and the NPV calculated for 2027 would equal 121.74 billion USD. This would allow 8.19 billion USD of continuing annual expenditure, the 2027 level of expenditure, until 2050, with a residual after 2050 of 10 times that level of expenditure. In short, plans 1.1 and 1.2 favour current consumption levels, current generations, over future consumption levels, while Plan 2 favours future generations over current generations.

The population census in Oman in year 2001 forecast an annual population growth of 2%, and if real interest rate is 4% then government savings have to grow annually by at least 2% to keep per capita wealth constant. In the past, when income decreased as a result of oil price decline, the government met its expenditure requirements by

increasing oil production and by withdrawing from SGRF. However, with declining oil reserves and since the SGRF funds are also exhaustible, these options are not available in the long run.

Further, while the government needs to increase its non-resource based revenue and lower its expenditures, in particular recurrent and defence expenditure, it needs to increase its development expenditure. The emphasis on development expenditure is very important, because in the long-run it will have positive impact on non-oil GDP and eventually, it has the potential of replacing oil revenues.

In summary:

- The results showed positive development in factor input contribution to GDP growth despite the fact that TFP was negative 66% during 1970-2007. During 2000-2007, TFP contribution to GDP growth was a positive 0.48.
- In Plan 1.2, the average government expenditure would be 2.5 billion USD higher, per annum, than Plan 1.1, during 2008-2036, but total expenditure would converge during 2037-2050. In this plan total government expenditure would increase 1by .4%, per annum, during 2008-2050.
- In Plan 2, oil expenditure would be reduced by 1.89% yearly to 2027 and the NPV calculated in 2027 would equal 121.74 billion USD. This would allow 8.19 billion USD of continuing expenditure, the 2027 level of expenditure, to 2050, with a residual after 2050 of 10 times that level of expenditure.

7. 6 RECOMMENDATIONS AND THE WAY FORWARD

7.6.1 Fiscal Policies

Since 1967, thanks to oil income, Oman has experienced unprecedented levels of economic growth and social transformation. This impressive progress came about as a result of government investment in physical infrastructure and social services. It was also due to the stable macroeconomic policies characterized by low inflation rate and

the currency pegged to the USD. The open policy towards foreign labour employment and capital flows encouraged the development of the non-oil sector.

Against the backdrop of the development success story in Oman is the continuous heavy dependence on oil income. Oil income contributed 79% of government total income in 2007. The oil income has also been used to finance large current expenditures. The biggest challenge that faces policy makers is how to maintain current achievements and sustain economic growth. This concern is of a particular importance because of the fluctuation of oil income. It is also because oil resources are exhaustible and it looks like Oman's oil production peaked in 2000 and oil production could be exhausted in two decades.

Looking beyond oil resources, Oman can achieve a sustainable development path and economic growth by adopting comprehensive structural reforms that will reallocate scarce resources more efficiently and bring about diversification away from the oil sector. Fiscal policy will be central in bringing about the required reforms and in promoting sustained economic growth. By adopting our version of PIM model expenditure levels, the government can achieve fiscal consolidation and ensure long-term sustainability with macroeconomic stability, insulate the economy from the boom and bust cycles, and induce growth in the non-oil economy. This would require readjusting the budget and associated consumption in line with the PIM model. In addition, the government needs to review its recurrent expenditure, including civil and military expenditure, improve the tax system for better tax collection and consider the introduction of personal income tax.

Another important aspect of wealth fund management is transparency. Transparent management of wealth funds helps in allocating resources much more efficiently by the continuous monitoring of fund assets. And such close scrutiny encourages prudent public spending, investment, subsidies, and transfers. In addition, a clear and transparent expenditure policy discourages rent seeking behaviour.

In summary, it is recommended that the government:

- Adjust the budget and associated spending in line with our model.

- Review its recurrent expenditure, including civil and military expenditures, improve the tax system for better tax collection and consider the introduction of personal income tax.
- Control expenditure growth during boom cycles.
- Use the established stabilization oil fund (reserve fund) to shield the economy from boom bust cycles.
- Increase its development expenditure because of its positive contribution on non-oil GDP growth.
- Establish transparent management processes for the wealth fund.

7.6.2 Structural Reforms Policies

In the past the government provided an extensive welfare system in the form of subsidized services for water, electricity, free education and health care services, with no income tax. The policy was justified by the lack of basic infrastructure and services and the underdeveloped nature of the non-oil economy. However, the government cannot maintain the current expenditure structure because of its strain on the country's financial assets. It is also compromising a fair share of the oil wealth of future generations. It can be argued that the country has adequate basic infrastructure and the non-oil economy is no longer exceptionally underdeveloped. The government, therefore, can afford to take austerity measures to cut recurrent expenditure and encourage the non-oil development growth path.

With the right kind of incentives from the government, the private sector can lead GDP growth and economic development. This can be done by reducing and simplifying private sector investment, including foreign direct investment. This will also require protection of property rights in a free competitive environment. Moreover, there is a need to liberalize domestic trade so that entry and exist to the market is simple and competitive. A free and liberal domestic market will encourage private sector investment and create much needed job opportunities.

The policy of free capital outflow should be combined with a more liberal policy on foreign capital inflow. Such a policy would not only encourage capital inflow but would also bring in technology and knowhow to the private non-oil sector. This can be

achieved by treating foreign and domestic capital equally in terms of regulation and rules. This would entail imposing one set of laws for domestic and foreign businesses operating in the country.

In summary, it is recommended that the government:

- Levy a fee on some of the services it provides on education and health care. The fee could be charged on books and other fees on health provision at hospitals.[41]
- Cut back its recurrent expenditure
- Simplify investment requirements, including those covering foreign direct investment. This includes the protection of property rights in a free competitive environment.
- Liberalize domestic trade so that entry and exist to the market is simple and competitive.
- Combine the policy of free capital outflow with a more liberal policy on foreign capital inflow.

7.6.3 Labour Market Policies

There is growing unemployment problem among Omani citizens, despite the presence of a large number of guest workers. According to some estimates, the labour force is growing by 4% a year and this growth rate is likely to increase because one-third of the Omani population is under the age of 15. In the past, the government employed mainly Omanis and the private sector employed cheap guest workers. The number of Omani citizens working for the government is estimated at 120,000 in 2007 and the number of foreign guest workers employed in the private sector was estimated at 694,000 in 2007. The Omani labour force is growing fast and the government cannot afford to continue the past policy of guaranteed employment for its citizens. The government needs to invest more in its human resources and bring reforms that will stimulate non-oil GDP growth, through which job opportunities can be created. The open policy toward guest workers employment was necessary in the past because of lack of skills and the small Omani labour force to run the economy. Although guest workers have played a positive

[41] The Ministry of Health introduced a small fee on patient registration and doctor consultation in 2003.

role in the economic development, the guest workers policy needs to be reviewed in view of the increasing unemployment among the Omanis.

Addressing labour market challenges is particularly important, not only to create job opportunities in the private sector for Omani citizens, but also to increase Oman's competitiveness. The traditional labour market division, with Omani citizens working for the public sector and non-Omanis working in low paid, low skilled positions in the private sector, is inefficient. With a growing and vibrant private non-oil economy, the private sector would be less reluctant to employ Omanis because of their lack of skills and Omanis would be more willing to work for the private sector if conditions are adequate and comparable to those in government employment.

The relatively flexible labour market regulation that allows businesses and establishments to hire foreign expertise and labourers needs to be reviewed in the light of the increasing number of Omani job seekers. First, the government needs to reduce the economy's dependency on foreign labour by replacing expatriates with Omani employee, a policy, known as "Omanization" that the government started in its fourth development plan. The second issue that the government needs to address is creating new job opportunities and that can only be achieved through strong non-oil GDP growth.

Moreover, Oman can consider increasing the most active age group by having a major migration policy. This policy would increase the number of the migrant in the most productive age group and decrease guest workers dependency. In addition, the policy would help reducing Oman's balance of payments, increase domestic consumption and reduce public spending on subsidized services that are consumed by guest workers. In addition, having an immigration policy would be viewed favourably by the international community that has been quite critical of Oman's stand on human rights.

In summary, it is recommended that the government:

- Invest more into its human resources and institute reforms that would stimulate non-oil GDP growth.

- Reduce the economy's dependency on foreign labour, by replacing expatriates with Omani employee.
- Increase labour productivity by implementing a development programme that will enhance labour skills.
- Decrease the gap and incentives between the government sector and private sector by promoting market discipline in the labour force market.
- Investigate a major migration policy that would increase the number of migrant in the most productive age group and decrease guest workers dependency.

7.6.4 Other Policies

Following the oil export boom resulting from resource discoveries in 1964 and the 1973 oil price shock, the issue that is raised with regards to the Dutch disease ailment is the re-allocation of factor inputs into the booming sector and its implications on the non-booming sector. Our results suggested that such movement into the booming sector did not take place because of two major reasons. The first reason was, oil production is highly capital intensive and did not require a large number of workers, hence, there was no labour shift from the non-booming sector to the booming resource sector. In addition, the skill requirements in the oil sector were not available in the domestic market and the demand was met by labour import.

The other reason why factor inputs did not move away from other sectors to the oil sector was because of the virtual "absence" of non-oil sectors. With the exception of the subsistence agriculture and fisheries sector, all other sectors played a very small role in the economic activities in Oman.

Given the fact the manufacturing sector was very marginal and played no significant role in the economy and the agriculture and fisheries sector was small, the unprecedented wealth pouring into the country as a result of the oil export boom accrued directly to the government. To make use of the oil wealth, the government pushed for ambitious development programmes by providing social programmes and basic infrastructure. The government's focus on the provision of basic infrastructure induced service sector growth more than growth in other sectors. Economic agents, in response to the government's fiscal expansion policy, found it more profitable to

allocate their scarce resources to the production of services by building the infrastructure that was seen as a pre-requisite to induce economic growth and development. Furthermore, the government's fiscal expansion policy created job opportunities, therefore offsetting the capital intensive nature of the oil industry. So, the combination of the sudden rush of oil wealth accruing to the government and increased demand for everything 'pen to steel' induced imports. Businesses found it more profitable to invest in import/export businesses than to manufacture goods.

The implication of such rational and utility maximizing behaviour of economic agents is the need for the government to invest in more direct productive activities and promote the non-oil economy growth.

In summary it is recommended that the government:

- Invest in more direct productive activities and promote growth in the non-oil economy.
- Focus on achieving price stability, high employment, and sustainable growth through monetary and fiscal policies, regulation of financial establishments, trade, and tax policies.
- Maintain and upgrade the basic infrastructure and services.
- Create an environment that is conducive to job creation, business development, know-how, and technology transfers.

REFERENCES

Abramovitz, M. (1993). "The Search for the Sources of Growth: Areas of Ignorance, Old and New." The Journal of Economic History **53**(2): 217 - 243.

AFL-CIO (2005). Petition to Remove Oman From the List of beneficiary Developing Countries Under the Generalized Ssytem of Preferences ("GSP"), American Federation of Labor and Congress of Industrial Organization (AFL-CIO).

Aghion, P and Durlauf, S. N., Eds. (2005). LONG-TERM ECONOMIC GROWTH AND THE HISTORY OF TECHNOLOGY. Evanston, Northwestern University

Ahmed, A. D. (2007). "Potential impact of financial reforms on savings in Botswana: an Empirical Analysis using VEVM Approach." Journal of Developing Areas **41**(1): 203 - 220.

Ahmed, A. D. and S. Suardi (2007). "SOURCES OF ECONOMIC GROWTH AND TECHNOLOGY TRANSFER IN SUB-SAHARAN AFRICA." South African Journal of Economics **75**(2).

Aiyar, S. and C.-J. Dalgaard (2005). Total Factor Productivity Revisited: A Dual Approach to Development Accounting. Washington D. C., International Monetary Fund.

Al-Marhubi, F. (1998). "Export diversification and growth: an empirical investigation." Applied Economics L etters **7**: 559 - 562.

Albala-Bertrand, J. M. (2001). A Benchmark Estimate for the Capital Stock, An Optimal Consistency Method. London.

Amnesty International (2005) Gulf Cooperation Council (GCC) Countries: Women Deserve Dignity and Respect. **Volume**, DOI:

Askari, H. (1990). Saudi Arabia's Economy: Oil and the Search for Economic Development. Greenwich, JAI Press LTD.

Asteriou, D. (2006). Applied Econometrics A modern Approach using Eviews and Microfit. New York, Palgrave Macmillan.

Atkinson, G. and K. Hamilton (2003). "Savings, Growth and the Resource Curse Hypothesis." World Development **31**: 1793 - 1807.

Auty, R. M. (1993). Sustaining Development in Mineral Economies; The resource curse thesis. London, Routledge.

Auty, R. M. (2000). "How Natural Resources Affect Economic Development." Development Policy Review **18**: 347 - 364.

Auty, R. M. (2001). "The political state and management of mineral rents in capital-surplus economies: Botswana and Saudi Arabia." Resources Policy **27**.

Baldwin, R. E. (1966). Economic Development and Export Growth: A Study of Northern Rhodesia, 1920-1960. Los Angles, University of California Press.

Barnett, S. and R. Ossowiski (2002). Operational Aspects of Fiscal Policy in Oil-Producing Countries. Washington D.C., International Monetary Fund.

Bartkus, J. R. and M. K. Hassan (1995). Ibn Khaldun and Adam Smith: Contributions to the Theory of the Division of Labor and Modern Economic Thought. Madrid, Universidad Nacional de Educacion a Distancia.

Blattman, C., J. Hwang, et al. (2004). The impact of the terms of trade on economic growth in the periphery, 1870-1939: volatility and secular change. Cambridge, National Bureau of Economic Research.

Charemza, W. W. and D. F. Deadman (1992). New Direction in Econometric Practice. Aldershot, Edward Elgar.

Citizens Trade Campaign (2005). Congress Should Reject the Oman Free Trade Agreement. Washington D.C., Citizens Trade Campaign.

Cobb, C. W. and P. H. Douglas (1928). "A THEORY OF PRODUCTION." American Economic Review **18**.

Corden, W. M. (1984). "Booming Sector and Dutch Disease Economics: Survey and Consolidation." Oxford Economic Papers **36**(3): 359 - 380.

Corden, W. M. and J. P. Neary (1982). "Booming Sector and De-Industrialisation in a Small Open Economy." The Economic Journal **92**.

Coronil, F. (1997). The Magical State, Nature, Money, and Modernity in Venezuela, Cambridge University Press.

Davis, J. M., R. Ossowski, et al., Eds. (2003). Fiscal Policy Formulation and Implementation in Oil-Producing Countries. Washington, D.C., International Monetary Fund.

Delgado, C. L., J. Hopkins, et al. (1998). Agricultural Growth Linkages in Sub-Saharan Africa. Washington D.C., International Food Policy Research Institute

Development Council (1976). The Five- Year Development Plan (1976 - 1980). D. Council.

Development Council (1981). The Second-Five Year Development Plan, 1981 - 1985. D. Council.

Development Council (1986). The Third Five-Year Development Programme, 1986 - 1990. D. Council.

Development Council (1991). Fourth Five-Year Development Plan. D. Council. Muscat.

Development Council (1997). The Fifth Five-Year Development Plan (1996 - 2000). D. Council.

Development Council (2001). The Sixth Five-Year Development Council. D. Council.

Dickey, D. A. and W. A. Fuller (1979). "Distribution of the Estimators for Autoregressive Time Series With a Unit Root." Journal of the American Statistical Association **74**.

Doan, T., R. Litterman, et al. (1986). Forecasting and conditional projection using realistic prior distribution. Minneapolis, Federal Reserve Bank of Minneapolis.

Eifert, B., A. Gelb, et al. (2002). The Political Economy of Fiscal Policy and Economic Management in Oil-Exporting Countries, The World Bank.

Ekanayake, E. M. (1999). "Exports and Economic Growth in Asian Developing Countries: Cointegration and Error-Correction Models." Journal of Economic Development **24**.

Elbadawi, I. A. and N. Majd (1993). Managing a Nonrenewable Resource Savings and Exchange-Rate Policies in Bahrain. Washington DC, World Bank.

Elhiraika, A. B. and A. H. Hamed (2001). EXPLAINING GROWTH IN AN OIL-DEPENDENT ECONOMY: THE CASE OF
THE UNITED ARAB EMIRATES. Explaining Growth. Rio deJaneiro.

Engle, R. F. and C. W. J. Granger (1987). "Co-Integration and Error Correction: Representation, Estimation, and Testing." Econometrica **55**(2): 251 - 276.

Estache, A. (1983). Infrastructure: A survey of recent and upcoming issues. Washington DC, World Bank.

FIDH (2008). EU/GCC Placing human rights at the centre of EU-GCC relations., International Federation for Human Rights (FIDH).

Findlay, R. and M. Lundahl (1999). Resource Led Growth - A Long-term Perspective. Helsinki, UNU World Institute for Development Economic Research.

Fosu, A. K. (1992). "Effect of Export Instability on Economic Growth in Africa." The Journal of Developing Areas **26**(3): 323 - 332.

Friedman, M. (1957). A Theory of Consumption Function. Princeton, Princeton University Press.

Garratt, A., K. Lee, et al. (2003). "A LONG RUN STRUCTURAL MACROECONOMETRIC MODEL OF THE UK." Royal Economic Journal(113).

Gelb, A. (1988). Oil Windfalls Blessing or Curse? Washington, Oxford University Press.

Gelper, S., A. Lemmens, et al. (2007). "Consumer sentiment and consumer spending: decomposing the Gra nger causal relationship in the time domain." Applied Economics **39**(1): 1 - 11.

Gerth, J. and S. Labaton (2004). Oman's Oil Yield Long In Decline, Shell Data Show. The New York Times. New York.

Ginsberg, N. (1957). "Natural Resources and Economic Development." Annals of the Association of American Geographers **47**(3): 197 - 212.

Glezakos, C. (1973). "Export Instability and Economic Growth: A Statistical Verification." Economic Development and Cultural Change **21**(July, 1973): 670 - 678.

Granger, C. W. J. (1969). "Investigating Causal Relations by Econometric Models and Cross-spectral Methods." Econometrica **37**.

Granger, C. W. J. and P. Newbold (1974). "Spurious Regression in Econometrics." Journal of Econometrics **2**.

Gregory, R. G. (1976). "Some implications of the growth of the mineral sector." The Australian Journal of Agricultural Economics **20**: 71 - 91.

Gujarati, D. N. (1995). Basic Econometrics. Singapore, McGraw-Hill, Inc.

Gyimah-Brempong, K. (1991). "Export Instability and Economic Growth in Sub-Saharan Africa." Economic Development and Cultural Change **39**: 815 - 828.

Hakura, D. (2006). Growth in the Middle East and North Africa. IMF/AMF High-Level Seminar on Institutions and Economic Growth in the Arab Countries. Abu Dhabi, United Arab Emirates, International Monetary Fund.

Halliday, F. (1974). Arabia Without Sultans. London, Penguin Books.

Hammoudeh, S. and S. Al-Gudhea (2006). Pricing Risk, Oil and Financial Factors in Saudi Sector Index Returns. Chicago, Middle East Economic Association.

Hirschman, A. O. (1958). The Strategy for Economic Development. New Haven, Yale University Press.

Hirschman, A. O. (1973). The Strategy of Economic Development. Clinton, Yale University Press.

Hirschman, A. O. (1981). A Generalized Linkage Approach to Development with Special Reference to Staples. Essays in Trespassing, Economics to Politics and Beyond. Cambridge, Cambridge University Press.

Hotelling, H. (1931). "The Economics of Exhaustible Resources." The Journal of Political Economy **39**: 137-175.

Hutchison, M. M. (1994). "Manufacturing sector resiliency to energy booms: empirical evidence from Norway, the Netherlands and the United Kingdom." Oxford Economic Papers **46**.

Ibrahim, M. H. (2001). "Financial Factors and Empirical Behaviour of Money Demand: A Case Study of Malaysia." International Economic Journal **15**: 55 - 72.

Jafarov, E., K. Moriyama, et al. (1995). Norway, Selected Issues. Washington, D.C., International Monetary Fund.

JCzelusta, G. W. a. (2003). Mineral Resources and Economic Development. Conference on Sector Reform in Latin America. Stanford, Stanford Center for International Development.

Johnston, B. F. and J. W. Mellor (1961). "The Role of Agriculture in Economic Development." The American Economic Review **51**(4): 566 - 593.

Jones, L. P. (1976). "The Measurement of Hirschmanian Linkages." The Quarterly Journal of Economics **90**: 323 - 333.

Jones, L. P. (1976). "The Measurment of Hirschmanian Linkages." The Quarterly Journal of Economics **90**(2): 323 - 333.

Juselius, K. (2006). The Cointegrated VAR Model; Methodology and Application. New York, Oxford University Press.

Kapiszewski, A. (2001). National and Expatriates. Population and labour Dilemmas of the GCC States. Reading, Ithaca press.

Kapiszewski, A. (2006). Arab Versus Asian Migrant Workers in the GCC Countries. Beirun, Population Division, Department of Economic and Social Affairs, UN Secretariat.

Keele, L. (2004). Not Just for Cointegration: Error Correction Models with Stationary Data. Oxford, Department of Politics and International Relations Nuffield College and Oxford University.

Khan, S. U. (2005). "Macro Determinants of Total Factor Productivity in Pakistan." SBP Research Bulletin **2**.

Krugman, P. (1994). "The Myth of Asia's Miracle." Foreign Affairs **73**(6).

Laumas, P. S. (1976). "The Weighting Problem in Testing the Linkage Hypothesis." The Quarterly Journal of Economics **90**(2): 308 - 312.

Lederman, D. and W. F. Maloney, Eds. (2007). Natural Resources Neither Curse nor Destiny. Washington D.C., The International Bank for Reconstruction and Development.

Lewis, W. A. (1979). Growth and Flactuations: 1870 - 1913. London, G. Allen and Unwin.

Lim, D. (1974). "Export Instability and Economic Development: The Example of West Malaysia." Oxford Economic Papers **26**(1): 78 - 92.

Limi, A. (2006). 'Did Botswana Escape from the Resource Curse?', IMF Working Paper WP/06/138, International Monetary Fund, Washington DC.

Litterman, R. B. (1984). Forecasting and policy analysis with Bayesian vector autoregression models. Minneapolis, Federal Reserve Bank Minneapolis.

Lütkepohl, H. (1993). Introduction to Multiple Time Series Analysis, Springer.

Luke, T. W. (1983). "Dependent Development and the Arab OPEC States." The Journal of Politics **45**(4): 979-1003.

Lutkepohl, H., P. Saikkonen, et al. (2001). Maximum Eigenvalue Versus Trace Tests for the Cointegrating Rank of a VAR Process. Berlin, Humboldt University Berlin, University of Helsinki, and Humboldt University Berlin.

M.Miller, S. and F. S. Russek (1990). "Cointegration and error-correction models: the temporal causality between government taxes and spending." Southern Economic Journal **57**: 221 - 229.

Makdisi, S., Z. Fattah, et al. (2000). DETERMINANTS OF GROWTH IN THE MENA COUNTRIES. Beirut, American University of Beirut.

Mankiw, N. G. (2002). Macroeconomics. New York, Worth Publishers.

Maudosa, J., J. M. Pastora, et al. (1999). "Total factor productivity measurement and human capital in OECD countries." Economic Letters(63): 39 - 44.

Mehlum, H., K. Moene, et al. (2002). Institutions and the resource curse. Oslo, Department of Economics, University of Oslo.

Mendoza, E. G. (1997). "Terms-of-trade uncertainty and economic growth." Journal of Development Economics **54**: 323 - 356.

Metz, H. C. (1993) Persian Gulf States: A Country Study. Persian Gulf States: A Country Study **Volume**, DOI:

Ministry of Information (2001). Speeches of H.M. the Sultan M. o. Information. Muscat, Ministry of Information.

Mohammed, A. (2009) Foreign Workers, A Threat to GCC Families. **Volume**, DOI:

N., W. K. and T. C. Tang (2008). Foreign direct investment and employment in manufacturing and services sectors: fresh empirical evidence from Singapore. Melbourne, Department of Economics at Monash University.

Nabil, M., J. Keller, et al. (2004). "Exchange Rate Management within the Middle East and North Africa Region: The Cost to Manufacturing Competitiveness." American Unversity of Beirut.

Nabli, M. and M.-A. Veganzones (2002). Exchange Rate Regime and Competitiveness of
Manufactured Exports: The Case of MENA Countries. Washington, World Bank.

Nurkse, R. (1970). Problems of Capital Formation in Underdeveloped Countries and Patterns of Trade and Development. New York, Oxford University Press.

Official Gazette (1974). Royal Decree No. 41/74.

Official Gazette (1981). Royal Decree 1/1980.

Omani Ministry of National Economy (1984-2006). Statistical Year Book. Muscat.

Ozler, S. and J. Harrigan (1988). Export Instability and Growth. Los Angeles, University of California.

Pacheco-Lopez, P. (2005). "Foreign Direct Investments, Exports and Imports." World Economy **28**(8): 1157 - 1172.

Pearce, D. and E. B. Barrier (2000). Blueprint for a Sustainable Economy. London, Earthscan Publication Ltd.

Pesaran, M. H., Y. Shin, et al. (2001). "Bounds Testing Approaches to the Analysis of Level Relationships." Journal of Econometrics **94**: 621 - 634.

Prebisch, R. (1950). The Economic Development of Latin America and its Principal Problems. New York, United Nationes.

Roemer, M. (1970). Fishing for Growth, Export-led Development in Peru, 1950 - 1967. Harvard, Harvard University Press.

Rosenstein-Roden, P. N. (1943). "Problems of Industrialisation of Eastern and South-Eastern Europe." The Economic Journal **53**: 202 - 211.

Ross, M. (1999). "The Political Economy of the Resource Curse." World Politics **51**(2): 297 - 322.

Rosser, A. (2004). Why did Indonesia overcome the resource curse? Brighton, INSTITUTE OF DEVELOPMENT STUDIES.

Rostow, W. W. (1990). The Stages of Economic Growth: A Non-communist Manifesto, Cambridge University Press.

Sachs, J. D. and A. M. Warner (1995). Natural Resource Abundance and Economic Growth. Cambridge, National Bureau of Economic Research.

Sachs, J. D. and A. M. Warner (1997). "Fundamental Sources of Long-Run Growth." The American Economic Review **87**: 184 - 188.

Sachs, J. D. and A. M. Warner (2001). "Natural Resources and Economic Development The curse of natural resources." European Economic Review **45**: 827 - 838.

Saif, I. (2009). The Oil Bomm in the GCC Countries, 2002 - 2008: Old Challanges, Changing Dynamics. Washington D.C., Carnegie Papers.

Sala-i-Martin, X. and A. Subramanian (2003). ADDRESSING THE NATURAL RESOURCE CURSE: AN ILLUSTRATION FROM NIGERIA. Cambridge, NATIONAL BUREAU OF ECONOMIC RESEARCH.

Salter, W. E. G. (1959). "Internal and external balance: The role of prices and expenditure effects." Economic Record **35**: 226 238.

Samir Makdisi, Z. F. a. I. L. (2000). Determinants of Growth in the MENA Countries. Oxford, Centre for the Study of African Economies, Oxford University.

Sarraf, M. and M. Jiwanji (2001). Beating the Resource Curse,
the Case of Botswana
Washington DC, The World Bank.

Setser, B. (2007). The Case for Exchange Rate Flexibility in Oil-Exporting Economies. Washington D.C., Peter G. Peterson Institute for International Economics.

Shiell, L. and C. Busby (2008). Greater Saving Required: How Alberta Can Achieve Fiscal Sustainability from its Resource Revenues. Ottawa, C.D. Howe Institute.

Sims, C. A. (1980). "Macroeconomics and Reality." Econometrica **48**.

Singer, H. W. (1950). "The Distribution of Gains between Investing and Borrowing Countries." The American Economic Review **40**: 473 - 485.

Sinha, D. (1999). EXPORT INSTABILITY, INVESTMENT AND ECONOMIC GROWTH IN ASIAN COUNTRIES: A TIME SERIES ANALYSIS. Connecticut, ECONOMIC GROWTH CENTER, YALE UNIVERSITY.

Smith, M. H. P. a. R. P. (1995). "Estimating Long-Run Relationships from Dynamic Heterogeneous Panels." Journal of Econometrics **68**: 79 - 113.

Solow, R. (1956). "A Contribution to the Theory of Economic Growth." Quarterly Journal of Economics **70**: 65 - 94.

Solow, R. M. (1974). "Intergenerational Equity and Exhaustible Resources." The Review of Economic Studies **41**: 29 - 45.

Stevens, P. (2003). Resource Impact - Curse or Blessing? A literature Survey. Dundee, University of Dundee.

Stiglitz, J. (1974). "Growth with Exhaustible Natural Resources: Efficient and Optimal Growth Paths." The Review of Economic Studies **41**: 123 - 137.

Strasky, M. S. J., P. Adolf, et al. (2008). The Gulf Coperation Council Countries Economic Structures, Recent Developments and Role in the Global Economy. Frankfurt, European Central Bank.

Swan, T. W. (1956). "Economic Growth and Capital Accumulatio." Economic Record **32**: 334-361.

The Commission For The Future (1987). Our common future. Geneva, Oxford University Press Australia.

The World Bank (2008). The Growth Report , Strategies for Sustained Growth and Inclusive Development. Washington d.C.

Toda, H. Y. (1994). "Finite Sample Properties of Likelihood Ratio Tests for Cointegrating Ranks when Linear
Trends are Present." The Review of Economics and Statistics **76**: 66 -79.

Vogel, S. J. (1994). "Structural Changes in Agriculture: Production Linkages and Agricultural Demand-Led Industrialization " Oxford Economic Papers **46**: 136 - 156.

Watkins, M. (1963). "A staple Theory of Economic Growth." Canadian Journal of Economics and Political Science.

Wong, K. N. and Tang, T. C. (2008). FOREIGN DIRECT INVESTMENT AND EMPLOYMENT IN MANUFACTURING AND SERVICES SECTORS: FRESH EMPIRICAL EVIDENCE FROM SINGAPORE. Selangor Darul Ehsan, Monash University

World Bank (2000). Measuring growth in total factor productivity. Washington D.C., World Bank.

Yotopouls, P. A. and J. B. Nugent (1973). "A Balanced-Growth Version of the Linkage Hypothesis: A Test." The Quarterly Journal of Economics **87**: 157 - 171.

Yousef, T. M. (2004). "Development, Growth and Policy Reforms in the Middle East and North Africa since 1950." American Economic Association **18**(3): 91 - 115.

Youtopoulos, P. A. and J. B. Nugent (1973). "A Balanced-Growth Version of the Linkage Hypothesis: A Test." The Quarterly Journal of Economics **87**(2): 157 - 171.

Zachariadis, T. (2006). On the Exploration of causal Relationships Between Energy and the Economy. Nicosia, Department of Economics, University of Cyprus.