The Role of the State in Economic Development: A Case Study of the GCC Countries

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ABSTRACT

The aim of this thesis is to assess the role of the state in economic development in the GCC countries. Three aspects of this subject are investigated. An Indirect role of the state is analyzed through the effect of financial development on the economic growth. And direct roles of the state are examined through the impact of defence spending and that of public infrastructure on the development process.

First the role of financial development is analyzed by using three alterative causality tests. The results suggest that the existence of long-run relationship between economic development and the state of financial development in most GCC countries. The results further suggest that financial sector can be a leading sector for some of the GCC countries. Second, the impact of defence spending on economic development is examined by employing VAR/ECM models. The emerging results suggest that defence expenditure appears to retard economic development for countries with relatively heavy defence expenditure (Saudi Arabia and UAE), whilst positive effect is suggested for GCC member with relatively low defence spending (Bahrain and Oman). Third, for one member of GCC (Saudi Arabia) the role of public infrastructure in economic development is analyzed also using VAR/ECM. The results indicate that the high public capital expenditure in Saudi Arabia has insignificant effect in the economic development in the long – run.

To my parents

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List of Abbreviations

2SLS	Two Stage Least Square
3SLS	Three Stage Least Square
ACDA	Arm Control and Disarmament Agency
ADF	Augmented Dickey Fuller
AIC	Akaike Information Criteria
ATM	Automated Teller Machine
bn	billion
BS	Bank Assets
CPS	Credit to Private Sector
CV	Cointegration Vector
D	Defence expenditure
DC	Developing Country
DIFC	Dubai International Financial Centre
ECM	Error Correction Model
FD	Financial Development
FI	Financial Indicator
FMS	Foreign Military Sales
G	economic Growth
GDP	Gross Domestic Product
G-M-D	Geweke, Meese, and Dent
GCC	Gulf Cooperation Council
GMM	Generalized Method of Moments
IMET	International Military Education and Training
IMF	International Monetary Fund

IRF	Impulse Response Function
K	capital formation
KG	public capital
Km	Kilometre
KP	Private Capital
KPSS	Kwiatkowski, Phillips, Schmidt, and Shin
KWH	Kilo Watt Hour
L	Labour force
M1	Narrow Money
M3	Liquid Liabilities
MENA	Middle East and North Africa
mn	million
MW	Mega Watt
OECD	Organisation of Economic Co-operation and Development
OLS	Ordinary Least Square
OPEC	Organisation of the Petroleum Exporting Countries
PDRY	People's Democratic Republic of Yemen
PP	Philips and Perron
R & D	Research and Development
SABIC	Saudi Arabian Basic Industry Corporation
SAMA	Saudi Arabian Monetary Agency
SEM	Simultaneous Equation Model
SIPRI	Stockholm International Peace Research Institute
UAE	United Arab Emirates
UK	United Kingdom

UNROCA	United Nations Register of Conventional Arms
USA	United States of America
VAR	Vector Auto regression
WB	World Bank
WTO	World Trade Organisation

CHAPTER 1

INTRODUCTION

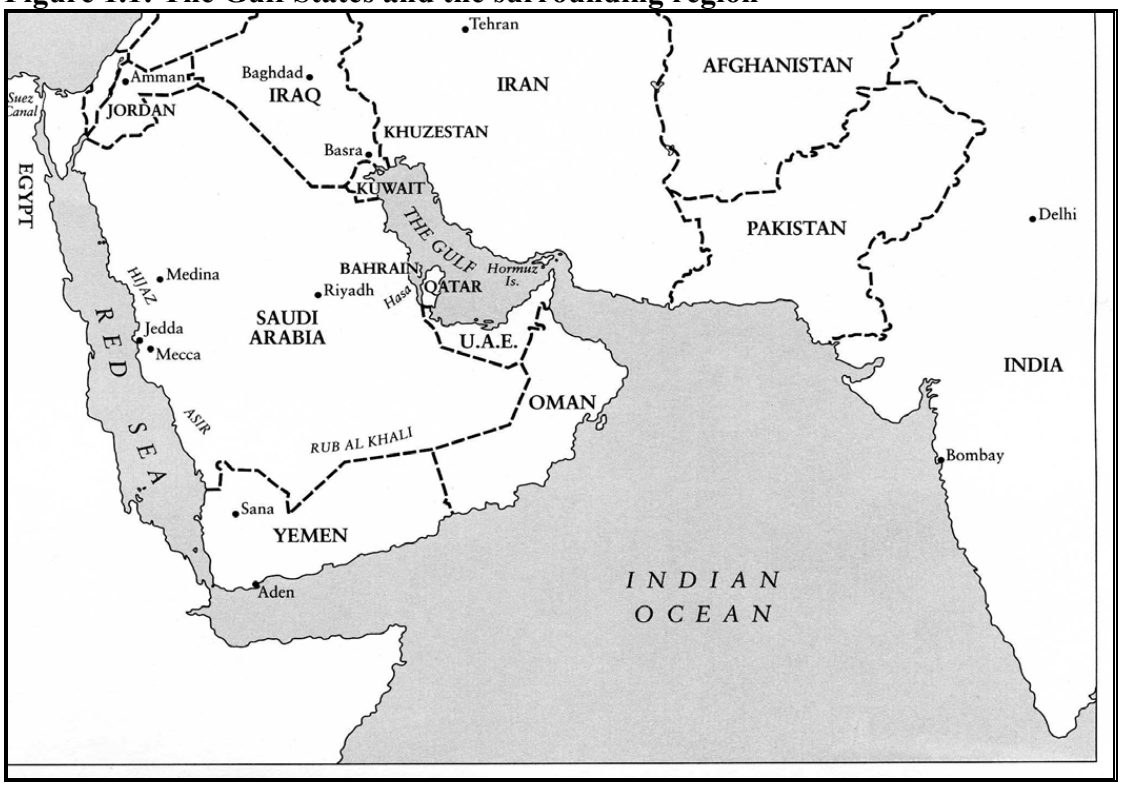
1.1 INTRODUCTION

The Arab Gulf Countries that constitute the "Gulf Cooperation Council" (GCC) are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates (UAE). The GCC was found in 1981 as result of the political instability of that time in the region, such as Iranian Revolution in 1979 and the First Gulf war between Iraq and Iran started in 1980, and further to strength the security and economic interests of those countries (Momani, 2008). Most of these countries were formed and found after World War II. Kuwait gained a sovereign status from United Kingdom (UK) in 1961, while Bahrain, Qatar, and UAE granted theirs in 1971. Oman, on the other hand, has been independent since the departure of Portuguese colonists in 1650, and Saudi Arabia granted its independence from UK in 1934 (Abdel-Hadi, 2005). These countries, to large extent, share common cultural, political, and economic features; royal monarchy, high dependency on oi l, and relatively low population density- around 35 m illion at present- are the most obvious characters of those countries (Azaam, 1988; Al-Muharrami et al, 2006; Beblawi 2008; among others).

After World War II, the level of socio-economic development in GCC countries and most countries in the Middle East and North Africa (MENA) region was below that of most newly independent developing regions; adult illiteracy rate were well over 85 percent and only about 23 percent of children ages 9-19 enrolled in school (Yousef, 2004). GCC states, with exception of Saudi Arabia, are quite small in terms of land

area and size of population; they are small coastal states located on the Persian Gulf as in Figure 1.1. Saudi Arabia amounts for about 80 percent of the land area of GCC region, 70 percent of the population, and about half of the collective GDP. Oman is the second in land area but the third in population after UAE, while Qatar and then Bahrain are the smallest after Kuwait in both land area and population size. Furthermore, GCC region is one of the driest places in the world with huge desert landscapes, possibly the most fragile on the earth, and has no rivers or lakes with sporadic and infrequent rainfall. During the summer the temperatures can go well over 50 centigrade. The economic activity in most GCC countries was revolved around a small agricultural sector and some small finishing industry in some of the small coastal states, in addition to livestock of the nomadic population "the herding population" and some commercial activities that usually take place in a bazaar or suq-type in few small scattered urban towns around the region.

Figure 1.1: The Gulf States and the surrounding region



Source: Ulrichsen (2009).

The discovery of oil, nonetheless, with massive quantity has undoubtedly changed the destiny of these countries. A destiny of traditional agricultural pastoral economies has been replaced, with oil wealth, to a more modern one with relatively advanced-service economies that can be capable of producing consumer and industrial goods. The region sits on the world's largest proven oil and natural gas reserves, a round 45% and 17% respectively of the world's total (Fasano and Iqbal, 2003); with four of the six countries are members of OPEC, the industrial cartel of oil producing countries.[1] However, the pronounce role of the oil wealth in the development process in the region did not take effect until the 1970s where the rest of the small states granted their independence from United Kingdom, and the political instability in the MENA region derived the oil prices to standard levels by that time.[2]

These countries have been receiving large amount of windfalls from oil exports since early 1970s. The development process in the region, therefore, has relied heavily on the rents derived from oil and natural resources exportations. Beblawi (2008) argues that the recurrent flow of rents from oil and natural gas have made those countries the most conspicuous rentier economies in the world. In essence, the windfalls from natural resources have major impact on the general pattern of economic behaviour and the potential comparative advantage of other economic sectors. This could be attributed to the fact that the discovery of oil in the region, with massive quantity, was coincided with the finding of those countries. As a result, oil rent has become the

[1] Oman, although oil producer, is not member of OPEC. Bahrain, on the other hand, has not been a big oil producer.

[2] The state formation and the economic development process in some of the GCC countries (Bahrain, Qatar, UAE, and to lesser extent other countries in the region) perhaps did not start effectively until the British announcement, in 1968, of their desire to withdraw from the Persian Gulf by 1971. For example, up to the 1960s the Gulf rupee, issued by the central bank of India, was the region's only universally accepted legal tender (Sursock, 1988).

major source of building both the state and the economy. [3] Furthermore, such heavy external windfall with small economic capacity have given the GCC region an international position as a significant supplier of financial funds to the international market, and to some world organizations – the World Bank (WB) and International Monetary Fund (IMF) – , as well as a generous donor to developing countries. For example, in 1981, one member of GCC, Saudi Arabia, claimed the sixth place among the 141 member of the IMF in voting strength as well as a constant seat on the 22 member board of directors after a $10bn loan from the kingdom to the Fund (El Mallakh, 1982).

A rentier economy is the case where the national resources sector, with substantial external rent, dominates the economy. A rentier state as Beblawi (1987) suggests is a special case of rentier economy where the rent accrues do not go to individuals or private corporations, but rather go directly to the state. In addition, only small portion of the labour force involved in the process of generating this rent whilst the rest of the society is only engaged in the distribution and in the utilization of the wealth. The oil exporting developing countries whose large portion of their income is derived from oil rent – such as GCC members (see Table 1.1) – are typical example of a rentier state (Okruhlik, 1999).

The most pronounced economic features of GCC countries are the dominant role of natural resource sector in the economy, as well as the high dependency on expatriate labour where over 50% of labour force in those countries is expatriate workers – in some cases as much as 90% (UAE) (Jbili et al,1997) –. Together with some

[3] Beblawi argues that this coincidence distinguishes them from other rentier, semi-rentier economies such as those of Norway, Canada, and Netherlands in the 1960s, where the natural resource activity in latter countries added to existing developed economy with productive sectors.

neighbouring countries GCC members form the most hydrocarbon-centred in the world (Sturm et al, 2008). Oil rents remain the major determinant of economic growth where the governments' ownership of the Petroleum companies has allowed the state to play the major role in all economic activity (Beblawi, 1987; Mazarei, 1997; among others). Devaux (2006) also argues that GCC countries remain rentier states where oil and natural gas, in case of Qatar, revenues account for over 70% of the governments' revenue in most of the GCC countries since the 1970s when oil companies nationalised and the ownership passed to the governments in the region.

The region, nonetheless, has made a relatively noticeable economic development in the last few decades, with relatively large projects of infrastructure. GDP per capita, for example, has jumped from around $1080 in 1970 to $17000 by 1980 due notably to the huge windfall from oil exports as in Table 1.1. However, GDP has declined remarkably since the mid of 1980s, as in Table 1.1, as result of relatively low oil prices in most of the 1980s and the 1990s. Reflecting the dominate role of natural resources sector in those economies. Other development indicators reflect the stage of development in some areas, with life expectancy increases from around 58 year in 1970 up to 70 year in the late 1980 and around 75 at present. [4] Table 1.1 presents some macroeconomic and development indicators in the region.

[4] Haq (1992), however, argues that the dilemma of development concept in most developing countries can be detected through some development indicators. Saudi Arabia GDP per capita, for instance, is 15 times that of Sir Lanka but much lower literacy rate. Costa Rica GDP per capita also is one third of that of Oman but its life expectancy is 10 years longer and its literacy rate is 3 times higher. These comparisons reveal the critical disparity between economic and social progress among countries.

Table 1.1: Consolidated GCC Macroeconomic and Development Indicators

Variable	unit	1970	1975	1980	1985	1991	1995	2000	2005
Nominal GDP	US$ bn	8.4	73.1	239.4	172.2	199.1	240.2	342.3	615.4
Exports	% GDP	0.61	73.9	81.3	58.8	50.2	54.8	64.9	70.9
Fuel exports	% merch exports	Na	na	71.1	na	59.1	79.4	88.1	87.5
Imports	US$ bn	1.9	11.6	52.1	43.6	56.5	68.2	82	187.6
Imports	% GDP	0.22	0.16	0.21	0.25	0.28	0.28	0.24	0.3
Population	mn	7.7	10.1	13.8	18.3	23.7	25.7	29.9	34
GDP Per capita	US$	1084	7201.9	17404.3	9410.1	8400.8	9354.5	11430.3	17866
Life expectancy	year	58	na	65.9	69	72.3	73.2	74.7	75.8
Illiteracy rate	% population over 15	Na	na	Na	0.25	0.23	0.21	na	0.24
Oil reserve	bn barrels	Na	na	272.4	305.5	463	464.9	476.1	484.3
Natural Gas reserve	ton cubic meters	Na	na	9.5	12.5	19.4	22.1	29.2	41.1

Sources: IMF, IFS, World Bank (WDI), (*Database, 2007*), and Annual statistical Bulletin, OPEC (2007)

Recently those countries have devoted more attention toward economic integration among them moving from free trade area in 1981 to full customs union in 2005. The gulf common market among those countries has been declared by the beginning of year 2008, and a monetary union with a common currency is the next expected step, although Oman has already withdrawn from the ongoing procedures of establishing a common currency and monetary union among the GCC members.[5] GCC countries do understand the challenges that facing their economies with economic globalization, where they are all now members of WTO. Hence, economic integration among them may help to mitigate the challenges of economic globalization.

[5] UAE also has expressed its desire of not joining the monetary union unless Abu Dhabi, the capital city of UAE, is the host city of the GCC central bank' headquarter.

The recent continuous surge of oil and natural gas prices, nevertheless, has drawn some attention worldwide to the region. Abdel-Hadi (2005), and Devaux (2006), among others, argue that the surge of oil prices since the beginning of this century has ranked those countries to that of Asian countries in its impact on the international investment flow. The impact of high oil prices has been reflected in the GDP figures where the GCC region ranks the 16th largest economy in the world with collective GDP of about $ 750bn in 2006.

Those countries have made over $ 2 trillion from oil revenue in the last decade.[6] Gray and Blejer (2007, p41) argues that "it is totally unfair to neglect the fact that those countries are rentier economies with no significant diversification or scope of economic development out side that supported by the petroleum sector" such as petrochemical and energy intensive industries such as aluminium. Devaux (2006) points out that the distribution of oil income still is the key factor of growth process as whole and the development of financial sector activity in particular in the GCC region.[7] Strurm et al (2008) also argue that the key transmission mechanism in translating the oil wealth into both higher investment and consumption in the GCC countries has always been government expenditure.

The governments of GCC countries, therefore, are in a position to influence profoundly the rate and the quality of economic development in their economy. The directions in which the government allocates its expenditure dictate the distribution of

[6] Abdel-Hadi (2005) argues that the higher oil prices since the beginning of this century is largely attributed to supply demand imbalances, which makes it different from that of 1970s where the latter was due mainly to political instability in the region.

[7] An interesting question that would rise up with this regard is whether the financial institutions in those countries are capable of deploying such massive flow of capital?, Al-Muharrami et al (2006), among others, doubts it as we shell see in the next chapter.

income and the allocations of resources; where spending flows, incomes are received and resources are utilised. It is, therefore, an important and interesting issue to assess the impact of government role on the development process in region.

1.2 Research Questions and Hypothesis

The traditional view of the role of the state in economic development rests on the triple issues of resource mobilisation, resource re-allocation and externalities associated with public capital formation. Typically, a developing country resides within its production possibility frontier, so growth spurts are possible if the government can mobilise additional resources which the private sector has failed to do. Once on the production possibility frontier itself, allocate efficiency becomes important and resource transfer from the private sector to the government may have a positive effect (crowding-in) or a negative effect (crowding out). Finally, if there exists increasing returns to capital and public capital adds to the productivity of private capital through spillovers, then these externalities are predominantly growth enhancing.

Easterly (2009) utilises a production function of the following type:

$$y_i = Ak_i^{\alpha} \overline{K}^{\beta}$$

Where i is the ith firm and $\overline{K}$ is the public capital provided by the state which, as a pure public good, would be available to all firms. y and k are output and capital stock. In long run equilibrium, assuming all $k = k_i$, and summing over all firms, the aggregate production function takes on the form:

$$Y = A\overline{K}^{\alpha+\beta}$$

It is possible that the provision of $\overline{K}$ and the possibility that α + β > 1 (increasing returns to scale) creates externalities purely due to the existence of the government. Government capital formation both human and physical (education, infrastructure, security) create externalities (given by the parameter 'β') which in turn increases the productivity of private capital and thereby increases economic growth.

All of these models whether in public finance or in growth theory, requires costly capital formation by the state whether it is trying to increase the supply of resources, or is allocating resources from the private to the public sector or creating government capital with positive externalities. Thus, optimum government spending on enhancing productivity requires an evaluation of the costs (via resource transfer away from the productive private sector) with the benefits (productivity growth from public infrastructure) for economic development of having an activist state and a major role for public investment. Normally, development literature is awash with such case studies where individual countries are evaluated depending on w hich side of the spectrum they lie on this issue.

The problem is somewhat different for the GCC countries. They are resource rich and the transaction costs of earning resource revenue are low. Thus, the economic costs of obtaining government capital are relatively modest. Hence, we should see a high productivity of government capital in these countries. In the three separate case studies we consider in this thesis we therefore attempt to evaluate the net benefit (if any) of government intervention. The three 'essays' reflect three different aspects of

the role of the State in the unique framework of the resource rich, population poor, gulf countries.

The study therefore investigates the role of the state in economic development in the GCC countries. The three core research questions are as follow:

1. **Is there a significant contribution from the financial institutions in the development process in the GCC countries?**

It is argued in the literature that the development of financial sector in the GCC did not start effectively until the mid of the 1970s when oil price jumped up and massive external windfall flowed to the region thereafter (e.g. Abdeen and Shook, 1984; Azzam 1988a). The massive wealth that flows into those countries has created some pressures on the governments to facilitate the development of financial intermediaries in order to channel the oil wealth to the other sectors in the economy. Hence, the role of financial development in the economic growth may be viewed as indirect role of the state in promoting economic development. Moreover, small countries with such massive wealth accompanied with limited domestic investment opportunities may have a comparative advantage in banking industry. Thus, the first hypothesis is that the financial development may have promoted the development of other sectors in the economy and may also contribute significantly to economic growth in the GCC countries.

2. **What is the effect of defence expenditure on the economic growth in the GCC countries?**

The large recurrent flow of capital from oil exports to small developing GCC countries raises the importance of security to those countries. GCC region apparently and according to several sources, remains one, if not the first, of the highly defence spending regions in the developing world, and correspondingly has higher level of arms imports. Deger and Sen (1995) argue that the problem of security in developing countries can not be impartial from the development failures or success according to most analysts. Allocating too much to security may hinder development, while giving too little to security may allow threats to grow. Military expenditure would carry both positive and negative effects on the economic development. Spin-offs from military expenditure may have positive effects on the other sectors in the economy. However, military expenditure has opportunity costs and may crowd out other forms of expenditure such as investment, which may carry adverse effects on economic development. Therefore, the second hypothesis is that the heavy defence expenditure that characterise most of the GCC may have come at the expense of the development of other sectors in the economy.

3. What is impact of public infrastructure on the development process in GCC?

This question, as the second question, represents a direct role for the government in economic development. Due to the small size of the economy, the state can dominate the economy and, thereby, the total capital formation in theses countries. Infrastructure has widely been thought of as an essential base for productive economic activities. Investments in public infrastructures will carry positive externalities to the

other sectors in the economy and allow business activities to flourish. With a relatively low level of public infrastructure prior to the 1970s, translating the oil wealth that these countries have been enjoying into higher investment in public infrastructure may contribute significantly in economic development. However, higher level of public investment with low level of human capital formation as well as the misuse and misallocation of public investment, as it is the case in most developing countries, may imply a very low of return on public investment and perhaps a negative impact on economic growth. The focus here is on one member of GCC "Saudi Arabia" who has engaged in unprecedented form of public capital expenditures since early 1970s. The hypothesis is that the large amount of public investments with low level of human capital to construct and to operate as well as the problem of misallocation of public investment may have lower the rate of return on public investment in the country.

1.3 STRUCTURE OF THE THESIS

The rest of the thesis is organized as follow:

Chapter 2 investigates the role of financial development in economic growth in the GCC countries. the propose is to assess whether the development that financial institutions in the region have witnessed since the 1970s contributes significantly to the economic growth, or is it merely a consequence of the whole development process that is fuelled by rent derived from oil exports. The chapter reviews the development of financial institutions in the GCC region and assess the financial deepening in the region as well as the development of capital market and the monetary policy in these countries. Number of financial indicators is selected to represent the level of financial

development, and three alternative causality tests – Granger–causality tests, Sims–causality and G-M-D causality tests –are considered to assess the causal relationship and the direction of causation between financial development and economic growth in each country in the GCC in the last few decades. The results, however, are country specific and vary, to some extent, with kind of proxies employ to measure financial development.

Chapter 3 explores the effect of defence expenditure in the economic development in the GCC countries. It provides an overview over the security of GCC region and the historical events that have challenged the security of the region. The chapter also survey a large body of literature that have considered different approaches (e.g. simultaneous – equations models (SEMs), Feder – Ram model, Augmented Solow growth model, and traditional demand side) to asses the casual relationship between defence expenditure and economic growth. The impact of defence expenditure on the development process is carried out in the context of the production function approach of Cubb- Douglas and time series analysis for each country during different periods in the last four decades. Positive and negative effects of defence expenditure emerge for two groups in the sample (negative for those with heavy defence expenditure such as Saudi Arabia and UAE, and positive for those members with relatively low defence expenditure, Bahrain and Oman).

Chapter 4 investigates the role of public infrastructure in the development process in one member of the GCC, Saudi Arabia. The chapter discuss the infrastructure development in Saudi Arabia during the second half of the last century and up to now. Saudi Arabia may represent an interesting study case to assess the impact of heavy

public investment in infrastructure on t he economic development (Loony and Frederiksen, 1985). Different theoretical approaches that have been employed in the literature (e.g. the production function approach", cost-function approach, endogenous growth model, and simultaneity equations models SEM) to assess the effect of public capital in economic development are reviewed. The chapter examine the long – run and the short – run impact of public capital on the level of economic development over the period 1970-2008 in the context of VAR/ECM model. The results, however, suggests that public capital has positive but insignificant impact on the level of economic development in Saudi Arabia. Despite the low level of public capital that Saudi Arabia had, the rate of return on t he heavy public investment, which the government launches since the 1970s, may have been well below the expectations.

Chapter 5 concludes the study and provides some policy implications.

CHAPTER 2

THE ROLE OF FINANCIAL DEVELOPMENT IN THE ECONOMIC GROWTH IN THE GCC COUNTRIES

2.1 INTRODUCTION

This chapter investigates the role of financial development in the economic growth in the GCC countries as it may represent an indirect role of the state in the process of economic development. The role of financial development in economic growth has attracted a wide attention among economists and policy makers worldwide. Countless arguments and evidences have been provided to verify the role of financial development in elucidating economic growth differentials (e.g. Goldsmith, 1969; McKinnon, 1973; Shaw 1973; and King and Levine, 1993, to name just few). In fact, Robert Lucas (1988) has argued that economists "badly over-stress" the role of financial development in economic growth. The pronounced role of financial sector comes in the endorsement of collecting additional savings, re-allocating resources, and redistributing the benefits of larges returns on capital investment (Tun Wai, 1972). In addition, they mobilize savings, facilitate the exchange of goods and services (Levine, 1997), and contribute to the credit market by lowering cost of borrowing (Bahita and Khatkhate, 1975).

According to Goldsmith (1969), financial development is the change in financial structure over time; the presence, nature, and relative size of financial instruments and financial institutions of various types that characterize the financial structure of a country. Finding credible measures that approximate financial development is

intrinsically a point of disagreement among economists. From the point of view of what is suitable for country A is not necessarily suitable for country B, one could argue that measures of financial development should be chosen based on the characteristics of the country's financial, economic, social, geographical and political structure. In essence, the measures should be chosen so that they include all possible factors that affect the evolution of a country's financial structure.

Since the financial intermediaries are considered the backbone of financial sectors in the countries of the Gulf Cooperation Council (GCC), this study aims at testing for a casual relationship between financial intermediaries and economic development in the GCC.[8] Testing for such relationship may be crucial for rentier economies where rent from natural resources – oil and natural gas - is the primary source of development in the region. In such economies there is a potential that the financial development is not more than a consequence of development process that is fuelled by rents derived from natural resources.[9] The direction of causality between financial development indicator and economic growth, therefore, may have an important implication for the policy makers. Unnecessary emphasize on the importance of financial development in economic growth my just divert attention away from other, perhaps more, important policy options that may promotes growth (Darrat, 1999).

On the other hand, although these countries have spent over $50 billion to set up an industrial base in order to lessen dependence on oil revenues, they are still highly

[8] The focus here is in the banking sector since the crash of Al-Manakh equity and real- estate market in Kuwait in 1982, where over US $90bn was wiped out (Abdel-Hadi, 2005), have to some extent slowed the development of financial markets in those countries in the last century, see Azzam (1988a) for further details.

[9] An interesting feature of the development process in this region is the fact that the finding of those states was coincided with oil discovery in the region. As a result, oil rents have become the major source of building both the state and the economy (Beblawi, 2008)

dependent on oil. [10] Looney (1997) argues that despite the industrial diversification efforts that has been carried out by GCC countries, the achievements, with exception of that of Saudi Arabian Basic Industry Corporation (SABIC), have been disappointing where a steady infusion of government expenditures is essential to maintain an adequate demand. In fact, some characters of those countries' economies such as, high dependency on oil, shortage of labour, small market size due to small size of the population, as well as unpleasant weather condition make it hard, to some extent, to launch an ambitious big industry. The region is blessed with 45 percent of the world's recoverable oil and 17 percent of natural gas reserves. The overall population of GCC is about 35 million, and expected to grow to 57.4 million by 2020. From the above brief statistics, it is readily perceived that there has been flow of massive wealth to this region, mostly resulting from their exports of oil and natural gas. Disciplined financial sectors then in needed for facilitating the channelling of this wealth and promoting economic development.

Moreover, financial sector may happen to be an alternative major sector for those economies, besides oil sector, that may account for a considerable block of their GDP if it is well managed.[11] Beblawi (2008) argues that oil revenue should be treated as a capital asset rather than an income. According to this view, the countries of the GCC possess a finite quantity of proven reserves of oil and natural gas, and they are neither recurrent nor renewable flows. Therefore, it is wise to think of oil as capital asset. To

[10] Most of the investment in the region has been in the petrochemical industry and energy intensive industry –aluminium- where those countries hold comparative advantage in such industries, since oil is the primary raw material in these industries.

[11] Financial services industry approximates 8% of United State GDP, which is greater than the contribution of both agriculture and mining together in the USA economy, and half as big as manufacturing. This industry consists of depository institutions or banks-, which account alone for two fifths of the industry total-, non-depository institutions, brokers, insurance carriers and agents (Wachtel, 2001).

Beblawi the process of producing and selling oil is no more than monetization of oil to monetary capital. Based on such view one could argue that the countries of the GCC may have comparative advantage in banking industry since they have abundant of capital that derived from natural resources exploitation[12]

To that end, this study aims to examine the causal relationship between financial development and economic growth process in the GCC countries in context of time series analysis and three alternative causality tests – Granger causality tests, Sims causality test, and a new version of Sims causality tests introduced by Geweke et al (1983). The following section discusses the development of the financial system in the GCC region. Section 3 reviews the literature on financial development and economic growth. Section 4 discusses the financial development indicators considered in the study, and section 5 presents the empirical methodology. Finally, section 6 reports the empirical finding and the conclusion.

[12] Author's own calculations have shown that those countries have made over US $ 2.5 "trillions" in the last 10 years from oil exports (see for example, OPEC website, *www.opec.org*). Considering, the limited capacity of those economies to absorb such a massive windfall.

2.2 FINANCIAL SYSTEM DEVELOPMENT IN THE GCC

It has been argued, in literature, that there has not been a significant development in the financial system in the GCC region prior to mid 1970s, when oil prices climbed up as result of political instability in the region (Abdeen and Shook, 1984; Azzam 1988a; Jbili et al, 1997; and Devaux, 2006).[13] The massive windfalls, thereafter, flowed into those countries have created some pressures to facilitate the development of financial intermediaries in order to channel the oil wealth to the other sectors in the economy. Abdeen and Shook (1984, p15) argue that most of the financial institutions in the region, namely banks, were originally branches of international banks. Those institutions were mostly colonial- based institutions that were oriented to exports-imports trade that was not related to development goals.[14] By the mid of 1970s, all foreign banks were required to transfer ownership to residents of the region.

As result of massive windfall from oil rents in the 1970s and early 1980s, governments in the region, which are the recipients of oil rents, established some commercial banks with private partners. Moreover, governments established other specialized development institutions such as industrial funds, real estate funds, Agricultural funds, etc. These specialized financial institutions target to distribute the oil wealth, as well as to facilitate the channelling of oil rents to promote the development of other potential sectors. They are mostly government owned, and they are not depository institutions rather they usually take the form of single branch banks

[13] The Egyptian Israeli war in 1973 accompanied with oil embargo by Arab oil-producer countries derived up oil prices to standards levels by that time.
[14] For instance, one of the oldest banks in Saudi Arabia, "Nederlandsche Handelmaatschappeij", later known as Saudi Holland Bank, was originally placed in the western part of Saudi to cater to the Muslim pilgrims from Far East, "Indonesia", which used to be one of the Netherland Colonies (Sursock, 1987).

that finance long- term projects with relatively low interest rates (Al-Muharrami et al, 2006; Gray and Blejer 2007). The development of those institutions is not considered here due to the lack of data in most cases, and to those reasons mentioned by Al-Muharrami such as different technology, structures, and goals of those institutions as well as a relatively small market share of them.

Azzam (1988), Jbili et al (1997), Devaux (2006), Al-Muharrami et al (2006), among others, point out some important features of financial sector in the GCC region such as a widespread government share in financial institutions, including commercial banks. The public sector, therefore, fully controls large number of commercial banks and specialized financial institutions. Notwithstanding, the private ownership in commercial banks is concentrated in the hands of few shareholders. Moreover, the countries of GCC do have moratoria on license new banks along with constraints on foreign ownership in financial institutions.[15] All of these factors have, to some extent, led to a relatively high degree of concentration in the banking sector in most countries in the region led-by Kuwait with the three largest banks account for 80% of banking sector assets in 1995, and over 50% in Oman and Saudi Arabia in 1994 and 1996 respectively Jbili et al (1997).[16] Fry (1995, p. 304) argues that high degree of concentration in banking sector is a common feature in most developing countries and in some cases, however, could be an obstacle to financial development.[17]

[15] Money laundering has been an issue of concern in the region (Stone and Corbett, 2007). UAE, for example stopped licensing foreign banks since 1982 (Pock et al, 2007).

[16] A recent study by Al-Muharrami et al (2006) on banking concentration in the GCC covering the period 1992 – 2002, using both bank Concentration Ratio (CR*k*) and Herfindahl-Hirschman Index (HHI), to measure the degree of concentration, suggests that Oman, Qatar, and Bahrain have highly concentrate market while Kuwait, Saudi Arabia, and UAE have moderately concentrated market and move toward less concentrated markets in the future.

[17] According to Fry, Morocco is a typical example of lack of competition in banking industry in developing countries due partly to higher degree of concentration within the Moroccan financial sector.

The Banking sectors in the countries of GCC, nonetheless, are relatively very well capitalized, with large number of banks that run a comprehensive networks of branches (Azzam, 1988a,b; Jbili et al, 1997). Compared with international standards the ratio of commercial bank assets to GDP is relatively high in the region ranging between 50 percent in Oman to 100 percent in Bahrain in 2000 as in Table 1.2. The commercial banks assets have increased dramatically in most countries in the region in the last three decades rising from 25 $bn in1985 up to 46 $bn by 1995 in UAE, and from 40 $bn to 81 $bn in Saudi Arabia as in Table 1.2. A recent study by IMF, Creane et al (2004), investigates the financial development in the Middle East and North Africa (MENA) region, by constructing comprehensive financial indices to major the financial development in the region, has classified the banking sector in GCC countries as well developed, profitable, and efficient sector.[18] Furthermore, the share of financial services in non-oil GDP is around 10 percent in the late 1990s in most countries in the region as Jbili et al (1997) argue.[19]

However, despite the massive wealth generated from natural resources exportation, the consolidated capital of the top 50 banks in the region at 31.5 $bn is globally low amounting for 1.7% of the capital of the world's top 1000 banks (Al-Muharrami et al, 2006). Generally, commercial banks in the GCC are relatively small in keeping up even with the size of their countries' economies (Devaux, 2006). The small size of those banks have prevented them from taking a part in financing energy related projects and local infrastructure projects since they do not have the resources to

[18] Based on qualitative and quantitative data the study developed six comprehensive indices that built upon six themes each of which reflects different aspect of financial development such as banking sector development, Institutional environment, financial sector openness, etc. See Creane et al (2004) for further details.

[19] Data on non-oil GDP for GCC countries is available at IMF; however, it is strictly confidential.

finance such projects.[20] As results, most of those banks, as Devaux (2006) argues, concentrate their services on a purely domestic activity. According to the Banker (2002, as cited in Al-Muharrami et al, 2006, p. 3489), unless GCC banks' consolidate together, they will be unable to survive the competition – with such small fragmented banking sector – with well established international banks when markets do eventually open up.

Table 2.1: Some Commercial Banks Statistics from the GCC countries

		1980	1985	1991	1995	2000	2005
Bahrain	Banks Assets (US$ bn)	2.18	3.54	2.24	5.84	8.32	14.11
	Banks Assets/GDP	0.7	0.96	0.91	0.99	1.04	1.05
	No. of Banks' Branches	na	na	na	na	na	366
	Bank Density Per 100000 Of Pop	na	na	na	na	na	50
Kuwait	Banks Assets (US$ bn)	17.45	27.22	30.83	34.11	38	65.12
	Banks Assets/GDP	0.61	1.21	2.79	1.25	1	0.77
	No. of Banks' Branches	na	na	na	124	163	231
	Bank Density Per 100000 Of Pop	na	na	na	7.2	7.3	8.5
Oman	Banks Assets (US$ bn)	1.08	2.79	2.58	3.34	7.49	9.78
	Banks Assets/GDP	0.23	0.29	0.32	0.35	0.49	0.45
	No. of Banks' Branches	na	na	na	320	378	380
	Bank Density Per 100000 Of Pop	na	na	na	14.7	15.7	14.5
Qatar	Banks Assets (US$ bn)	1.83	3.74	6,38	8.97	13.23	34.01
	Banks Assets/GDP	0.23	0.6	0.92	1.1	0.74	0.8
	No. of Banks' Branches	na	na	na	na	98	125
	Bank Density Per 100000 Of Pop	na	na	na	na	16	15.5
Saudi Arabia	Banks Assets (US$ bn)	23.38	40.19	65.6	81.89	111.19	191.84
	Banks Assets/GDP	0.14	0.38	0.5	0.57	0.59	0.61
	No. of Banks' Branches	na	na	na	1192	1184	1224
	Bank Density Per 100000 Of Pop	na	na	na	6.5	5.7	5.1
UAE	Banks Assets (US$ bn)	13.8	25.75	38	46.04	70.08	162.18
	Banks Assets/GDP	0.46	0.95	1.12	1.14	0.99	NA
	No. of Banks' Branches	na	na	na	na	420	564
	Bank Density Per 100000 Of Pop	na	na	na	na	13	13.8

Note: Pop is population
Source: IMF, IFS statistics, annual report (2007). And GCC database of Saudi Arabian Monetary Agency (SAMA).

With regard to financial deepening, traditional measures of financial development reveal a relatively well-monetized region. The ratio of liquid liabilities (M3) to GDP

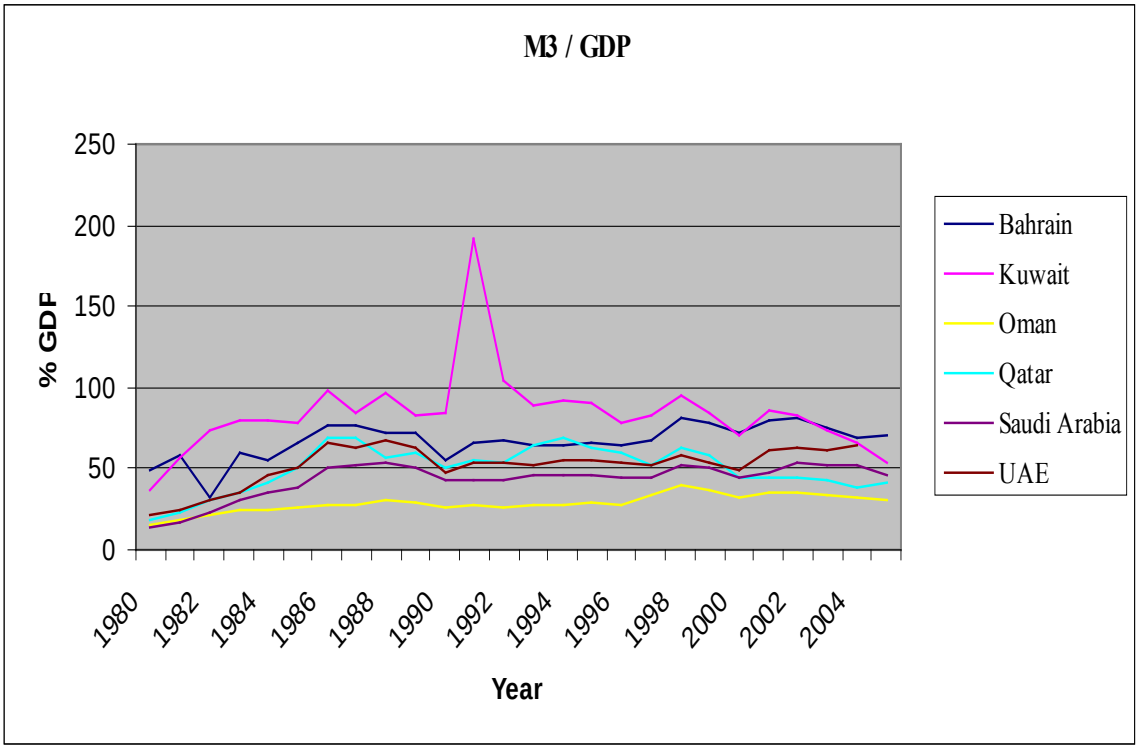
[20] The largest bank in GCC "National Commercial bank" ranks the 109th worldwide (Devaux, 2006).

is relatively high ranging from 45% in Oman to 82% in Kuwait in 2002 as in Figure 2.1. However, although this ratio has been relatively higher than those of other developing regions such as Latin America and South Asia, it ranks far below that of East Asia as in Figure 2.2, indicating more needs to be done towards financial development in the region. The increase of banking awareness as well as the expansion of financial institutions services, the complexity of the financial sector, could be captured through the ratio of Currency in circulation to narrow money M1. The ratio has slowly declined over time in the region in the last three decades ranging from 21% - Kuwait- to 41% in Oman in 2002. There has been, however, a decreasing trend in this ratio in most of these countries in the last few years as in Figure 2.3. This probably due to the introduction of some new financial services such as Islamic financial products Devaux (2006), mutual funds, and advanced consumer-banking technology such as ATM, Sale points, telephone and internet banking. The low banking habit, however, could be also stemming from the relatively low bank density in some countries in the region as in Table 2.1.

Moreover, the ratios of credit to private sector as share of GDP - albeit growing (Figure 2.4) – have been noticeably disappointing compared with the international standards averaging less than 40% of GDP most of the time as in Figure 2.5. Azzam (1988b), Jbili et al (1997), and Devaux (2006), among other, related the limited role of commercial banks in the development process in the region to some common structural features of those institutions. The widespread of government ownership in commercial banks in the region have, to some extent, made those institutions an active lender to governments. Commercial Banks have been contributing in financing the large fiscal deficits some countries in the region run into as result of relatively low

oil prices since the mid of the 1980s and through the 1990s as well as the costs of Second Gulf War.[21] They all argue that the commercial banks lending also continues to take the form of short- term and generally revolved around the traditional niches such as trade[22], constructions related activities, refinancing, letters of Credit, real estate activities.

Figure 2.1:[23] M3 as a share of GDP



[21] For example, Saudi government's debit, mostly domestic, has reached up to 100% of the country's GDP in the late 1990s.

[22] GCC region has been rather a big importer due to the nature of those countries economies "rentier economies". For example, the region imports surged from US$ 11.6bn in 1975 up to US$ 52.1bn in 1980, and accounts for 30% in 2005 of those countries GDP as in Table 1.1. Abdel-Fadil (1987) sees it natural for societies that have been living in stagnation and poverty for centuries to have a relatively high marginal propensity to import in such coincidence "massive external windfall".

[23] Source of data for all charts is IFS, IMF (2007).

Figure 2.2: M3/GDP Compare to other regions

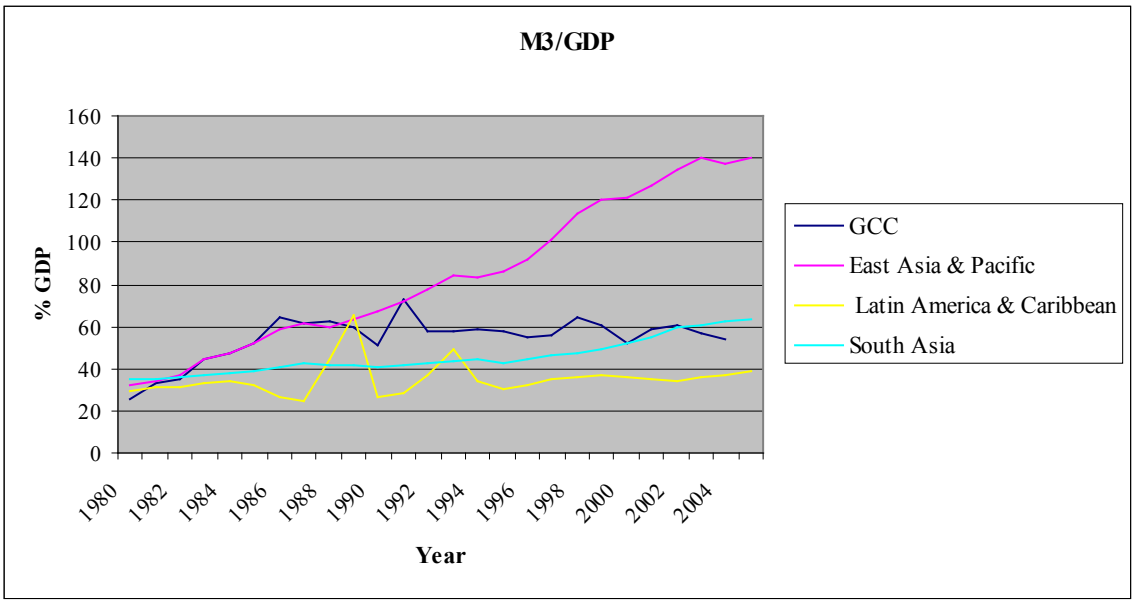


Figure 2.3: Currency in circulation as a share of M1

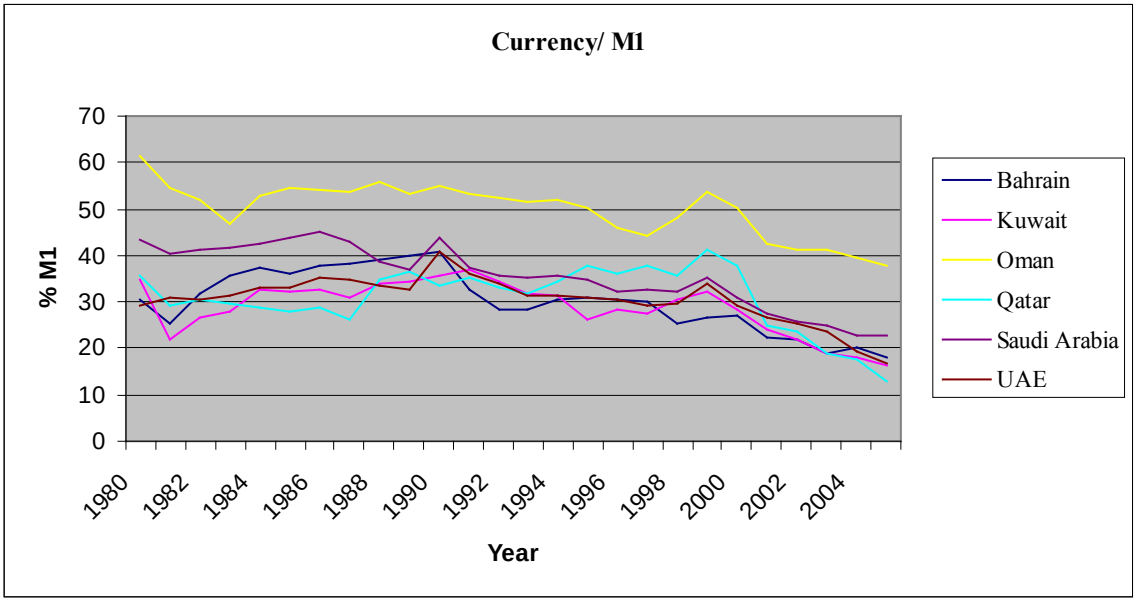


Figure 2.4: Credit to private sector as a share of GDP

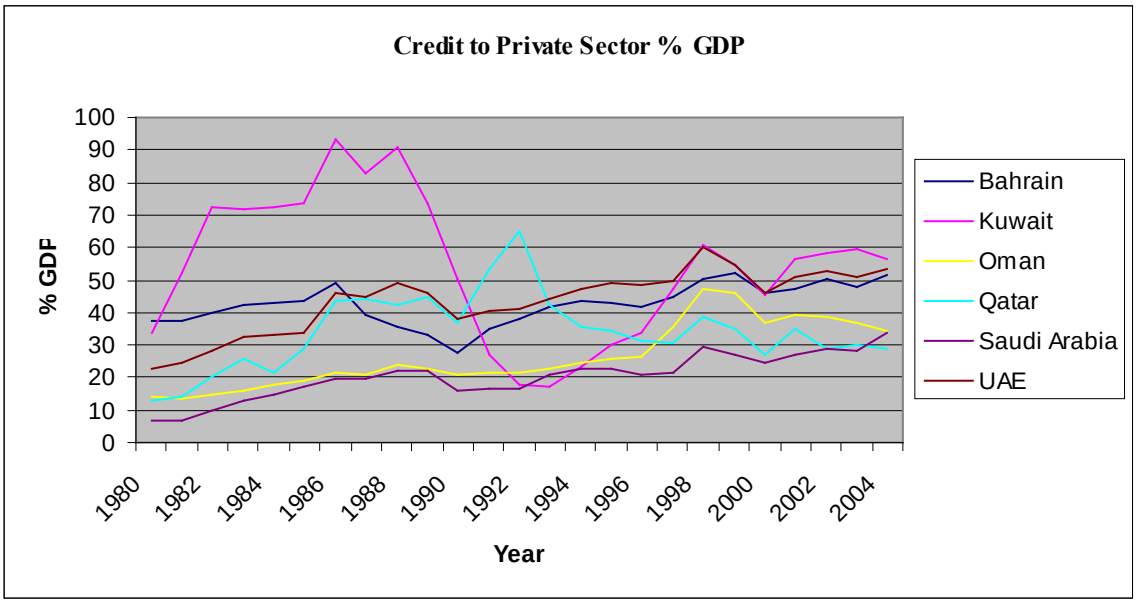
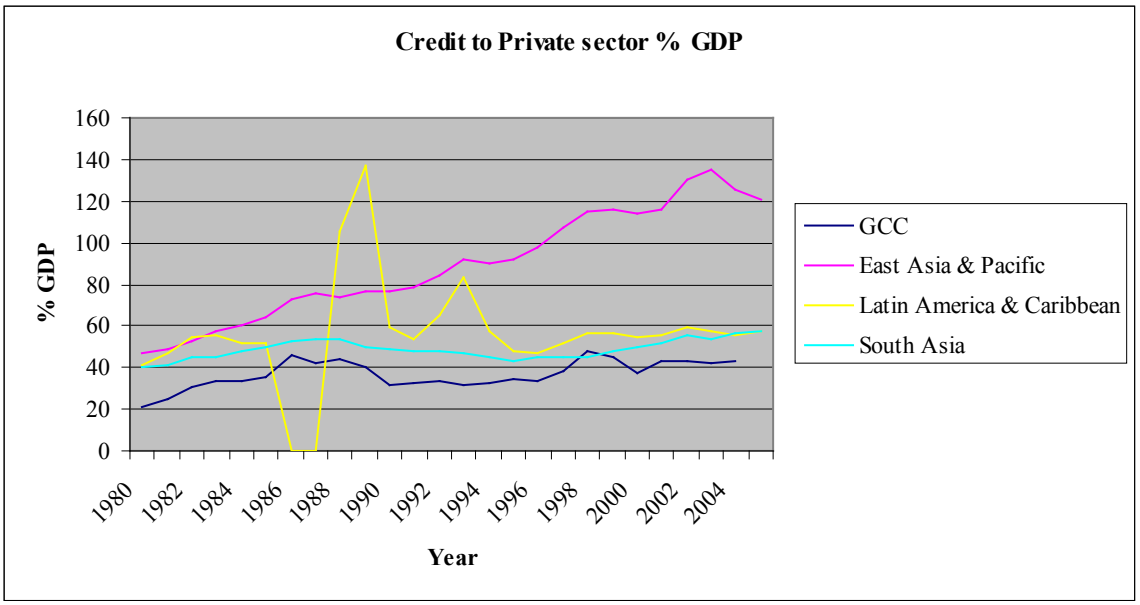


Figure 2.5: Credit to private sector/GDP compare to other regions



The problem of negligible engagement of commercial banks in financing the productive sectors is more general in fact, where the commercial banks deposits are dominated by s hort-term nature (Azzam, 1988b). With this nature of deposits, the commercial banks have been reluctant to finance the development of productive sectors, which usually require medium to long-term form of credit. Notwithstanding,

many banks in the region are not capable to assess the viability of industrial projects. Moreover, Devaux (2006) argues that in rentier economies such as those of GCC the general role of financial institutions is simply to handle the financial transactions for governments and the public enterprises.

Abdeen and Shook (1984), on the other hand, claim that the concept of interest has been a major obstacle to the financial development in the Middle East region as a whole, where interest is strictly prohibited in Islam.[24] According to Abdeen and Shook, this has hindered a full cooperation and integration of financial system in most countries in the region with the most developed financial system in the world, the Western, which based upon interest, to large extent. That in return has precluded the financial institutions in the region to fully benefits from the financial development experiences in the industrial countries. Devaux (2006) among other, nonetheless, argues that the introduction of some Islamic banking products since the late 1990s has undoubtedly played a major role in mobilizing more saving in the region.[25] Recently, there has been rapid development in Islamic finance where there are over 267 Islamic financial institutions, banks, and insurance and reinsurance companies operating in different countries mainly in the GCC countries. Moreover, the Islamic market approximates US$100bn growing at 17% per capita (Boustany, 2003). Such development may provide another viable way to increase monetization and probably facilitates the financial development process as a whole in the region.

The development of other components of financial systems such as the capital market has been rather slow in the whole region. It was just until recently the development of

[24] Not to mentioned, the GCC societies are quite traditional ones.
[25] Islamic Bank is rather young one, introduced in the 1980s in Pakistan, where they were allowed to operate at national level, followed by Iran and Sudan (Boustany, 2003).

capital markets has become an issue of concern in most of these countries. In fact, they are at different stages of development with Dubai and Abu Dhabi – UAE - stock markets established just in the beginning of this century, while Kuwaiti stock market, in contrast, is over 30 years old (Abdel-Hadi, 2005). Azzam (1988a), among others, points out number of causes for the slow development of capital markets in the region. The crash of Al-Manakh equity and real estate market in Kuwait in 1982, where over US$ 90bn reportedly wiped out, has caused a psychological damage in the other GCC countries and therefore has limited the development of capital markets in the region. Not to mentioned, as Azzam argues, since those countries have abundant of capital derived from natural resources exportation accompanied with limited domestic investment opportunities, there was not need to develop capital markets. The structure ownership of most firms in the region, where they are mostly either family owned or predominant by government ownership, has been another obstacle.[26] Those families have been reluctant to relinquish control of their firms by going public, and therefore continue to use traditional bank finance rather than open their firms' capital to new investors. Weak regulatory is another hurdle halted the development of capital markets in those countries. Jbili et al (1997) argue that there are a general weakness in transparency requirements and provision of information in most countries in the region.[27]

The countries of the region, however, have devoted considerable attention toward the development of their Capital markets in the last decade. Saudi Arabia, for example,

[26] Family firms' activities amount for over 90% of the whole commercial activities' in the region. There are over 5000 firms with collective assets over US$ 500bn; those firms employ around 70% of labour force too (Ithmar Capital, 2007).

[27] Boustany (2003) argues that flourishing capital market requires an independent and scientific measurement of risk and return, which an application of transparency concept. Yet, emerging markets have not devoted much attention due particularly to the role of transparency in uncovering corruption.

established the capital market authority in 2003 and opened its financial market lately to foreign investors. Financial markets in all other GCC countries are opened to foreign investors. UAE launched Dubai International Financial Centre (DIFC). Qatar too launched its own version of International Financial Centre. While Bahrain, on the other hand, is developing its financial market to become a regional financial centre. Oman is following suit.

Development of other components of capital market such as bonds market has been shallow and just recently developed in most countries. In addition, the trade of government bonds is limited to financial institutions. The shallowness/ lack of secondary market for government securities, therefore, has slowed the financial development and tied up the use of open market operations as an effective tool of the monetary policy in those countries.[28]

2.2.1 MONETARY POLICY IN THE REGION

In most developing countries, the role of monetary policy instruments is limited due mainly to the absence or the shallowness of capital market as well as to the lack of diversified productive base whose output could be enhanced by liquidity provision (Al-Hamar, 1988). Furthermore, a country with small-undiversified economy that relies heavily on the exports of one commodity, oil and natural gas in our case, and imports most of other goods is obviously more vulnerable to external disturbances.[29] In such case - as Al- Hamar argues - both fiscal and monetary policy have limited role

[28] For further details about capital markets in the region (see for example, Azzam 1988a; Jbili et al, 1997; and "MENA-OECD investment programme", 2005).

[29] Beblawi (2008) argues that GCC countries export oil and natural gas and nearly import everything else even labour.

in controlling monetary development and influencing other economics variables compared to countries with relatively independent economies.

Azzam (1988c), among other, argues that the fixed exchange rate to a major currency, therefore, has been the refuge for such countries to mitigate the external shocks – as exchange rate may have great effects on price levels and balance of payment stability (Al-Jasser and Banafe, 1999) – . In fact, the monetary policy in the GCC countries has been always geared to maintain a stabile exchange rate with US$ where all currencies in the region - with exception of Kuwait which pegged to basket of currencies - are pegged to US$. As results, the monetary authority in the region set their interest rates with accordance to that set by US Federal Reserve since all countries have free capital movements. Furthermore, in open economies where the government plays the dominant role in all economic activity accompanied with fixed exchange rate regime has other implications for the role of monetary policy in the region (Jbili et al, 1997). In such case the fiscal policy is the main determinant of money supply[30] and the demand pressure of fiscal deficit is tend to be absorbed through balance of payments. Thus, the primary role of monetary policy is left to regulate the short- term liquidity and to mitigating the impact of external disturbance while the burden of adjustment falls on fiscal policy.

Fixed exchange rate with respect to US$, as argued in the literature, has been a wise decision taken by the central banks and monetary agencies in the region, Since those countries rely heavily in the rents generated from oil exports which are priced in US$.

[30] Albatel (1993) argues that government expenditure in Saudi Arabia has been the main determinant of the change in monetary aggregate, due particularly to the nature of Saudi economy "rentier Economy". As thus, the monetary authority finds it difficult to apply monetary policy when needed. Al-Jasser and Banafe (1999) argue that the monetary policy in Saudi Arabia is often used to fine-tune the effect of fiscal policy.

Hence, these rates reflect neither the strength nor the weakness of those economies; exchange rates of those countries are no m ore than a conversion formula for petrodollar revenues through which the governments finance their domestic expenditures (Azzam, 1988c). [31]

Addition to guarding a stable exchange rates the monetary authorities in the region apply monetary policy instruments with growing tendency lately to the use of some forms of open market operations (Jbili et al, 1997). The monetary agency of Saudi Arabia, for instance, uses the repos operations in government bonds, while the central bank of UAE relies heavily on purchases of foreign exchange, Kuwait and Bahrain monetary authorities use purchase and sale of government bonds, repos of government securities, and some central bank-lending operations such as o verdraft window and overnight lending. As mentioned earlier, however, the effectiveness of open market operations in the region is limited due mainly to the lack of well-structured secondary markets for government securities in those countries.

Regulation and supervision of financial institutions is another task shouldered by the monetary authorities in the region. Jbili et al (1997) argue that regulations and monetary authorities supervision in these countries has strengthened the banks soundness in most countries in the region. Provision and capital adequacy requirements in those countries are generally stricter than those of Basle rules. Furthermore, monetary authorities in the region run an on-side inspection and offside

[31] A huge surplus in the balance of payments of those countries does not mean the exchange rates of those currencies will appreciate.

analysis of banks in addition to some prudential regulations such as foreign currency exposure limits, liquid asset ratios, limits on consumer lending, etc.[32]

[32] See Jbili et al (1997) for further details.

2.3 LTERAURE REVIEW

The role of financial development in economic growth has received a considerable attention among economists and policy makers worldwide. Schumpeter (1912) was one of the first economists who established the theoretical foundations of the relationship between development in the financial sector and economic growth. He relates banking system to economic development through its role in maintaining credit, which enhance entrepreneurship and productivity. He argued that the role of money market and capital market is acute for financing development, and in terms of causality, he believes that economic growth promotes financial sector. Sir John Hicks (1969, pp.143-145, as cited in Levine 1997) argues that the primary cause of industrial revolution in England in 18th century was the capital market development. According to Hicks industrial revolution required big commitments of capital for long period of time, but savers usually do not like to engage in such investments, because they do not want to relinquish control of their savings for long periods. Hence, the financial market improvements in England mitigate the liquidity risk, which makes it possible to transform the capital to long run and high-return investments.[33]

Broadly speaking, there are at least two opposite hypotheses in the literature regarding the causal relationship between financial development and economic growth (Darrat, 1999). There are those who argue that financial development is pre-condition for economic growth. According to this view (supply- leading hypothesis) more developed financial system promotes economic growth through mobilizing saving, allocating resources to better investment projects, exerting corporate control and

[33] "Industrial revolution, therefore, had to wait for financial revolution", (Starr etal.1966, p. 243, as cited in Levine 1997).

monitoring managers, facilitating the exchange of good a nd services, and allowing investors to diversify risk.[34] Presenting such views, among other, are McKinnon (1973), Shaw (1973), Goldsmith (1969), Levine (1993), Fry (1995), and Khan and Senhadji (2000, 2003). Shaw and McKinnon argue that liberating interest rates to reach their market-determined levels is necessary for financial development.[35] According to this view, liberated interest rates would increase saving in financial forms and the allocation of funds to the most efficient investors, which will enhance economic growth and development (Al-Jasser, 1986).

On the other hand, some economists reject such views arguing that financial development grows in respond to the economic growth process. According to this view (demand- following hypothesis), as an economy grows it creates demand for more financial services and financial system responds positively to this demand (Robinson 1952, as cited in Levine 1997). Patrick (1966) has lent support to this view by introducing the demand-following role of financial development. He argues that as the real side of the economy grows the demand by enterprises for funds will increase, and hence the demand for financial intermediaries services. Moreover, Cameron (1972) points out that banking system should not be impartial with respect to economic development since they exist as a result of demand for their services and such demand usually comes from growing economy.[36]

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[34] Levine (1997) provides an interesting and extensive discussion about these functions.

[35] McKinnon and Shaw school attributes the financial repression, in most developing world, to government restrictions on the banking system such as interest rate ceiling and high reserve requirements. Further details in liberalization; see for instance Fry (1995) and Gelb (1989).

[36] Khan and Senhadji (2003, pp 6-7) argue, among other, that "although demand-following hypothesis argument carries some weight, the findings from empirical work, however, cannot be disregarded on the basis of such premise. Since it would amount to assuming not only that growth affects financial development, which is realistic, but also that financial development has no effect on growth, which is certainly counterintuitive. Thus, the real issue in the empirical literature is not of spurious correlation but one of simultaneity bias".

The obvious role of financial intermediaries in the economic development has been widely tested through many empirical studies. Some of these studies are based on regression analysis for large cross-section countries, while there are some country-case studies. Their outcomes differ based on the types of measures they use to represent the level of financial development.

Most of cross-country studies reviewed here lend support to the supply-leading hypothesis.[37] According to Khan and Senhadji (2000), one of the most influential studies on this subject is King and Levine (1993). King and Levine's study covers cross-section of 80 countries during the period 1960-1989. They used four measures as proxies for the level of financial development. The first measure is liquid liabilities of banks and non-bank institutions as a share of GDP, which measures the size of financial intermediaries. The second is the ratio of bank credit to the sum of bank and central bank credit, which measures the degree to which banks versus central bank allocate credit. The third is the ratio of private credit to domestic credit. The fourth measure is the ratio of private credit to GDP. Their findings show a strong positive relationship between financial development and growth. They argue that financial development has predictive power for future growth, which is evident for casual relationship that runs from financial development to economic growth.

Johnston and Pararbasioglu (1995) use panel data for 40 countries to investigate the impact of financial development on growth. [38] Their results suggest that the interest cost of capital, the volume of intermediation, and the efficiency of intermediation can

[37] See Levine (1997), Khan and Senhadji (2000) for comprehensive survey about the studies that have investigated the causal relationship between economic growth and financial development.
[38]They use a combination of three variables to reflect the different aspect of financial development, they are interest rate, credit to private sector/GDP, and a measure of financial sector efficiency (gross spread between the average lending and deposit rates and the ratio of base money to deposits).

be separately identified as explaining economic growth. They also find that the impact of financial development on economic growth is very different in repressed and reformed financial systems, and in countries that have experienced financial crises. Pill and Pradhan (1995) examine the role of financial development in promoting economic development using four indicators of the level of financial development: broad money, base money, bank credit to the private sector, and real interest rates. They find that credit to private sector is the main factor that can be expected to influence financial development. Gelbard and Leite (1999), in their study of measuring financial development in sub-Saharan Africa, use cross-sectional data of 38 countries over the period 1987-97. They suggest that the initial level of financial development is an important predictor of future economic growth.[39] In addition, they find that financial liberalization, changes in the institutional environment, and changes in the array of financial products are the most important variables, which have stronger impact on growth.

Country-case studies have, to some extent, yield similar results. McKinnon (1973) studies the role of financial system in economic growth in the case of Argentina, Brazil, Chile, Germany, Indonesia, Korea, and Taiwan in the post-World War II period. He finds that well-developed financial system support faster growth. He uses the ratio of financial institutions assets to GDP as an indicator of financial development.

Albatel (1993) demonstrates the role of financial evolution in enhancing economic development in Saudi Arabia. Specifically, he explores the impact of financial sector

[39] Others too, have found evidences support this argument; see for example Levine (1993b), and Sen (2000).

on saving, investment, and income. He uses data covers the period 1965-1989. He applies different proxies for the financial development: nominal and real money balances, the ratio of total assets of the financial system to GDP, the number of bank branches per 100,000 of population, and credit to private sector. He concludes that financial development has a positive impact on saving, investment, and economic growth in Saudi Arabia. Alhmeed (1999) observes positive contributions of financial development (represented by the evolution in the financial markets) to economic growth in Saudi Arabia in both macro- and micro level. Using time-series for the period 1969-1997 and utilizing error correction model-based analysis, he finds highly significant positive relationship between the financial development variables used in the model (M1 and M2) and economic growth.

The empirical work on the issue causality, nevertheless, is still largely disputed in the literature. Does financial development causes economic growth or does it simply follow the economic development, is a point of disagreement among economists (Fry 1995). Some of the influential works on the issue of causality such as those by Jung (1986) and Demetriades and Hussein (1996) have generally shown that the pattern of causality differs among countries.

Jung (1986) tests for the causality between financial development and economic growth using data for 56 countries including developing and developed countries, the findings of his study was country specific. He found that causality runs from financial indicator to economic growth in less developed countries where the reverse causality occurs in developed countries.[40] Based on reasonably representative data set for 16 developing countries, as they argued, Demetriades and Hussein (1996) conduct

[40] Jung's work, however, has been criticized because of the short span of time series, where in some case as low as 15 observations.

a variety of causality tests between the two variables using both the Vector Auto regression (VAR) and Error Correction Model (ECM) frameworks.[41] Findings, however, favour neither supply -leading hypothesis nor demand-following hypothesis. It is rather bidirectional hypothesis - where both financial development and economic growth are mutually casual (bidirectional causality) – what seems to be the form of relationship hold between the two variables in most countries considered in the study.

Other studies by D arrat(1999), Al-Yosif (2002), Ghirmay (2004), and Abu-Qarn (2006) found evidences that support supply- leading hypothesis, demand- following hypothesis and bidirectional hypothesis, and those findings tend to vary with kind of indicators considered to measure financial development. In fact, Darrat (1999) argues that it is the direction of causality not the correlation between the two variables what researchers should focus on when it comes to study the relationship between financial development and the economic growth process.[42]Thus, proponents of time series approach-such as those mentioned above- argue that the causal relationship between the financial development and economic growth is more likely to be country specific and tend to vary with kind of proxies employ to measure financial development. They related that to the fact that countries differ in their level of financial development due to differences in economic policies and institutions implemented them. A final word about the issue of causality could be that stated by L evine (1997, p 710) "any

[41] They argue that their study overcomes the shortages of previous time-series studies, addressed the causality issue between the two Variables, by a) using a relatively long span of data, a minimum of 28 observations, b) considering Financial indicators that fit the theory requirements – such as claims on private sector-, and c) applying appropriate econometrics techniques to examine the integration properties of the data when the variables are non-stationary.

[42] According to Darrat (1999) serious doubts are casted on m ost works in the area, if the causal relationship between financial indicators and economic growth in a giving country appears to follow demand-following hypothesis, or bidirectional hypothesis.

statements about the causality are – and will remain – largely impressionistic and specific to particular countries and specific periods".

2.4 FINANCIAL DEVELOPMENT MEASUREMENTS AND DATA SOURCES

Finding credible measures that approximate financial development is intrinsically a point of disagreement among economists, since countries have different financial structures as well as different institutional environment (Jung, 1986). Wide variety of financial indicators have been proposed and employed in the literature to measure the development of financial system. In fact, Von Furstenber and Fratianni (1996), and Beck et al (1999), provide and discuss a comprehensive list of financial development indicators.

Following the common practice, the first proxy of financial development considered is the traditional measure of financial depth that is the ratio of liquid liabilities to GDP - M3/GDP-. This proxy, which measures the size of financial intermediaries, is one of the most common proxies used in literature. Numerous numbers of studies in the area have employed this proxy (see, for example, McKinnon, 1973; Shaw, 1973; Jung, 1986; Levine, 1993b; Fry, 1995). Fry (1995), among other, argues that this measure is an appropriate proxy of financial development in the majority of developing countries where direct financial claims such as stocks and bonds are unimportant compared with indirect claims such as demand and time deposits. Therefore, the real growth of financial aggregates, M2 and M3, reflect the extent to which financial intermediaries are able to supply more credit on relation to the level of economic activity. Ghirmay (2004), however, rejects the use of this measure arguing that it does not reflect some important functions of financial system such as sav ing mobilization and efficient

allocation of investment, where it is more likely to measure the extent to which transactions are monetized.[43]

An alternative measure of M3/GDP, albeit similar, is Bank assets as a share of GDP. According to IMF, banks assets can be calculated as follow: claims on monetary authorities, securities, foreign assets, claims on central government, claims on states and local governments, claims on nonfinancial public enterprises, claims on private sector, and claims on nonbank financial institutions. This indicator reflects, to large extent, the ability of commercial banks to provide credits to different sectors in the economy including government. Therefore, considering this measure may be crucial in such case where the public sector dominates overall economic activities in most GCC countries.

The third measure considered is credit to private sector as a share of GDP. Most studies reviewed here argue that this measure is an accurate proxy of the functioning of financial system. It reflects the role of financial institutions in channeling funds to private sector (Khan and Senhadji, 2003), as well as it measures the quantity and quality of investment (Ghirmay, 2004; Demetriades and Hussein, 1996, among others).[44]

The fourth measure considered here is the ratio of currency to the narrow money (M1). Jung (1986), and Al-Yousf (2002), among others, argue that this variable is an

[43] Demetriades and Hussein (1996) argues that excluding the currency in circulation from the broad money stock is crucial when using this variable as measure of financial development, since a large component of broad money stock in developing countries is currency outside banking system.
[44] Former Soviet Union has been a typical example for misallocation of capital; Soviet Union always have high rates of saving and investment (abundance of machinery and equipment), but relatively low growth simply because investment was not allocated to effective use (Wachtel, 2001).

adequate variable to capture the qualitative development in the financial system, where a decline in this ratio reflects the complexity of financial system and a great availability and use of non-currency transaction methods.

The economic development indicator considered, as following the common practice in the literature, is the real GDP per capita. It has been argued that, the figures of GDP per capita are prone to fewer errors than those of total GDP Figures. Heston (1994, p. 40, as cited in Demetriades and Hussein, 1996, p 396) argues, "This is because some of the errors which affect estimates of the level of GDP also affect population estimates and, as such, they tend to be offsetting". For the purpose of this study, both the level and the growth rate of real GDP per capita will be used interchangeably as economic development indicator. Considering both the level and the growth rate of real GDP per capita may provide further information to assess whether the state of financial development is correlated with the level or with the growth rate of GDP per capita or with both.[45]

The data for all variables considered in this study are obtained from the International Monetary Fund publication *international Financial Statistic (Database, 2007),* World Bank Publication *World Development Indicator (Database, 2007)*. The different sample periods are as follow: Bahrain (1975 – 2005), Kuwait (1973 – 2006), Oman (1976 – 2006), Qatar (1980 – 2006), Saudi Arabia (1964 – 2007), and United Arab Emirates (UAE) (1973 – 2004).

[45] Further implication is regarding the long – run relationship as we demonstrate in the empirical discussion.

2.5 EMPIRICAL METHODOLOGY

Testing for the direction of causality between the economic development and the state of financial development is carried out in different forms. The study employs three alternative causality tests to assess the form of relationship between the two variables. The first causality test is the well known Granger – causality test proposed by Granger (1969), the second one is Sims – causality test introduced by Sims (1972). The third one is a new version of Sims causality tests proposed by Geweke et al (1983) and it is quoted as G-M-D causality test.

Granger – causality tests are conducted in the form of the Vector Auto regression (VAR) framework. The VAR model developed to account for the possibility that both time series variables are random and jointly determined (Griffiths et al, 1993). Testing for Granger – causality is rather easy test in the context of VAR models. A time series Y is said to be Granger – caused by another time series X if the currant value of Y can be better predicted from the past values of both Y and X rather than from the past values of Y alone (Granger, 1969). The conventional Granger causality tests in the form of VAR model between the two variables are as follow:

$$G_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 G_{t-i} + \sum_{i=1}^{k} \alpha_2 FD_{t-i} + \mu_t \qquad (1)$$

$$FD_t = \beta_0 + \sum_{i=1}^{k} \beta_1 G_{t-i} + \sum_{i=1}^{k} \beta_2 FD_{t-i} + \nu_t \qquad (2)$$

Where G is economic development indicator, where both the level and the growth rate of GDP per capita are used interchangeably as economic development proxy. FD is the financial development indicator, which is either the ratio of M3 to nominal GDP, bank assets as a share of GDP, credit to private sector as share of GDP, or the ratio of

currency to narrow money (M1). And $\sum_{i=1}^{k}$ are polynomials of appropriate orders. Finally, μ and ν are mutually uncorrelated white noise series. It is said that FD Granger causes G if the coefficient $\alpha_{2,}$ in equation (1), is statistically significant, whilst the significance of β_1, in equation (2), refers to reverse direction of causality. In return, Granger Causality does not exist if both coefficients α_2 and β_1 are not significant and therefore bi- directional causality is the form of Granger causality when both coefficients α_2 and β_1 are statically significant.[46]

Nevertheless, results based on the estimates from equation (1) and (2) are valid only if the variables considered in the system are level stationary. The means and the variances of Non –stationary variables change over time, and therefore all computed statistics in which these means and variances are used, are time dependent and fail to converge to their true value as the sample increases (Roa, 1994). [47] The well-known Augmented Dickey – Fuller unit root test as well as Philips-Perron (PP) unit root test are carried out here to determine the order of integration for each variable in the sample. Taking the difference of non- stationary time series is the common practice in the literature to covert non - stationary time series to achieve stationarity. [48] Yet, a model of the first difference variables does not have long – run solution, since the

[46] A word about the concept of causality, "it is worth mentioned that Granger's concept of causality does not imply a cause – effect relationship, but rather is based only on "predictability" of the time series (Griffiths et al, 1993, p.696). Granger causality tests are essentially tests of the predictive content of economic time series. Therefore, it may be preferable to attach "Granger" to "cause" since a controversy still surrounds the Granger concept of causality which differs somewhat from the causality definition in the strict philosophical sense (Darrat, 1999, p. 23).

[47] "Spurious regression" is the term used to describe the estimates obtained by regressing two or more time series where at least one of them is non-stationary. In such case usual properties of least squares estimates do not hold, and therefore tests such as (t, F, DW, and R^2) are not reliable (Granger and Newbold, 1974).

[48] If a variable is found to be non-stationary in its level form, but stationary in its first differenced form, then the variable is integrated of order one or I(1) , and I(2) in case it is stationary in its second differenced.

economic theory suggests that economic variables take same values from period to another in long – run steady – state, thus $y_t = y_{t-1} = y_{t-2} = \ldots = y^*$ until the system is disturbed (Griffiths et al, 1993). Thus, in case the first difference model is considered the difference terms in the model will be zero and there is no long – run solution. The first difference model, therefore, may only provides short – run inferences rather than long – run.

An appropriate way to investigate the existence of stable long – run equilibrium with unit root variables is to consider cointegration technique. Two or more variables are said to be cointegrated if they possess the same order of integration (same I(p)), and the linear combination of them ε_t, ($\varepsilon_t = y_t - \alpha - \beta x_t$), is level stationary, integrated of order zero I(0). Engel and Granger (1987) argue that if two or more variables are cointegrated then, this may reveal inherited long run relationship among them. A stationary linear combination, error term, represents how far the variables in a regression were away from equilibrium and therefore it could be regarded as equilibrium error. To detect the presence of cointergration between the two variables considered, the study conducts the Johansen (1988) Maximum Likelihood approach which relied on Engel and Granger (1987) representation theorem. Engel and Granger (1987) representation theorem states that if a set of variables are cointegrated then this equilibrium long – run relationship among the variables can be modelled in the form of Error Correction Model (ECM). In other word, the previous VAR model can be re-parameterise in the form of ECM, which allows testing for long – run in addition to short – run Granger Causality among the unit root variables.

The Error Correction Model (ECM) conventional framework is as follow:

$$\Delta G_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 \Delta G_{t-i} + \sum_{i=1}^{k} \alpha_2 \Delta FD_{t-i} + \Phi_1 EC_{t-1} + \mu_t \qquad (3)$$

$$\Delta FD_t = \beta_0 + \sum_{i=1}^{k} \beta_1 \Delta G_{t-i} + \sum_{i=1}^{k} \beta_2 \Delta FD_{t-i} + \Phi_2 EC_{t-1} + \nu_t \qquad (4)$$

Equations (1) and (2) are in the first difference form Δ augmented with error term (EC) to form the framework of Error Correction Model (ECM) as in Equation (3) and (4). The EC terms which is stationary series I(0) refer to the lag residuals obtain from the underlying cointegration regression of the two variables. As thus, the significance of Φ_1 and/or Φ_2 in equations (3) and (4) indicates long- run Granger causality between the two variables, whilst the significance of α_2 and/or β_1 refers to short run Granger causality.

An alternative causality test employed to assess the direction of causality between the two variables is that proposed by Sims (1972). Sims makes use of future values of the variables as an indicator of the direction of causality. The test based on the assumption that, only if causality runs from one variable, say, X to another variable Y, the coefficients of future values of X in the regression of Y on X should be insignificantly different from zero. He suggests one – sided distributed lagged model of Y on X and vice versa where future values of independent variable are included. Sims causality test between the economic development and the state of financial development will take the following form:

$$G_t = \alpha_0 + \sum_{i=0}^{k} \alpha_1 FD_{t-i} + \sum_{i=1}^{k} \alpha_2 FD_{t+i} + \mu_t \qquad (5)$$

$$FD_t = \beta_0 + \sum_{i=0}^{k} \beta_1 G_{t-i} + \sum_{i=1}^{k} \beta_2 G_{t+i} + \nu_t \qquad (6)$$

The direction of causality in this test depends upon the significance of the coefficients of future values α_2 and β_2 in both equations (1) and (2). If both coefficients α_2 and β_2 are insignificantly different from Zero then the variables are independent, while the significance of both coefficients, α_2 and β_2, refers to bidirectional causality. In case that α_2 is significant, but β_2 is not, then causation runs from G to FD, and reveres direction of causality from FD to G, in case β_2 is significant whilst α_2 is not.[49]

To achieve stationarity and to mitigate the problem of autocorrelation in the estimated models Sims suggests the variables to be measured as natural logs and to be "whitened" or prefiltered using the filter {FiltX(t) = X(t)– 1.5X(t-1) + 0.5625X(t-2).[50] Moreover, Sims emphasizes the importance of the Size of those coefficients in the interpretation of his test. He argues that it is a common practice in the empirical literature to ignore insignificant coefficients even if they are large from economic point of view and that should not happen, large coefficients should be considered no matter how insignificant they are. To what extent a coefficient can be considered large enough in the notion of Sims tests, Sims suggests comparing the size of the coefficients of future values with those of current and past values. If they are comparable or larger than those of current and past values, then the coefficients of future values may be considered regardless of their significances. Small coefficients

[49] Rowley and Jain (1986), however, stress that those tests of Sims should not be considered as indication of exogeneity of the independent variable in the previous equations. Sims test is not more than extension of existing practice where the theatrical one-sided distributed lagged model is augmented with future values, and that cannot resolve the issue of exogeneity. Sims work may just have been exaggerated by monetarists view.

[50] Sims argues that prefiltered "whitened" time series will help in reach white noise residuals of the regression, by flattening the spectral density of economic time series. In fact, prefiltered time series will be stationary even if the original series is not. Sims among others argues against differencing time series to reach stationarity since differencing as they claim will through information away from the series and gives no inferences about the long – run relationship.

of future values relative to those of current and past values may, also, be ignored sometimes even if they are statistically significant.

Geweke et al., (1983), nonetheless, construct several tests of causality in both forms "Granger causality tests" and "Sims causality tests" in a series of Monte Carlo experiments, where the properties of these tests investigated and compared. The results of their experiments indicate that the problem of serially correlated residuals is a common feature in most of those tests. They point out, however, that the performance of causality tests that includes lagged dependent variable in both forms of causality tests "granger causality test" and "Sims causality test" is "excellent" in comparison to other forms. Thus, a new version of Sims causality tests was introduced in their work by using two-sided distributed lagged model. In other word, each equation of the previous equations (5) and (6) is augmented with lags of the dependent variable as follow:

$$Y_t = \alpha_0 + \sum_{i=1}^{k} \alpha_1 Y_{t-i} + \sum_{i=0}^{k} \alpha_2 X_{t-i} + \sum_{i=1}^{k} \alpha_3 X_{t+i} + \mu_t \qquad (7)$$

$$X_t = \beta_0 + \sum_{i=1}^{k} \beta_1 X_{t-i} + \sum_{i=0}^{k} \beta_2 Y_{t-i} + \sum_{i=1}^{k} \beta_3 Y_{t+i} + \nu_t \qquad (8)$$

The direction of causality in this test, as that of Sims, depends on significance of the coefficients of future values $\alpha 3$ and β_3 in equations (7) and (8) with the same interpretation of those of Sims, as mentioned above.[51] The latter causality tests are usually quoted as G-M-D causality tests in the literature, which refers to the names of the authors, introduced this version of Sims – causality tests.

[51] Lags of the right hand side variables in the previous equations (1), (2), (3), (4), (5), (6), (7), and (8) will be dictated due to the limited number of observations for most countries in our sample.

2.6 EMPIRICAL INVESTIGATION

The empirical analysis of this study is built upon six economic variables to investigate the causal relationship between the economic development and the state of financial development in each country in the sample. Both the level of real GDP per capita and its growth rate are used interchangeably as economic development indicator. Considering both the level and the growth rate of real GDP per capita may provide further information to assess whether the state of financial development is correlated with the level or with the growth rate of GDP per capita or with both. Moreover, the growth rate of GDP per capita is more likely to be level stationary I (0), since it is the growth rate of the first differences of the GDP per capita, and that may preclude the study from applying the cointegration tests to investigate the existence of stationary long – run relationship between the two variables. On the other hand, the study considers four alternative measures to reflect the state of financial development. They are money supply M3 as a share of GDP (M3), banks assets as a share of GDP (BS), credit to private sector as a share of GDP (CPS), and currency in circulation as a share of narrow money M1 (C).

2.6.1 UNIT ROOT TEST

Unite root test, as mentioned earlier, is a prerequisite step before proceeding in such analysis. Two alternative unit root tests, the Augmented Ducky-Fuller (ADF) test and Philips-Perron (PP) test, are considered here to assess the degree of integration (stationarity) of each variable considered. The null hypothesis in each test is that the concerned variable has a unit root and the alternative hypothesis is that the variable is

stationary. The results of both tests for the level and the first difference of each variable for all countries are reported in Table 2.2.[52] The various ADF and PP statistics show that the null hypothesis of a unit root in the level of GDP per capita (LG) cannot be rejected at 5% level for all GCC countries. Meanwhile, the null hypothesis of unit root in its first difference is rejected for all countries at 5% level or better. On the other hand, the growth rate of GDP per capita variable (G) is level stationary I (0), where the null hypothesis of unit root in G was strongly rejected at 5% level or better for all countries. For financial development indicators considered the statistics of both unit root tests, ADF and PP, suggest that most of the financial indicators are first difference stationary I (1) in most countries with few exceptions.

In case of Bahrain, only the ratio of M3 to GDP variable (M3) is level stationary I (0) with constant and trend at 5% level of significance. The null hypothesis of unit root in the other three variables – BS, CPS, and C -, cannot be rejected for any variable at 5% level. On the other hand, the null was strongly rejected at 1% level for the first difference of all three variables (BS, CPS and C) indicating that the variables are first difference stationary I (1). For Kuwait, the first two financial indicators considered M3 and BS are level stationary I(0) where the null hypothesis of unit root in each variable was rejected at 1% level by both unit root tests. For The other two financial indicators, CPS and C, the statistics of both unit root tests, ADF and PP, seem to disagree in the order of integration of each variable, even though both tests cannot reject the null of unit root in the level of both variables. The ADF test suggests that both variables are second difference stationary I (2), the null hypothesis of unit root in each variable cannot be rejected neither in its level form nor in its first difference

[52] Only the level of GDP per capita was in the natural logarithm form since all other variables (financial indicators) are in ratios form.

form, whilst it is rejected for the second differences of both variables at 1% level. Philips-Perron PP t est, on the other hand, suggest that both variable are first difference stationary I (1), where the null hypothesis of unit root in the first difference of both variable was strongly rejected at 1% level. The latter two variables, CPS and C, are excluded from empirical analysis since the possibility that both variables are second difference stationary I (2) cannot be ruled out.[53]

In case of Oman, only one financial indicator - the ratio of currency to M1 (C) - the null hypothesis of unit root was reject at 1% level by both unit root tests.[54] The other three financial indicators - M3, BS, and CPS– are first difference stationary I (1). The null hypothesis of unit root in the first difference of the three variables was strongly rejected at 1% level according to both unit root tests ADF and PP. For the remaining three countries Qatar, Saudi Arabia, and UAE the null hypothesis of unit root cannot be rejected at 5% level by a ny one of the unit root tests for the level form of all financial indicators considered. On the other hand, the statistics of the unit root tests, ADF and PP, support the rejection of the null hypothesis at 1% level in the first difference form of all four financial indicators in the three countries.

Based on the results of the unit root tests the cointegration investigation can be carried out between the level of GDP per capita LG and each unit root I (1) variables of financial development indicators in five out of the six GCC countries. Cointegration

[53] We considered a third unit root test, Kwiatkowski-Phillips-Schmidt-Shin test (KPSS), to determine the order of integration of these two variables. However, the result of the test, in contrast to the finding of ADF and PP, suggest the variable is I (0). On the other hand, Perron (1997) unit root test with structural break, Second Gulf War (1990), in the three alternative forms of the test suggests the two variables (CPS and C) are not level stationary I (0).

[54] The variable is level stationary I (0) according to both tests with constant and trend. The coefficient of the trend in the regression comes with negative sign, as expected, implying the ratio of currency in circulation to M1 declines with time reflecting a g radual increase of non-currency transactions and, perhaps, the role of financial institutions in the economic development, see Figure 2.3.

tests cannot be conducted for Kuwait since both financial indicators, M3 and BS, and the level of GDP per capita LG have different order of integration.

T able 2.2: Unit Root Tests:

H0: the variable has a unit root

Country	Variable	Order of integration	ADF	k	P-P	L
Bahrain	LG	I (0)	1.007	0	0.942	2
	G	I (0)	-4.066**	0	-4.097**	5
	M3	I (0)	-3.898*	0	-3.937*	2
	BS	I (0)	-1.678	0	-1.687	2
	CPS	I (0)	-1.595	0	-1.663	1
	C	I (0)	-0.669	0	-0.700	2
	ΔLG	I (1)	-4.082**	0	-4.105**	3
	ΔG	I (1)	-7.859**	1	-10.267**	5
	ΔM3	I (1)	-8.770**	0	-8.770**	0
	ΔBS	I (1)	-5.126**	0	-5.127**	1
	ΔCPS	I (1)	-5.761**	0	-5.767**	0
	ΔC	I (1)	-5.570**	0	-5.567**	1
Kuwait	LG	I (0)	-1.980	0	-1.980	0
	G	I (0)	-5.860**	0	-5.907**	5
	M3	I (0)	-5.095**	0	-4.621**	3
	BS	I (0)	-4.892**	0	-4.393**	3
	CPS	I (0)	-1.424	0	-1.403	5
	C	I (0)	-2.023	0	-2.023	0
	ΔLG	I (1)	-6.094**	0	-6.240**	4
	ΔG	I (1)	-6.828**	1	-17.038**	31
	ΔM3	I (1)	-8.322**	0	-8.322**	0
	ΔBS	I (1)	-7.400**	0	-8.031**	4
	ΔCPS	I (1)	-1.451	4	-5.209**	11
	ΔC	I (1)	-0.938	6	-6.084**	4
Oman	LG	I (0)	-0.266	0	-0.276	6
	G	I (0)	-4.466**	0	-4.363**	11
	M3	I (0)	-1.538	0	-1.399	11
	BS	I (0)	-1.026	0	-0.987	6
	CPS	I (0)	-1.333	0	-1.422	2
	C	I (0)	-4.736**	1	-4.656**	19
	ΔLG	I (1)	-4.485**	0	-4.424**	7
	ΔG	I (1)	-6.465**	3	-11.498**	13
	ΔM3	I (1)	5.641**	1	6.318**	22
	ΔBS	I (1)	-4.270**	0	-4.467**	16
	ΔCPS	I (1)	-4.783**	1	-3.834**	7
	ΔC	I (1)	-4.561**	1	-4.395**	23

Table 2.2 continues: Unit Root Tests

H0: the variable has a unit root

Country	Variable	Order of integration	ADF	k	P-P	L
Qatar	LG	I (0)	-1.698	0	-1.887	2
	G	I (0)	-3.158*	2	-3.054*	2
	M3	I (0)	-2.622	0	-2.622	0
	BS	I (0)	-2.585	0	-2.731	4
	CPS	I (0)	-2.682	0	-2.621	4
	C	I (0)	-0.454	0	-0.516	1
	ΔLG	I (1)	-3.438*	0	-3.380*	3
	ΔGR	I (1)	-5.057**	3	-16.455**	9
	ΔM3	I (1)	-4.246**	0	-4.246**	0
	ΔBS	I (1)	-4.308**	0	-4.265**	0
	ΔCPS	I (1)	-4.715**	1	-5.108**	9
	ΔC	I (1)	-4.663**	0	-4.663**	0
Saudi Arabia	LG	I (0)	-2.274	0	-2.270	1
	G	I (0)	-6.399**	0	-6.401**	2
	M3	I (0)	-0.173	0	-0.257	2
	BS	I (0)	-0.222	0	-0.314	2
	CPS	I (0)	1.094	0	1.419	2
	C	I (0)	-0.341	0	-0.311	1
	ΔLG	I (1)	-5.943**	0	-5.950**	2
	ΔG	I (1)	-5.88**	4	-28.166**	19
	ΔM3	I (1)	-5.150**	0	-5.018**	4
	ΔBS	I (1)	-4.777**	0	-4.570**	5
	ΔCPS	I (1)	-5.393**	1	-5.727**	1
	ΔC	I (1)	-6.700**	0	-6.700**	0
UAE	LG	I (0)	-1.027	0	-1.028	2
	G	I (0)	-4.648**	0	-4.583**	0
	M3	I (0)	-1.434	0	-1.466	3
	BS	I (0)	-1.789	0	-1.792	1
	CPS	I (0)	-1.556	0	-1.644	8
	C	I (0)	-1.039	0	-0.990	2
	ΔLG	I (1)	-7.155**	0	-6.912**	1
	ΔG	I (1)	-6.567**	1	-9.467**	1
	ΔM3	I (1)	-5.870**	0	-5.856**	3
	ΔBS	I (1)	-5.411**	0	-5.411**	2
	ΔCPS	I (1)	-5.546**	0	-5.836**	5
	ΔC	I (1)	-5.575**	0	-5.581**	4

Note: k is the degree of augmentation in ADF tests determined automatically based on (SIC). L is the bandwidth determined automatically based on (Newly-West Bandwidth).
One asterisk * indicates the significance at 5%, whilst two asterisks ** indicate the significance at 1% level.

2.6.2 COINTEGRATION TEST

The cointegration analysis, as mentioned earlier, is associated with the existence of long – run relationship among the concerned variables. The Johansen maximum likelihood method is carried out here to detect the presence of cointegration between LG and each of the unit root financial indicators. The maximum likelihood method of Johansen consists of two alternative likelihood ratio tests, the Trace statistic test and Maximum eigenvalue test. The results of these tests are based on the maximum likelihood estimates of VARs of order 1 and 2, using model 3 (no trend in the cointegration relationship) and model 4 (with trend in the cointegration relationship) of Johansen (1995), to assess the sensitivity of cointegration tests outcome to lag length in VAR and to the inclusion of a trend in the relationship as Demetriades and Hussein (1996) suggested.[55] The null hypothesis in each test is that there is no cointegration vector "r = 0 " between the two variables, against the alternative hypothesis of the existence of one cointegration vector, "r = 1".[56] The statistics of the tests, Maximum eigenvalue test and Trace statistic test are reported in Table 2.3.

The reported results show that the Johansen cointegration tests detect few cases of possible long – run relationship between the level of economic development LG and the alternative "unit root" measures of financial development considered in the study. The cointegration tests of both models, model 3 and model 4 of Johansen (1995), reveal similar results for most countries in the sample. Only in two cases the cointegration was detected with the inclusion of trend; one is between LG and CPS in case of Bahrain and one is between LG and C in case of Qatar. However, only in 7

[55] It is to be mentioned, that we test for the optimal lag length in VAR in the cointegration tests and it is suggested to be 2 and 3 in most cases, according to Akaike Information Criteria (AIC).
[56] Since there are just two variables in the system the maximum cointegration vector in this case is one.

cases out of the 18 considered the cointegration relationship between the two variables is detected by the tests. Generally, the tests seem to be less sensitive to the lag length of the VAR except in four cases. The cointegration relation was detected only with higher lags, lag 2, in three cases, between LG and BS in case of Bahrain, LG and M3 in cases of Qatar, and between LG and CPS in case of Saudi Arabia. In contrast, the cointegration relationship in the fourth case is suggested with lag 1, but not with lag 2, between LG and CPS in case of UAE.[57]

Table 2.3: Johansen cointegration tests

Country	Variables in cointegration vector	Null hypothesis: r = 0 ; alternative hypothesis: r = 1			
		Maximal eigenvalue statistic		Trace statistic	
		k = 1	k = 2	k = 1	k = 2
Bahrain	LY, BS	8.694	16.319*	10.933	17.993*
	LY, CPS	26.484*	27.258*	31.209*	32.336*
	LY, C	13.954	9.40	21.082	15.970
Oman	LY, M3	6.863	3.876	7.106	4.845
	LY, BS	7.775	6.834	7.802	7.014
	LY, CPS	7.6749	4.833	7.876	5.173
Qatar	LY, M3	15.411	26.588*	24.038	41.649*
	LY, BS	14.604	17.018	24.734	27.162*
	LY, CPS	15.289	19.487	21.544	23.929
	LY, C	21.362*	25.841*	29.582*	35.325*
Saudi Arabia	LY, M3	7.206	8.525	9.569	10.526
	LY, BS	6.698	7.921	8.706	10.042
	LY, CPS	8.994	15.685*	9.488	17.199*
	LY, C	8.024	8.007	8.595	8.241
UAE	LY, M3	9.395	6.105	11.793	10.049
	LY, BS	8.775	8.166	12.150	10.987
	LY, CPS	17.667*	11.853	19.456*	13.945
	LY, C	9.982	9.584	11.153	10.846

Note: r is the number of cointegration vector, K is number of lags in the cointegration tests.
One asterisk * indicates the significance at 5%,

[57] Some studies such as Ghirmay(2004), and Darrat (1999), among others, report results for relatively higher lags, up to 4 lags in the cointegration tests, despite the limited number of observations. Yet, even though we relax the lags up to 3 (and to 4 in case of Saudi Arabia) no cointegration relationship was detected except for lag 3 in the cointegration test between LG and CPS for UAE. However, lag 2 in the latter cointegration test (LG and CPS for UAE) is significant at 10% level.

The results of both cointegration tests in case of Bahrain reject the null hypothesis of zero cointegration vector between the level of GDP per capita LG and two financial development indicators, BS, and CPS at 5% level. On the other hand, the null hypothesis of zero cointegration vectors between the level of economic development LG and the ratio of currency to narrow money (C) cannot be rejected by either test.

For Oman, however, the Johansen tests, Trace statistic test and Maximum eigenvalue test, fail to reject the null hypothesis between the real GDP per capita LG and any one of the three unit root financial indicators, M3, BS, and CPS. This finding, nonetheless, needs to be interpreted with some caution and may not be considered as a sign of the lack of stable long – run relationship between the economic development process and the level of financial development in the Omani economy. It may be rather due to the limited number of observations, 31 observations in case of Oman, considering that the Johansen cointegration technique requires long series for better performance. Moreover, others such as D emetriades and Hussein (1996), Al-Yousf (2002) and Boulila and Trabelsi (2004) related such finding to a possible non – linear relationship between the two variables rather than a linear relationship. Or perhaps to the failure of the financial development proxies considered to reflect extensively the financial activities in Omani economy. Interestingly, Oman has the highest ratio of currency in circulation to narrow money (C) – Figure 2.3 – in our sample, which may indicate that, a considerable number of financial transactions occur outside the banking sector.[58]

[58] Moreover, for the other three financial indicators considered, Oman has the lowest ratios in two indicators in the sample; BS (Table 2.1) and M3 (Figure 2.1).

For Qatar, on the other hand, three cointegration relationships are detected between the level of GDP per capita and three out of the four financial indicators M3, BS, and C. The null hypothesis of no cointegration was rejected by both tests in all cases at 5% level. For Saudi Arabia and UAE the credit to private sector as a share of GDP (CPS) is the only financial development indicator suggested to have a long – run relationship with real GDP per capita LG, according to both cointegration tests. The null hypothesis of zero cointegration vectors between LG and CPS is rejected by cointegration tests at 5% level for the two countries. The null hypothesis, however, cannot be rejected by those tests between the real GDP per capita LG and each one of the remaining unit root financial indicators considered – M3, BS, and C – in both countries. In sum, there is at least one financial indicator has a stationary long – run relationship with level of real GDP per capita LG in four countries out of the five countries considered in the cointegration analysis.

The existence of stationary long – run relationship between the two variables, the real GDP per capita LG and the level of financial development, provide evidence to support the underlying theoretical argument of causal long – run relationship between the two variables. This long – run relationship between the two variables can be modelled according to Granger representation theorem, as mentioned earlier. The Granger causality tests therefore can be expressed in a dynamic Error Correction Model (ECM), if the level of real GDP per capita LG and the concerned financial indicator are cointegrated. For most case where no long – run relationship is detected between the alternative financial proxies and the real GDP per capita LG, the Granger – causality tests are conducted in the form of first difference model, where both variables are taken in their first difference form. The first difference model, as

mentioned earlier, may only provide inferences about a possible form of short – run Granger – causality between the two variables. However, Sims causality tests may provide an alternative way to determine the form of long – run causality between the two variables. Variables involved in Sims causality tests are prefiltered or whitened rather than differenced to achieve stationarty. Therefore, the inferences of Sims causality tests may refer to the long – run Sims – causality between the concerned variables.

2.6.3 CAUSALITY TESTS

Following the preceding discussion the study conducts three causality tests, Granger – causality test, Sims – causality test, and G-M-D causality test, to determine whether the economic development process – measured interchangeably by the level of real GDP per capita and its growth rate – and the state of financial development are related. The Granger – causality tests are based on the estimates of first-difference VARs in case the concerned variables have different order of integration or if they are not cointegrated. If, however, the two variables are level stationary I (0) the results of the tests are based on the estimates of level VARs. Finally, in case the two variables are cointegrated the Granger – causality tests are based on the form of ECM.[59] The null hypothesis of Granger – causality tests is always of no causality between the concerned variables. The tests are based on F-tests and t-tests of the relevant coefficients in each equation. Sims – causality tests and G-M-D causality tests, on the other hand, are based on the estimates of single equations of the two variables. For Sims tests, the variables are transformed, pre-filtered, using Sims filter {FiltX(t) =

[59] To conserve the degrees of freedom the lag length in the ECM are based on the shortest lag for which the cointegration is reported. However, different lag, lag 2, do to not alter the finding.

X(t)– 1.5X(t-1) + 0.5625X(t-2) to ensure both variables are level stationary I(0). For G-M-D causality test, we followed the unit root tests results to apply the test. In other words, the test is carried out using the level form of the two variables if both variables are level stationary I (0). Alternatively, the test is conducted using the first differences of the time series of both variables in case one of them or both variables are first difference stationary I(1). The null hypothesis in both tests (Sims – causality tests and G-M-D causality tests) is that the coefficients of future values are insignificantly different from zero (no causation between the two variables). Same as Granger tests both tests based on F-tests and t-tests of the relevant parameters in each equation.[60]

The Granger – causality tests between the level of real GDP per capita LG and each of the alternative measures of financial development (FD) are report in Table 2.4. The results of the alternative causality tests (Sims – causality tests and G-M-D causality tests) between the two variables are presented in Table 2.5 for all countries in the sample. Results of these tests for Kingdom of Bahrain are based on a sample of data from 1975 to 2005. The Granger – causality tests detect two possible forms of causation between LG and three financial indicators, BS, CPS, and C. The null hypothesis of no causality running from BS to LG is rejected at %5 level for long – run (error term in the ECM), but not for short – run (dynamic lagged terms of BS in the ECM). Therefore, there seems to be evidence to suggest that financial system development leads the level of real output in long- run in Bahraini economy. However, the results for the other two indicators CPS and C suggest that the causation is the other way around; LG does impart the demand for credit CPS in the long- run,

[60] For all tests considered, F-tests statistics are reported if the independent variables have dynamic terms (lagged \ forwarded more than once) in the relevant equation, and t-tests statistics considered if the independent variable is lagged\forwarded once.

Whilst LG appears to alter the demand for financial services C in the short-run. [61] In both cases the null hypothesis of no causality was rejected at 5% level of significance.

Table 2.4: Granger –causality tests between LG and financial indicators based on VARs and ECMs

Country	Model	*Null hypothesis*	*K*	*F-Statistics for short-run*	*Coeff*	*t-Statistics for Long-run*	*Coeff*
Bahrain		*M3 Does not cause LG*	1	-0.0406	-0.0062		
	VAR	*LG Does not cause M3*	1	-1.29927	-0.3262		
		BS Does not cause LG	2	1.231	0.212	**2.2170***	**0.1807**
	ECM	*LG Does not cause BS*	2	-1.309	-0.6312	-0.1164	-0.0159
		CPS Does not cause LG	1	-	-	0.3607	0.0248
	ECM	*LG Does not cause CPS*	1	-	-	**2.9375***	**0.1004**
		C Does not cause LG	1	-0.1982	-0.0887		
	VAR	*LG Does not cause C*	1	**-2.1666***	**-0.1704**		
Kuwait		*M3 Does not cause LG*	1	-0.8130	-0.2424		
	VAR	*LG Does not cause M3*	1	0.1621	0.0232		
		BS Does not cause LG	1	0.9318	-0.1825		
	VAR	*LG Does not cause BS*	1	0.4532	0.1041		
Oman		*M3 Does not cause LG*	1	-1.6098	-1.7342		
	VAR	*LG Does not cause M3*	1	**2.5010***	**0.1256**		
		BS Does not cause LG	1	-0.7838	-0.4853		
	VAR	*LG Does not cause BS*	1	1.9589	0.1752		
		CPS Does not cause LG	1	-0.9685	-0.7541		
	VAR	*LG Does not cause CPS*	1	1.5377	0.1231		
		C Does not cause LG	1	1.5534	1.0030		
	VAR	*LG Does not cause C*	1	-1.7976	-0.1030		

Note: diagnostic tests of the residuals of VARs and ECMs where causality is reported indicate the absence of autocorrelation and Heterosckedasticity, as well as normally distributed residuals; except for ECM of LG and CPS in case of Saudi Arabia where the residuals are not normally distributed. For the remaining VARs in Table 2.4 where no causality is detected, some of these problems were reported in few cases.

k is the number of lags in VAR and ECM.

One asterisk * indicates the significance at 5%, whilst two asterisks ** indicate the significance at 1% level.

Moreover, Sims – causality tests support the finding of supply - leading hypothesis in Bahrain, albeit with different financial indicator (CPS). The test rejects the null hypothesis of no causality run from CPS to LG at 5%. In contrast, G-M-D causality tests confirmed the demand following hypothesis of short – run causality, suggested by Granger-causality test, between the level of output LG and the financial

[61] Note that there is no coefficient for the dynamic short-run between LG and CPS, since the lag is already included in the cointegration vector in the ECM estimates.

development C (reverse causality). The null hypothesis of no causality from LG to C is rejected at 5% level as in Table 2.5. However, the cointegration tests showed that these two variables (LG and C) are not cointegrated, and therefore such finding may need to be viewed with considerable scepticism, Since the two variables seems to be wandering apart from each other and do not show a sign of cointegration. The three causality tests fail to report any further form of causality between LG and the alternative financial indicators considered for Bahrain.

Table 2.4 continues: Granger –causality tests between LG and financial indicators based on VARs and ECMs

Country	Model	*Null hypothesis*	*K*	*F-Statistics for short-run*	*Coeff*	*t-Statistics for Long-run*	*Coeff*
Qatar		*M3 Does not cause LG*	2	0.5178	0.4292	1.4394	0.2937
	ECM	*LG Does not cause M3*	2	0.1684	0.0264	**-2.9309***	**-0.262**
		BS Does not cause LG	2	-0.8842	-0.3229	**3.8034***	**0.1916**
	ECM	*LG Does not cause BS*	2	**2.7603***	**0.8282**	**-3.767***	**-0.174**
		CPS Does not cause LG	1	0.1891	0.073		
	VAR	*LG Does not cause CPS*	1	0.1668	0.0205		
		C Does not cause LG	1	-	-	**-5.937****	**-0.1215**
	ECM	*LG Does not cause C*	1	-	-	0.9907	0.0077
Saudi Arabia		*M3 Does not cause LG*	1	-1.1482	-1.3961		
	VAR	*LG Does not cause M3*	1	0.0785	0.0030		
		BS Does not cause LG	1	-1.1915	-1.0148		
	VAR	*LG Does not cause BS*	1	0.2162	0.0113		
		CPS Does not cause LG	2	0.2115	0.2937	**-2.2869***	**-0.1274**
	ECM	*LG Does not cause CPS*	2	-0.452	-0.0098	**2.6386***	**0.0187**
		C Does not cause LG	1	-0.7807	-0.77439		
	VAR	*LG Does not cause C*	1	**-2.6184***	**-0.0633**		
UAE		*M3 Does not cause LG*	1	0.0057	0.0024		
	VAR	*LG Does not cause M3*	1	0.1228	0.0096		
		BS Does not cause LG	1	-0.6401	-0.1938		
	VAR	*LG Does not cause BS*	1	0.2868	0.0464		
		CPS Does not cause LG	2	-0.6439	-0.37196	-1.0798	-0.1932
	ECM	*LG Does not cause CPS*	2	0.0121	0.00085	-1.1916	-0.0582
		C Does not cause LG	1	-0.0866	-0.0745		
	VAR	*LG Does not cause C*	1	**-2.3152***	**-0.0660**		

The form of causality between the level of economic development LG and the development of financial sector in Bahrain seems to be sensitive to both the causality

tests considered and the proxies of financial development. Finance leads economic development in the long - run according to Granger – causality tests (from Bs to LG) and Sims – causality tests (from CPS to LG). And economic development leads finance in short – run (from LG to C) and in the long- run (from LG to CPS) according to Granger – causality tests as well as a short-run causality (from LG to C) suggested by G-M-D causality tests. Therefore, Considering the causality tests between the growth rate of GDP per capita G and the alternative measures of financial development, as we proceed, may help to determine the dominate form of causality between economic development and financial system activity in Bahrain in the last three decades.

The findings of these tests, nonetheless, are discouraging for two countries in the sample, Kuwait (1973 – 2006) and Oman (1976 – 2006). The null hypothesis of no causality between LG and each of the alternative financial indicators considered for Kuwait (M3 and BS) cannot be rejected at 5% level according to the three alternative causality tests. For Oman also the three causality tests suggest no form of causality between LG and the alternative measures of financial development – M3, BS, CPS, and C-. However, Granger – causality tests detect one reverse short – run causality from LG to M3, at 5% level for Oman. Yet, again, the cointegration tests suggest that the two variables (LG and M3) do not carry a stationary long – run relationship (not cointegrated). Therefore, the lack of cointegration between the two variables may cast some doubt in the reliability of this evidence of short – run causality.

Although our finding for Kuwait based only on two financial indicators (M3 and BS), other studies also, such as Al-Yousf (2002) and Boulila and Trabelsi (2004), report no

evidences of causality between the economic development and financial development for Kuwait.

Table 2.5: Sims-causality tests and G-M-D Causality test between LG and Financial Indicators

			Sims		*G-M-D*	
Country	***Null Hypothesis***	***lag***	***F/T- Test***	***Coeff***	***F/T- Test***	***Coeff***
Bahrain	*LG Does not cause M3*	1	-0.284	-1.636	-1.626	-0.232
	M3 Does not cause LG	1	0.035	0.012	0.045	0.0097
	LG Does not cause BS	2	0.231	-0.057 0.028 0.522	1.634	-0.172 -0.038 0.459
	BS Does not cause LG	2	2.423	-0.0053	2.539	0.053
	LG Does not cause CPS	1	0.566	0.176	0.882	0.269
	CPS Does not cause LG	1	**2.135***	**0.178**	1.600	0.143
	LG Does not cause C	1	-1.507	-0.695	**-2.089***	**-0.921**
	C Does not cause LG	1	0.682	0.062	-0.429	-0.038
Kuwait	*LG Does not cause M3*	1	-1.623	-0.252	-1.6131	-0.275
	M3 Does not cause LG	1	1.073	0.097	1.892	0.123
	LG Does not cause BS	1	-0.902	-0.096	-1.789	-0.139
	BS Does not cause LG	1	0.972	0.107	1.357	0.151
Oman	*LG Does not cause M3*	1	1.047	0.840	1.724	1.277
	M3 Does not cause LG	1	-1.415	-0.050	-1.190	-0.040
	LG Does not cause BS	1	1.409	0.542	1.721	0.691
	BS Does not cause LG	1	-0.075	-0.0045	-0.427	-0.027
	LG Does not cause CPS	1	1.518	0.824	1.650	0.823
	CPS Does not cause LG	1	-0.829	-0.041	-1.014	-0.051
	LG Does not cause C	1	-0.806	-0.573	-1.231	-0.880
	C Does not cause LG	1	0.706	0.043	0.966	0.056

Note: for each equation the usual residuals tests (autocorrelation, Heteroskedasticity, normality) are conducted to ensure that they are white noise. In case, however, there are evidences of serial correlation, Heteroskedasticity, or both we make sure we correct for it. Normality, on the other hand, where it was detected in few cases, may require longer span of data.

Lag in Sims tests refers to the number of forward periods and the number of lagged periods of independent variable. Whilst, it refers to the number of forward periods and the number of lagged periods of independent variable as well as the number of lagged periods for the dependent variable in case of G-M-D tests.

One asterisk * indicates the significance at 5%, whilst two asterisks ** indicate the significance at 1% level.

This finding for Kuwait may take us back to Azam's (1988a) argument about the psychological and financial damage caused by the collapse of Al-Manakh equity and real estate market in Kuwait in 1982, where over US$ 90bn reportedly wiped out. Damage of such magnitude, in a relatively small economy such as that of Kuwait,

may have hindered the role of financial institutions in the economic activity for sometimes in the last three decades.

T able 2.5: continues: Sims-causality tests and G-M-D Causality test between LG and Financial Indicators (FI)

			Sims		*G-M-D*	
Country	***Null Hypothesis***	***k***	***F/T- Test***	***Coefficient***	***F/T- Test***	***Coefficient***
Qatar	*LG Does not cause M3*	1	-0.8105	-0.3027	-0.7271	-0.2729
	M3 Does not cause LG	1	-0.1268	-0.0230	-0.0183	-0.0029
	LG Does not cause BS	1	0.8283	0.1174	0.8495	0.1263
	BS Does not cause LG	1	0.5456	0.0660	0.1370	0.0180
	LG Does not cause CPS	1	0.3290	0.1228	0.1507	0.0569
	CPS Does not cause LG	1	0.1501	0.0251	0.0303	0.0042
	LG Does not cause C	1	-1.4865	-1.1266	-1.5292	-1.1793
	C Does not cause LG	1	0.3365	0.0257	0.5854	0.0395
Saudi Arabia	*LG Does not cause M3*	1	1.0686	0.73291	-0.04041	-0.02805
	M3 Does not cause LG	1	-1.1072	-0.030325	-1.05638	-0.022418
	LG Does not cause BS	1	1.2707	0.639224	0.096594	0.050862
	BS Does not cause LG	1	-1.1446	-0.041814	-1.13590	-0.034012
	LG Does not cause CPS	2	0.3326	0.9974 0.2018	0.0921	0.2505 -0.5718
	CPS Does not cause LG	2	0.3038	0.0095 0.0189	0.2462	-0.0122 -0.0037
	LG Does not cause C	2	**3.6236***	**-2.1376** **-2.0989**	2.5099	-2.8497 -2.2349
	C Does not cause LG	2	1.1010	-0.0018 0.0459	0.5537	-0.0183 -0.0147
UAE	*LG Does not cause M3*	2	**3.9581***	**0.0835** **0.4753**	**3.4526***	**-0.3558** **0.42909**
	M3 Does not cause LG	2	**6.006****	**0.1079** **-0.1808**	**3.6426***	**0.1600** **-0.1878**
	LG Does not cause BS	1	-0.7210	-0.0616	-0.5496	-0.0549
	BS Does not cause LG	1	0.9310	0.0719	0.6900	0.0536
	LG Does not cause CPS	1	0.1434	0.0298	-0.5757	-0.1358
	CPS Does not cause LG	1	0.1331	0.0049	1.2628	0.0437
	LG Does not cause C	1	-1.0208	-0.8907	-1.8694	-1.6064
	C Does not cause LG	1	0.0049	0.00028	-0.3205	-0.0138

Note: see the previous note of the same table**.**

A possible channel of such impact is through the rise of government controls and intervention in the allocation of financial resources. Further explanations of such finding perhaps related to some characters of the resource rich economy, such as the

role of public sector, and the negligible role of private sector as it will be demonstrated as we proceed in our discussion.

For Qatar, only Granger – causality tests, out of the three causality tests, suggests a casual relationship between the level of output LG and three financial indicators M3, BS, and C. However, different forms of causation is reported for each relationship; the level of output LG imparts financial development M3 in the long-run, whilst bi-directional causality is the form of causation between LG and BS in the long – run and demand following hypothesis in the short – run. On the other hand, the third relationship reported (LG and C) suggests that financial development appears to stimulate the level of economic development in the long – run. In all cases the null hypothesis was rejected at 5% level or better. However, the short span of data for Qatar 26 may cast doubt on such different outcome for each relationship.

For Saudi Arabia (1964 – 2007), few evidences of causality are recorded between the level of output LG and the development of financial system. Two forms of causality between LG and two financial indicators (CPS and C) are reported by Granger – causality tests; a bi-directional long-run relationship between LG and CPS, and a short – run demand following hypothesis between LG and C. The null hypothesis of no causality was rejected at 5% level in both cases. [62] However, as mentioned above, the latter finding of short – run reverse causality may be less reliable since LG and C are not cointegrated. Sims – causality tests support the finding of reverse causality; a long-rung causation runs from LG to C is reported with 5% level of significance. The G-M-D causality tests, on the other hand, detect no form of causality between the LG

[62] However, The lack of short – run causality between LG and CPS in the ECM contradicts the suggestion of Granger representation theorem of the existence of short – run causality between the two cointegrated variables at least in one direction, thereby, casting some doubt on this finding

and any financial proxy considered for Saudi Arabia. As thus, there seems to be evidences, albeit weak, suggest that the development of real sector LG seems to impart the financial system activities in Saudi Arabia in the last four decades. This finding of Saudi Arabia is probably due to the fact that the public sector plays the dominant role in all economic activity, which in return may have enhanced the activities of other sectors and hence the demand on financial services by other sectors.[63]

For the UAE (1973 – 2004), the evidences from Granger-causality test are weak, only a short-run reverse causality between LG and one financial indicator C is detected with 5% level of significance.[64] Sims-causality test and G-M-D causality, on the other hand, demonstrate evidences of bi-directional causality between the level of economic output LG and the development of financial system with the same financial proxy M3. The null hypotheses of no causality from M3 to LG and vice versa are rejected according to both causality tests at 5% level or better. No other form of causation is reported by any causality tests between LG and any financial proxy considered for UAE.

The finding of bi-directional causality, where the level of income LG and the financial system development seems to impart the activities of each other may be related to some features of the UAE economy. In the case where the economic activity enhance the financial sector activities, demand – following hypothesis, such form of causation may be attributed to the flourishing private sector in Dubai Emirate (real estates, constructions, re-export industry, tourism, …etc), . In addition, as mentioned earlier

[63] Saudi Arabia is the largest oil producer in the world, and it has the largest economy in the region.
[64] Similar to that reported earlier for Bahrain and Saudi Arabia, the two variables LG and C are not cointegrated which may doubt the reliability of this finding.

for Saudi Arabia, the role of Public expenditures, in rich oil producer country, to fuel the other sectors activities and in returns the demand for financial services.[65] The supply – leading hypothesis, where the financial sector development stimulates the economic development in UAE, could be related to the fact that UAE is among the countries with the highest rate of bank density relative to its population and its level of GDP. There are over 45 local and foreign banks, and around 50 representative offices of other international banks.[66] Thus, the expected higher level of competition among this large number of banks may have fostered the quality and the quantity of the financial services in the country and ultimately the level of economic activities. Moreover, it might be related, to some extent, to the rapid development of financial sector of Dubai Emirate since early 1990s. Dubai has paid a considerable attention to develop its financial sector as it aims to lesson its dependency on oil and the hope to become a financial centre in the Middle East region.

The second set of causality tests considered here is regarding the forms of causality between the growth rate of GDP per capita (G) and the development of financial sector. ADF and PP unit root tests suggests that G is level stationary I(0), therefore, Granger – causality tests and G-M-D causality tests will be carried out using the first differences of the two variables (short – run causality) if the concerned financial indicator is first difference stationary I(1). Table 2.6 reports the results of the three alternative causality tests between the two variables for all countries in the sample.

The results of the three tests for Bahrain suggest strong evidences in favour of the view that the expansion of financial services fuels the growth of real sector activities.

[65] UAE has two industrial zones, Jabal Ali free zone in Dubai as well as Zannah –ArRuways industrial Zone in Abu Dhabi, both zones host most of manufacturing industry in the country.
[66] Country profile (UAE), Federal research division, (Library of Congress, 2007).

Granger – causality tests reports this form of causality, supply – leading hypothesis, in the long - run (between (G) and M3, both variables are I(0) and in the short – run (between G and two other financial proxies BS and CPS). The null hypothesis of no Granger – causality running from the alternative financial indicator (M3, BS, and CPS) to (G) is rejected in the three cases at 5% level or better as in Table 2.6. Interestingly, Sims causality tests also, seem to support this finding of Granger tests of supply – leading hypothesis is the form of causation between the financial development and growth of real output. The null hypothesis that financial development does not cause economic growth (G) is rejected for both financial indicators, BS and CPS, at 5% level. Moreover, G-M-D causality tests give support for supply – leading hypothesis, but only from one financial indicator (BS) to (G), where the null hypothesis of no causation is rejected at 5% level. These substantial evidences of supply – leading hypothesis, along with the previous finding of causality between LG and the development of financial sector, may conclude that the supply – leading hypothesis may have been the dominant form of causation in Bahrain in this period. This finding for Bahrain may, in fact, carry some weight. Bahrain has served as financial centre for the GCC region, where Bahrain was initially developed strongly, to deploy and to recycle the petro-dollars of the GCC region in 1970s; since then Bahrain has been seeking to make a niche of its financial sector (Gray and Blejer, 2007).

Moreover, Bahrain has always been relatively opened to the international financial institutions (e.g. offshore banks, insurance companies,) compare to some other countries such as Saudi Arabia and Kuwait. Hence, Bahrain has provided the right place for some international financial institutions interested in operating in the GCC

region and in targeting the huge energy and petrochemical industries as well as some big construction activities in the region.[67]

Table 2.6: Causality tests between (G) and Financial indicators (FI)

			Granger		*Sims*		*G-M-D*	
Country	***Null Hypothesis***	***lag***	***F/T- Test***	***Coeff***	***F/T- Test***	***Coeff***	***F/T- Test***	***Coeff***
Bahrain	*G Does not cause M3*	1	-0.7768	*-0.1702*	-0.841	-0.2306	-1.8503	-0.2422
	M3 Does not cause G	1	**2.389***	***0.2426***	1.2073	0.3216	0.1560	0.0382
	G Does not cause BS	1	-1.2669	*-0.2938*	-0.6225	-0.0949	-0.2820	-0.0330
	BS Does not cause G	1	**3.5203****	***0.4732***	**3.2515***	**0.6119**	**2.7199***	**0.5725**
	G Does not cause CPS	1	-0.2934	*-0.0283*	-0.5478	-0.2305	-0.3781	-0.1281
	CPS Does not cause G	1	**2.3103***	***1.0381***	**2.5131***	**0.1905**	1.3163	0.1149
	G Does not cause C	2	1.0321	- 0.0962 - 0.0821	0.3492	-0.6260 -0.5581	1.1186	- 0.558 - 0.454
	C Does not cause G	2	1.1713	0.2737 - 0.7195	0.640541	0.05611	1.0089	- 0.035 - 0.123
Kuwait	*G Does not cause M3*	2	1.0866	*-0.1619* *0.1852*	1.0928	-0.585 -0.2162	2.9866	-0.4475 -0.0988
	M3 Does not cause G	2	0.4993	*0.1052* *0.0461*	**8.6392****	**0.2571** **0.0188**	**4.4004***	**0.1645** **-0.1005**
	G Does not cause BS	1	-0.7383	*-0.0974*	-0.4433	-0.1129	-1.6448	-0.1908
	BS Does not cause G	1	1.3505	*0.1549*	**4.5211****	**0.3279**	-0.3142	-0.0333
Oman	*G Does not cause M3*	1	-0.4281	-0.0185	0.3861	0.4915	0.9324	0.8554
	M3 Does not cause G	1	0.6544	1.0203	-0.67008	-0.0168	-0.8862	-0.0249
	G Does not cause BS	1	0.1198	0.0082	0.3844	0.2315	1.0294	0.5305
	BS Does not cause G	1	1.1570	0.9038	0.9854	0.0446	0.1582	0.0082
	G Does not cause CPS	1	-0.19171	-0.0103	1.4083	1.1425	1.5093	0.9575
	CPS Does not cause G	1	1.4623	1.2872	0.4365	0.0167	-0.2548	-0.0115
	G Does not cause C	1	**-2.0451***	***- 0.1059***	0.1905	0.2154	-1.9253	-1.3178
	C Does not cause G	1	0.2192	0.0850	1.5516	0.0686	0.7610	0.0437
Qatar	*G Does not cause M3*	1	-0.7537	-0.0817	-0.7676	-0.4665	-0.8360	-0.3421
	M3 Does not cause G	1	-0.2219	-0.0736	-0.4115	-0.0927	-0.8338	-0.134
	G Does not cause BS	1	0.0965	0.0182	0.9131	0.17607	1.6285	0.2354
	BS Does not cause G	1	1.6548	0.6229	1.6013	0.18046	0.1484	0.0223
	G Does not cause CPS	1	-0.2651	-0.029	-0.1074	-0.0693	0.7446	0.3167
	CPS Does not cause G	1	0.4848	0.2100	-0.2592	-0.0372	-0.0744	-0.0110
	G Does not cause C	1	-1.071	-0.0548	-0.7001	-0.8538	-1.234	-1.0010
	C Does not cause G	1	1.1320	0.9974	1.0391	0.06855	1.3737	0.0928

Note: lag is the number of lagged periods for each variable in Granger tests. For Sims and G-M-D tests see the note of Table 1.6.

For each equation the usual residuals tests (autocorrelation, Heteroskedasticity, normality) are conducted to ensure that they are white noise. In case, however, there are evidences of serial correlation, Heteroskedasticity, or both we make sure we correct for it. Normality, on the other hand, where it was detected in few cases, may require longer span of data.

One asterisk * indicates the significance at 5%, whilst two asterisks ** indicate the significance at 1% level

[67] Considering, the fact that the small size of the local banks has prevented them from participating, as mentioned earlier, in the energy related projects in their economies.

Table 2.6 Continues: Causality tests between (G) and Financial indicators (FI)

			Granger		*Sims*		*G-M-D*	
Country	***Null Hypothesis***	***lag***	***F/T- Test***	***Coeff***	***F/T- Test***	***Coeff***	***F/T- Test***	***Coeff***
				0.0038		0.1988		-0.1167
Saudi	*G Does not cause M3*	2	0.4435	*-0.0028*	0.0051	0.1323	0.0252	-0.2343
				-0.3709		0.0144		0.0049
Arabia	*M3 Does not cause G*	2	1.28095	2.477	0.3416	0.0147	0.3306	0.0134
				0.0219		0.8488		0.6169
	G Does not cause BS	2	0.3036	*0.0059*	0.1474	0.0084	0.2311	-0.4674
				-0.3221		- 0.037		0.0094
	BS Does not cause G	2	0.9273	*1.5295*	0.2287	-0.008	0.2632	0.0181
				0.0046		2.3623		0.8530
	G Does not cause CPS	2	0.06116	*0.0035*	0.3322	-1.0339	0.2528	-1.4286
				0.4058		0.0118		0.0078
	CPS Does not cause G	2	0.2096	*1.219*	0.14897	0.0081	0.1601	0.0079
				-0.0279		-2.6099		-2.3845
	G Does not cause C	2	1.6366	*0.1068*	0.7011	-2.6189	2.2684	-2.2333
				0.0169		0.0287		0.0209
	C Does not cause G	2	1.3932	2.6784	1.5053	0.0326	1.3132	0.0307
				-0.0272		**-0.3149**		**-0.4156**
UAE	*G Does not cause M3*	2	**4.1786***	**0.1149**	**7.8828****	**0.6222**	**5.8012***	**0.5001**
				0.9894		**0.0760**		**0.0138**
	M3 Does not cause G	2	**5.1869***	**-0.5327**	**4.7814***	**-0.0920**	**3.7340***	**-0.1634**
				-0.0785		- 0.1236		-0.1283
	G Does not cause BS	2	0.6284	0.0574	1.3217	0.1240	0.8433	0.0881
				0.8495		**-0.1611**		0.1888
	BS Does not cause G	2	**5.2552***	**0.1977**	**4.5809***	**0.0401**	2.0410	0.0132
	G Does not cause CPS	1	-1.1231	-0.0434	0.2168	0.1168	-0.9563	-0.5892
	CPS Does not cause G	1	**3.4473****	**2.0562**	**2.5648***	**0.0906**	**3.4269****	**0.1557**
	G Does not cause C	1	-0.7405	-0.0156	0.0247	0.02728	-0.8522	-1.2228
	C Does not cause G	1	0.8307	1.2243	-0.0676	-0.0032	0.5886	0.0228

The findings of these tests for Kuwait, nonetheless, contradict our earlier finding of no form of causality between the level of economic development LG and financial sector activity in Kuwait. Two causality tests, Sims – causality tests and G-M-D causality tests, suggest that the financial system activities encourage the economic growth process in Kuwait in the long-run. Sims – causality tests reject the null hypothesis that development of financial system does not cause the economic growth (G) at 1% level for both financial indicators M3 and BS. G-M-D causality tests, however, support this finding for just one financial indicator M3. The null hypothesis

that M3 does not cause (G) is rejected at 5% level. Granger – causality tests, on the other hand, report no form of causation between (G) and the two proxies of financial development, M3 and BS.

This finding for Kuwait, even though disagrees with our previous finding, perhaps related to some facts about the economic development of Kuwait in the last three decades. Kuwait has witnessed dramatic financial development since mid 1970s where Kuwait has the oldest financial market in the region. Thus, it seems that this dramatic financial development has encouraged the growth of other sectors in the economy. Moreover, the role of financial institutions may have played a noticeable role in rebuilding the country after the invasion of the country in the Second Gulf War in 1990.

For Oman, the results of the causality tests report very week sign of causation, similar to the earlier finding between LG and financial development indicators. Only Granger – causality tests detect one possible long – run causality from growth indicator (G) to one financial measures C at 5% level of significance.

For Qatar and Saudi Arabia, the causality tests suggest that the growth rate of output per capita (G) and the level of financial system activity are not related. No form of causality is reported by any tests between the economic growth (G) and the alternative measures of financial development. In case of Qatar, this probably due to the short span of data, just 26 observations (1980 – 2006). However, even though that Saudi Arabia has the longest span of data in our sample, over 40 observations (1964 – 2007), no form of causation was detected between the two variables.

The lack/weak causality between the economic growth and the development of financial sector in those countries may be related to some characters of the financial sector of those countries, as well as the negative impact of Almanakh collapse in 1982 in the whole region. Some features of the financial structure are well discussed in section 2 of this chapter. Those features include the widespread of government ownership in commercial banks in the region, the small size of the commercial banks relative to the size of the economy, short terms nature of most deposits of the financial institutions, religious factor and Abdeen and Shook's (1984) argument about the impact of interest concept in the financial development in the region.[68] In addition, this finding for those countries may favour Devaux's (2006) argument that the general role of financial institutions in the rentier economies such as those of GCC is simply to handle the financial transactions for governments and the public enterprises. Needless to mention that the public sector dominates most economic activities and the private sector plays negligible role in most countries in the region.

For UAE, the causality tests report similar results, to some extent, to that found between LG and the financial development indicators. The three causality tests find evidences in the form of bi-directional causality between the economic growth (G) and one financial development measures M3. The null hypotheses that economic growth does not cause M3 and vice versa are rejected at 5% level or better by all causality tests. However, there are some substantial evidence suggest that the financial deepening imparts the economic growth process in the UAE in the last 30

[68] For some, and perhaps most, banks in the region the remittances of expatriate labour, over half of the labour force of the region, provide a high margin of profits. According to Migration and Remittances Fact book of World Bank (2008) Saudi Arabia ranks the second biggest country, after Unite State, in the source of the migrant labour remittances (over 15$bn in 2006).

years. Granger – causality tests reject the null hypothesis of no short – run causality running from finance to economic growth (G) at 5% level or better for two financial indicators (BS and CPS). Sims – causality tests also report long – run causality running from the same two variables, BS and CPS, to economic growth (G), where the null hypothesis is rejected at 5% level for both variables. Moreover, G-M-D causality tests support this finding of supply – leading hypothesis, but only from one financial indicator CPS to (G). the null hypothesis that CPS does not cause (G) in the short – run is rejected at 5% level. No further form of causality is reported by any causality tests between the alternative measure of financial development and economic growth (G) in the UAE. The latter finding of supply – leading hypothesis has overwhelmed the form of relationship between the growth rate of the economy and the development of financial services and might be related to some features of the UAE economy, as we discussed earlier, such as high bank density, rapid development of the financial sector of Dubai Emirate… etc.

Overall, the cointegration results suggest that the level of economic output LG and the development of financial system may have stable long – run relationship in four countries (Bahrain, Qatar, Saudi Arabia, and UAE) out of the five countries considered in the cointegration test. On the other hand, our findings of the form casual relationship between the economic development and the state of financial system activities seems to vary from one country to another and, to some extent, from one financial indicator to another according to the alternative causality tests considered. In order to summaries our findings, we report the results of the three causality tests (Granger – causality tests, Sims – causality tests, and G-M-D causality tests) for all countries in two Tables. Table 2.7 presents the findings of the cointegration test as

well as that of the three causality tests between the level of GDP per capita LG and each financial indicator considered for all GCC countries. On the other hand, Table 2.8 summaries the findings of causality tests between the growth rate of GDP per capita (G) and the alternative measures of financial development for all countries.

Table 2.7: Results Summary: summary of cointegration and the alternative causality tests between LG and Financial Indicators (FI)

			Granger- causality		*Sims- causality*		*G-M-D causality*	
Country	*FI*	*Cointegration*	*Finance causes development*	*Development causes finance*	*Finance causes development*	*Development causes finance*	*Finance causes development*	*Development causes finance*
Bahrain	M3	No	No	No	No	No	No	No
	BS	**Yes**	**Yes**	No	No	No	No	No
	CPS	**Yes**	No	**Yes**	**Yes**	No	No	No
	C	No	No	**Yes**	No	No	No	**Yes**
Kuwait	M3	No	No	No	No	No	No	No
	BS	No	No	No	No	No	No	No
Oman	M3	No	No	**Yes**	No	No	No	No
	BS	No	No	No	No	No	No	No
	CPS	No	No	No	No	No	No	No
	C	No	No	No	No	No	No	No
Qatar	M3	**Yes**	No	**Yes**	No	No	No	No
	BS	**Yes**	**Yes**	**Yes**	No	No	No	No
	CPS	No	No	No	No	No	No	No
	C	**Yes**	**Yes**	No	No	No	No	No
Saudi	M3	No	No	No	No	No	No	No
Arabia	BS	No	No	No	No	No	No	No
	CPS	**Yes**	**Yes**	**Yes**	No	No	No	No
	C	No	**Yes**	No	No	**Yes**	No	No
UAE	M3	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**
	BS	No	No	No	No	No	No	No
	CPS	**Yes**	No	No	No	No	No	No
	C	No	No	**Yes**	No	No	No	No

For Bahrain (1975 – 2006), Table 2.7 shows that the finding of the alternative causality tests suggest two forms of causation between the level of real output per capita LG and the development of financial system. Granger – causality tests report results for supply-leading hypothesis with one financial indictor BS, and demand – following hypothesis with two financial indicators (CPS and C). Sims – causality tests

suggest supply-leading hypothesis with one financial indicator (CPS), whilst G-M-D – causality tests support the view that economic development imparts the level of financial system development for one financial indicator C. On the other hand, the three causality tests report strong evidences, with the same financial indicators, to the view that the expansion of the financial system services imparts the economic growth (G) as in Table 2.8. Therefore, the supply – leading hypothesis perhaps have been the dominant form of relationship between the economic development and the level of financial development in Bahrain in the last thirty years.

For Kuwait (1973 – 2006), the three alternative causality tests detect no form causal relationship between the level of the real output LG and the two alternative measures of financial development, M3 and BS. However, similar to Bahrain there are some evidences to support the existence of supply – leading hypothesis between the growth rate of economic output (G) and the development of financial system as in Table 2.8 according to both tests, Sims – causality test and G-M-D causality tests. Even though the results are weak, the supply – leading hypothesis may have been the form of relationship between the economic development process and the development of financial system in Kuwait, due to the reasons addressed earlier.

For Oman (1976 – 2006), there are weak evidences of causality between the level of real output LG and the alternative measures of financial development as in Table 2.7. Only Granger – causality tests suggest a short – run demand – following hypothesis form the level of real GDP per capita LG to one financial indicator, M3. Again only Granger causality – tests detect one long – run causality from the growth rate of output (G) to just one financial indicator, C as in Table 2.8. This finding for Oman

that the development of economic activity leads the development of financial sector is probably related to some characters of those economies (e.g. dominant role of public sector, small size of the financial institution) as we mentioned in the results discussion earlier.

Table 2.8: Results Summary: summary of the alternative causality tests between (G) and Financial Indicators (FI):

		Granger- causality		***Sims- causality***		***G-M-D causality***	
Country	***FI***	***Finance causes development***	***Development causes finance***	***Finance causes development***	***Development causes finance***	***Finance causes development***	***Development causes finance***
Bahrain	M3	**Yes**	No	No	No	No	No
	BS	**Yes**	No	**Yes**	No	**Yes**	No
	CPS	**Yes**	No	**Yes**	No	No	No
	C	No	No	No	No	No	No
Kuwait	M3	No	No	**Yes**	No	**Yes**	No
	BS	No	No	**Yes**	No	No	No
Oman	M3	No	No	No	No	No	No
	BS	No	No	No	No	No	No
	CPS	No	No	No	No	No	No
	C	No	**Yes**	No	No	No	No
Qatar	M3	No	No	No	No	No	No
	BS	No	No	No	No	No	No
	CPS	No	No	No	No	No	No
	C	No	No	No	No	No	No
Saudi Arabia	M3	No	No	No	No	No	No
	BS	No	No	No	No	No	No
	CPS	No	No	No	No	No	No
	C	No	No	No	No	No	No
UAE	M3	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
	BS	**Yes**	No	**Yes**	No	No	No
	CPS	**Yes**	No	**Yes**	No	**Yes**	No
	C	No	No	No	No	No	No

For Qatar (1980 – 2006), three cointegration relationships between the level of output and three financial indicators M3, BS, and C are reported. However, different forms of causation are reported for each indicator according to Granger – causality tests, supply-leading hypothesis with C, bi-directional with BS, and demand-following hypothesis with M3 as in Table 2.7. However, these forms of causality between the

two variables are suggested by Granger – causality tests only. On the other hand, the economic growth (G) and the level of financial system activities seem to be independent according to these causality tests as in Table 2.8. No conclusion of the dominant form of relationship between economic development and the state of financial development can be drawn from the causality tests considered.

For Saudi Arabia (1964 – 2007), the relationship between level of economic output LG and the development of financial system appears to be bi-directional with one indicator (CPS) according to Granger – causality tests. Demand-following hypothesis is suggested by Sims-causality tests and Granger-causality tests (short-run) with one financial proxy (C) as in Table 2.7. However, the growth rate of output (G) and the level of financial system activities seem to be independent according to the alternative causality tests considered as in Table 2.8.

For UAE (1973 – 2004), the level of real output LG and the financial system development exhibit bi-directional causality with the same financial indicators, according to Sims-causality and G-M-D causality tests. Granger-causality tests, on the other hand, report short-run causation from LG to C as in Table 2.7. However, even though there is evidence of bi-directional causality between the growth rate of output (G) and the state of financial development according to all three tests with M3 as in Table 2.8. There are some substantial evidences in support of supply – leading hypothesis emerge from the results of the three alternative causality tests between the rate of economic growth (G) and two financial indicator BS, and CPS.

Finally, it needs to be mentioned that some results of the alternative causality tests come with the opposite sign implying a negative correlation between the state of financial development and the development of economic activities. Such finding has been reported by other studies. Al – Yousif (2002) suggests two explanations for such finding: it might be due to the possibility that financial institutions operate under a weak regularity environment with the expectation that government will help failing banks.[69] Thus, banks may have been inefficient in the allocation of their resources. Another possible explanation is that the negative correlation may be as a result of business cycle rather than a form of long – run relationship between the two variables.

[69] Weak regulations, as mentioned in section 3 of this study, are an obstacle to the development of financial sector in the GCC region.

2.7 CONCLUSION

In this chapter we investigate the role of financial sector in the development process in the GCC countries. The financial sector may play a key role in the development process of GCC countries in channelling the oil wealth to other potential sectors in the economy. in addition, financial system may stand as promising sector in these countries as those countries may have a comparative advantage in banking industries and in financial services in general since they have abundant of capital that derived from natural resources exportations. However, the development of financial sector in the GCC courtiers perhaps is a merely consequence of the development process as a whole. Hence, we investigate the development of the financial system in the region in the last few decades, and construct three alterative causality tests - Granger-causality tests, Sims-causality and G-M-D causality tests – to assess the form the relationship between the economic developments (measured interchangeably by the level and the growth of output) and financial development for each country in the region.

The results suggest the existence of cointegration space (long-run relationship) between the level of economic development and the state of the financial development in four countries out of the six countries in the sample. Moreover, similar to the results emerge from other studies in the field our findings vary from country to another and with kind of proxies employ to measure financial development. However, there are some evidences to suggest that the financial development seem to impart the development process especially in case of Bahrain and UAE, and, to lesser extent, in Kuwait. Qatar, on the other hand, has mixed results; different forms of causation are reported for each indicator according to Granger – causality tests (the low frequency

of the data may cast doubt over Qatar's results). In Oman the economic development appears to stimulate the financial development, whilst the bi-directional causality may fit the relationship between the economic development and the level of financial development in case of Saudi Arabia.

The financial system in the GCC countries have witnessed unprecedented form of development since the mid of 1970s compare to the other financial systems in the MENA region and in most developing countries. However, despite such development and the fact that GCC region has the financial means to become an international financial hub, as G CC countries have witnessed massive flows of windfall from natural resources exportations, the financial institutions in the region are still way smaller compare to the international standards, and are not even capable to participate in financing big projects such as those of energy related projects in their countries and in the MENA region. It is clear that financial institutions can play a major role in economic development in the GCC region. However, GCC banks first need to increase their capital and strengthen their deposit base through merging between them or associating with regional or international banks, so they can be able to absorb the risks of financing megaprojects Jbili et al (1997).

The GCC countries need to devote much more attention to the development of the financial system and to implement reform policies that would strengthen the position of financial sector in the economy. Such policies should aim at increasing the level of competition by a llowing new and foreign banks participation, promoting merging between banks in the region, reducing government ownership in the financial institutions, enhancing prudential regulations and supervisory framework to meet

with international standards, and ensuring that judiciary systems enforce contracts and allow banks to collect debts and liquidise collaterals. However, there are various factors can be blamed for the small size of the financial system in the region. Security is an essential factor for financial activities to flourish and Middle East region has not been a stable region since the end of World War II. In the next chapter we investigate the effect of security in the development process in the region.

CHAPTER 3

THE ROLE OF DEFENCE SPENDING ON THE ECONOMIC DEVELOPMENT IN THE GCC COUNTRIES

3.1 INTRODUCTION

This chapter investigates the role and the importance of security outlays on the development process in GCC countries. The large recurrent flow of capital from oil exports to small developing GCC countries raises the importance of security to those countries. Beblawi (2008) suggests that it has been historically observed that most financial centres in the world are usually backed by pol itical, military, and/or economic powers. GCC countries are obviously small rich developing countries that lack, to large extent, political, military, and to lesser extent economic powers. The security of the fields and the trade of the strategic commodity "oil" is a critical issue for oil – rentier GCC countries. Moreover, those countries locate in one of the most turbulent regions in the world, Middle East, which has relatively been unstable since the end of World War II. Stork (1985), for example, finds it surprising for small GCC states (Bahrain, Kuwait, Qatar, and UAE,) to survive for a decade and half after the departure of British navy from Persian Gulf in 1971.[70]

Internal and external securities, therefore, have been major concerns for the governments of those countries, and, as thus, have received a considerable amount of the states' budget allocations. This allocation to security, in rentier states where the government is usually the main player in most economic activities, may have some

[70] Further details on the threats that have faced GCC countries since Egyptian revolution in1952 will be presented in the following section.

considerable impact on the development process in the region. Deger and Sen (1995) argue that the problem of security in developing countries can not be impartial from the development failures or success according to most analysts. Allocating too much to security may hinder development, whilst giving too little to security may allow threats to grow. The levels of defence expenditures in most GCC countries are relatively high, and enjoy a relatively considerable share of budget allocation (Frederiksen and Looney, 1983; Lebovic and Ishaq, 1987; Looney, 1991, among others). Hasbani (2006), for example, argues that GCC countries are among the highest in the world in terms of defence expenditure; about 23% to 45% of the state budget is allocated to defence. In defence literature Middle East region in general has been noticed with its high intensity to defence burden (military expenditure as a share of GDP), see for instance, among other, Lebovic and Ishaq (1987), Looney (1994), Abu-Bader and Abu-Qarn (2003), and Yildirim et al (2005).[71]

The impact of defence burden on the economic development has received a considerable attention among economists and policy makers worldwide since the seminal works of Benoit (1973, 1978), where a significant positive impact of defence expenditure on growth rate of output is found for a sample of 44 developing countries in the period of 1950 to 1965. Benoit suggests some channels through which the defence expenditure may carry some positive and/or negative impacts on the economic development. Besides its important value to economic progress, the spin-off from the military expenditures may carry some positive effects on the growth of the economy. The positive effects of defence expenditures on the economic growth

[71] According to Stockholm International Peace Research Institute (SIPRI) - a pioneer research institute established in 1966 ,dedicated to research into conflict, armaments, disarmaments, and arm control - as well as most analysts of defence economics, Middle East region is among the most highly defence spending regions in developing world.

maybe explained through the Keynesian demand effect. An increase in defence expenditures may increases the aggregate demand and that may lead to an increase – multiplier effect – in resources utilization and economic growth.

Deger and Sen (1983) suggest that there seems to be a general acceptance among researchers in defence literature toward the argument that defence expenditure has a substantial spin-off that will carry some positive effects on development process. Benoit describes several positive contributions of military expenditure on civilian output in developing countries. Those include the engagement of military programs in some public works – roads, airports, dams, communication networks… etc – that may in part serve civilian sector, the process of modernisation[72], technological and scientific progress, and – creation of demand for some industries that may, otherwise, suffer capital underdevelopment (Deger and Sen, 1995) –. However, military expenditure has opportunity costs[73] and may crowd out other forms of expenditure such as investment, which may carry adverse effects on economic development. Deger (1986a) stresses the negative impacts of military expenditure on saving and balance of payment, which may have an ultimate adverse impact on long – run economic growth, notably from saving.

Supply side view, on the other hand, suggests that the effects of military expenditure may operate through the contribution to production factors accumulation (labour, capital, and natural resources), as well as to the technological progress, which together dictate the economic output (Dunne et al, 2005). Biswas and Ram (1986)

[72] Deger and Sen suggest that the help of military programs in modernisation maybe effective in a backward society. Looney (1991) argues that the role of military expenditure in modernisation may be crucial for Middle East region where it has a relatively low human capital formation.

[73] Allocating some of available resources to less productive defence sector may have a highly opportunity cost.

suggest that the use of supply side model in the form of Feder two sectors framework provides another important mechanism through which defence expenditure may affect economic output. The model estimates the factor productivity differences, along with ad hoc effect on growth, between the military sector and the civilian sectors, which may have significant impact on the growth of output.

Although there is not a well established economic model that reflects the causal relationship between defence spending and economic growth (Hartley, 2006), several econometrics models have been proposed in the literature to predict the form of such relationship between the two variables. Those models include, among others, ad hoc traditional growth function, simultaneous equations models (SEMs), Feder – Ram model, Augmented Solow growth model, traditional demand side, and Granger – causality. However, the findings of the empirical works in the area seem to vary from positive, to negative, to no effect of defence spending on economic development. Ram (1995), Deger and Sen (1995), and Hartley (2006) survey a large body of the empirical works on defence and economic growth nexus, and suggest, among other, that the differences in empirical works findings may be related to different methodologies, periods of time , samples, and variables proxies used in the empirical works.

In this chapter we will investigate the impact of defence expenditure on development process for each country in the GCC. We consider the production function approach of Cobb- Douglas form in the context of VAR model and coitegration analysis for

each country.[74] The following section provides an overview on the security in GCC region. Section 3 includes a survey of the literature, section 4 presents the empirical methodology, and section 5 reports the empirical findings and the conclusion.

[74] This approach is widely common one in the public capital literature as we shall see in the next chapter.

3.2 AN OVERVIEW ON THE SECURITY OF THE GCC REGION

Since their independence from United Kingdom (UK), GCC countries have faced several external and internal threats that have formed great challenges to the security and the stability of the region. Some neighbouring countries have posed, and some to some extent remains, a threat to the security of some GCC countries. Egypt revolution in 1952 and the Pan-Arabism – Arabic nationalism – movement thereafter have formed a major threat to the GCC countries internally and externally, pictured in Yemen revolution in 1963 where Egypt enters to support the revolutionists by sending troops to Yemen, Saudi Arabia, on the other hand, along with some other countries in the region support the king of Yemen by that time. Interventions by neighbouring countries, mostly Egypt and Iraq, in the political affairs in other Arabic countries including GCC countries were usually justified by the pan-Arabism ideology (Yousef, 2004). For example, Iraqi communist government claims that Kuwait is part of Iraqi soil and intends to take over Kuwait Immediately after Kuwait granted its independence in 1961. The crisis was resolved in1963 at Arab league where Kuwait is recognised as a member of the Arab league and that was forced by sending troops from some members of Arab league countries to Kuwait to replace the British troops and to halt the Iraqi communist government aggression.[75]

Disputes over borders with other neighbouring countries of the region are there; Saudi Arabia has long had disputes over the borders with Republic of Yemen as well as with former People's Democratic Republic of Yemen PDRY which also had borders

[75] The International Security council failed to reach an agreement to resolve the crisis since Iraq was backed by Soviet Union.

disputes with Oman another member of GCC. [76] UAE also has dispute with Iran over three Islands – Abu Musa, Greater Tunb, and Lesser Tunb – where Iran immediately takes control of the Islands after the departure of the British troops and claims sovereignty over them, whilst UAE sees those islands as Arabic islands and claims legal ownership of them (Mobley, 2003). GCC also have disputes along the borders between them such as those between Saudi Arabia and Oman, Saudi Arabia and UAE, Bahrain and Qatar, Kuwait and Saudi Arabia. However, most of these disputes among the GCC members have been soft and have not led to serious border clashes.

Internally perhaps Oman and Saudi Arabia are the ones that have faced serious political tremors. In 1964 a rebellion broke out in Dhofar province of Oman against the Sultan of Oman, with the support of the PDRY the aim was to overthrow the Sultan in Muscat. Oman later ended the leftist revolt in Dhofar by the mid of 1970s with the help of Iran, UK, and US after 10 years of war (Katzman, 2005). The takeover of Mecca's Grand Mosque in Saudi Arabia by Islamic extremist rebels in 1979 has caused a major disturbance to the whole region. The Grand Mosque was freed from the extremist rebels after several weeks with the help of Jordanian army (Stork, 1985).[77] The small states of the Gulf were not also spared from this turmoil with sabotages and demonstrations in Bahrain and Kuwait as well as the ruling circle paralysis in UAE.

[76] Former PDRY has always formed a real threat to Oman even though Oman and PDRY relations were normalized in 1983; borders clashes between them were occasional events (Katzman, 2010).
[77] According to Stork Jordanian and Pakistani troops play key advisory and mercenary roles in the armed forces of the GCC countries. For example, over 30 percent of UAE arm forces are expatriates mostly from Pakistan (Foley, 1999).

The departure of the British navy from Persian Gulf in 1971, nevertheless, has been a major disturbance to the security of the whole region.[78] The three largest states on the Gulf – Iran, Iraq, and Saudi Arabia – have competed to fill the gap left by the British troops' withdrawal, as the idea of Gulf collective has been haphazardly advanced by the three countries since the British announcement of the withdrawal (Stork, 1985). To secure their monarchies most of GCC countries have resort to security treaties with some of the World major powers namely United States (US), which also increases its presence in the region to fill the gap left by the British forces. Moreover, the Arab- Israeli war in 1973 and the subsequent regional instability accompanied with oil price shock and the massive windfall of oil revenue have allowed the GCC region to take over the first place in global arms imports; as those states start to build up their national armies from scratch, especially small states, from building army bases, airports and communications centres, to the acquisition of military equipments (Hasbani, 2006).

The fall of Reza Pahlavi, the king of Iran, under the rise of Islamic revolution in 1979 has further eroded the stability of the region. The fear that the revolution would spread throughout Middle East and the subsequent war between Iran and Iraq, started in 1980, has shaken the GCC monarchies. GCC countries lined up with Iraq in its 8 years war with Iran, where they diverted billions of dollars to Iraqi war treasury. Kuwait became the main port for war material shipments to Iraq whilst Bahrain and

[78] In 1968 as part of Budget cut plan the United Kingdom declared that the British Navy to depart Persian Gulf by 1971, although UAE had offered to pay the financial cost of keeping the British Navy in the Gulf (Mobley, 2003).

Oman rashly offered their territories to Iraqi air force as staging points (Stork, 1985).[79]

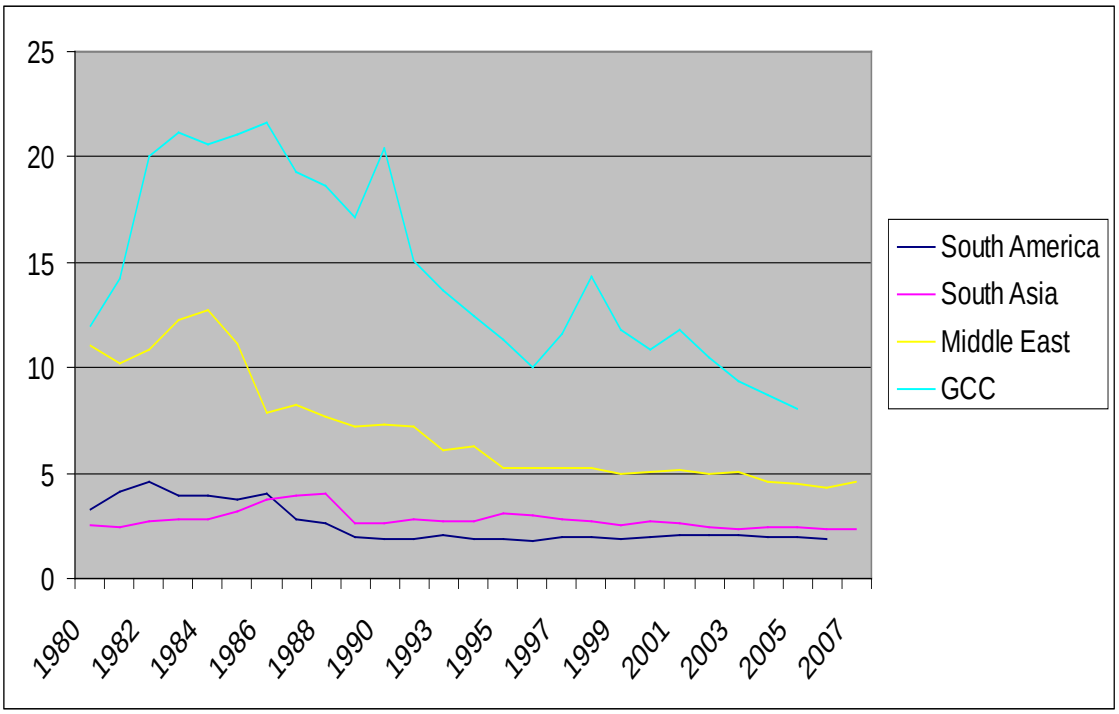
Furthermore, the invasion of Kuwait by I raqi army in 1990 and the subsequent Second Gulf war, where an international coalition led by US was formed to drive Iraqi troops out of Kuwait, has crumbled the stability of the region and has further given the GCC countries more appetite to import more arms equipments – around 40 percent of the world's arms sales during the 1990s has been form GCC region (Hasbani, 2006) - . Early this century the terrorist attack of September 2001 on New York Wold Trade Centre and the following invasions of Afghanistan and Iraq by American forces as well as the dispute between the West – led by US – and Iran over the Iranian nuclear programme, have also disturbed the security of the GCC region. Not to mention the rise of Islamic extremists in the region and the number of terrorist attacks that some countries have witnessed especially Saudi Arabia.

Thus, GCC region apparently and according to several sources, remains one, if not the first, of the highly defence spending regions in the developing world, and correspondingly has higher level of arms imports. Figure 3.1 below compares the share of the defence expenditures to GDP of the GCC region with those of some other developing regions in the world. It clearly shows that the share of defence to GDP for GCC region is far greater than those of the other regions; it is almost double the size of that of the rest of Middle East region and is over three times that of Latin America and South Asia regions throughout the time in the last three decades. This high

[79] Transparency in arms transfers in the Middle East region is poor, most Arab countries boycott the United Nations Register of Conventional Arms (UNROCA) (Perlo-Freeman, 2009); there are large unreported exports of arms and arms transfers to the region and among the countries of the region which challenge the credibility of military data published by those countries (Lebovic and Ashfaq, 1987).

defence expenditure that characterises the GGC region has motivated some researchers to investigate the impact of such heavy spending on t he economic performance in the region as we review some in the following section.

Figure 3.1: Defence Expenditure as a Share GDP



Source: SIPRI Year Book various issues, and the database of SIPRI available on www.SIPRI.org.

3.3 LITERATURE REVIEW

Since the seminal works of Benoit (1973, 1978), the role of defence spending in economic development has attracted a considerable interest among economists and policy makers worldwide. Benoit (1973) notes that defence programmes in developing countries have been growing faster than their economies. He estimates the relationship between the defence burden (military expenditure as a share of GDP) and economic growth for a sample of 44 developing countries in the period of 1950 to 1965. The results obtained based on a single ad hoc growth equation where the growth rate of civilian output is regressed in the defence burden and other control variables. Contrary to his expectation and to the general belief, the results suggest strong positive effect of defence spending on economic growth; countries with high defence expenditure had the most rapid rate of growth.[80] Furthermore, Benoit's analysis suggests that the direct interaction between defence burden and economic growth in the sample countries appears to run from defence burden to economic growth rather than vice versa.

Benoit argues that these results may suggest that the defence spending carries substantial positive effects on economic growth, at least to the extent of offsetting any adverse effects that defence spending may have had on growth. [81] This may be possible, as Benoit claims, since most part of any income that is not spent on defence, in developing countries, is usually put into consumption and much less into social

[80] The general belief for many economists prior to Benoit's findings is that defence spending is a major component of government expenditures which exceeds that of health and education in some cases, and May crowds out other forms of productive spending and civilian investments which will have adverse impact on the economic growth (Hou, 2009).

[81] Benoit (1973, 1978) provides a comprehensive discussion regarding the channels through which defence spending may carry some positive and negative effect on economic development. Deger and Sen (1995) summarize those effects in nine channels.

investment such as housing, which has little contribution to future production. Even that put into productive investment may have little effects on real economic growth, where productive investment in most developing countries are badly conceived or managed that they operate at uneconomically high cost which undermines their contributions to real economic growth. Thus, a heavy defence burden may increase resources utilization and economic growth with low opportunity cost.

Following Beniot's argument, Frederiksen and Looney (1983) suggest that the resource constraints faced by individual developing countries is probably what determines whether the impact of added defence spending is positive or negative on the economic growth. They hypothesize that in most developing countries the tendency is to maintain defence programs even if that could reduce other high growth development expenditures. They expect that an increase in defence expenditure is more likely to carry a negative impact on economic growth for developing countries with resource constraints, whilst developing countries with resource abundant may experience a positive impact, since they can afford to keep high growth development expenditures along with maintaining or even increasing defence spending. A sample of 74 developing countries was divided into two groups: resource - poor countries and resource – rich countries. Similar to that of Benoit they use a single ad hoc growth equation to estimate the relationship between defence spending and economic growth for each sub-sample over the period 1960-1978. As they expected, the results report a positive significant impact of defence spending on economic growth for resource – rich countries, and a negative impact, albeit not significant, for the group of resource – poor developing countries.

Biswas and Ram (1986) test Benoit's hypothesis for a sample of 58 countries over the period 1960-1977. They group the sample countries with accordance to World Bank's classification into two subgroups, law-income developing countries and middle-income developing countries. As to avoid the possibility of structural changes during the 1970s, they report estimates for two sub- periods 1960-1970 and 1970-1977 for both two subgroups samples (law-income and middle-income developing countries) as well as the estimated results for the whole sample. The results, however, are mixed, whilst results from the full sample and from middle-income group over the period 1960-1970 convey Benoit's findings; it is not the case for low-income sample where defence burden has negative and insignificant effect on growth. Moreover, the defence burden coefficient was not significant, and even with negative sign for low-income group, the full sample, and for the two sub-samples over the period 1970-1977. The study concludes that Benoit's findings have been special case, if Benoit has considered more developing countries and had separately treated both low-income and middle income developing countries his conclusion may have been more mixed and qualified.

Benoit's works have been criticised on s everal grounds including the proxies' variables used and the sample sensitivity, the misspecification of the relationships, as well as the used of a simple equation model that may neglect the complexity of such relationship (Deger, 1986; Biswas and Ram, 1986; Ram, 1995). Robert and Alexander (1990), on the other hand, suggest that there are always plausible justifications for expecting both positive and negative impact from defence spending on e conomic growth, and that makes the question of whether the defence expenditure has positive or negative effects an empirical one rather than a theoretical. Generally the empirical

works in the literature may be divided into: demand-side models, Supply-side models, demand and supply side models, and forms of Barro and Solow models in addition to Granger-causality test and different ad hoc specifications (Hou, 2009). Our review of the empirical works will try to group them according to the above classifications where a summary table of the empirical works for each classification is provided.

Concern with negative impact of defence expenditure from crowding out other forms of investments and its opportunity cost, some studies use the demand side model based in the initial work of Smith (1980) to capture such impact.[82] Defence expenditure is a component of aggregate demand, and therefore it competes with other forms of demand for resources. Smith investigates the opportunity cost of defence spending on investment in 14 OECD countries over the period 1954-1973. He estimates the relationship between investment and defence burden by us ing alternatives data treatment: time-series, pooled data, and cross-section sets. The results for all alternative sets suggest a negative effect of defence spending on investment.

Deger (1986b) employs a sample of 50 developing countries over the period 1965 – 1973 to assess the impact of defence spending on investment. She considers

[82] The demand side models can be derived from the Keynesian representation of aggregate demand , and may be expressed as: $Y= P – W = C + I + M +B$
Where Y is actual output, P is potential output, w is P – Y, C total consumption, I total investment, M is defence expenditure, and B is balance of trade.
Rearrange terms one can get : $i = 1 – w – c – m – b$
Smith (1980) suggests that consumption can be presented as: $C = \alpha_0 + \alpha_1 u + \alpha_2 g$,
then $i= (1 - \alpha_0) + \alpha_1 u + \alpha_2 g – m – (w + b)$
Where u is unemployment rate and g is the growth rate of output. Rearrange terms and assuming $(w + b)$ is function of u, thus $(w + b) = \beta u$, one can get :
$i= (1 - \alpha_0) – (\beta – \alpha_1) u + \alpha_2 g – m$
The possibility of crowding out of defence spending can be capture through the sign of m term in the last equation; if negative then defence spending has an adverse impact on investments and therefore on economic growth, see Hou (2009).

alternative forms of investment equation where the share of investment in GDP is regressed in defence burden and other control variables such as exports and balance of payment, all as share of total output. Based on cross – section estimates the results reports a significant negative impact on investment from defence expenditure for all alternative forms of investment equation used. Deger suggests that these empirical results imply the crowding out impact of defence spending on other form of investment has been operating in the study sample. Moreover, Knight et al (1996) use panel data for 79 developing countries over the period 1971-1985, to estimate the form of the relationship between defence burden and investment. The share of investment in fixed capital is regressed in the defence burden and other controlled variables such as openness of trade, the rate of investment in human capital, and a proxy for war incidence. Their findings suggest that defence burden has a significant negative impact on investment and the crowding out effects proved to exist.[83]

[83] This association with negative impact of defence expenditure as well as the neglect of the supply side have drawn some criticisms to the demand side studies (Hou, 2009).

Table 3.1: literature Survey (Some ad hoc and Demand-Side Empirical Studies on The Impact of Defence Expenditure on Economic Development)

Author(s)	*Sample*	*Remarks*	*Main Conclusion*
Ad hoc Studies			
Benoit (1973, 1978)	44 DCs, 1950-1965	Correlation and cross-sectional estimations.	Defence expenditures have a significant positive effect (spin-offs) on economic growth.
Frederiksen and Looney (1983)	74 DCs 1960-1978	Sub-samples (resources-rich countries, and resources poor countries) cross-sectional estimations.	Positive and significant impact of defence expenditure on economic growth for resources-rich countries, and negative but insignificant impact from defence expenditure to economic growth for resources-poor countries.
Biswas and Ram (1986)	58 DCs 1960-1970 and 1970-1978	Cross-section estimations	Although the results for middle-income sub-sample as well as that of the whole sample covey Benoit's finding, the result for low-income countries reflects a negative but insignificant impact of defence expenditure on economic growth.
Demand Side Studies			
Smith (1980)	14 OECD Countries 1954-1973	Time-series, pooled panel, and cross-sectional estimates	Three sets of results estimates (time series, pooled panel, and cross-section) all suggest negative impact of defence expenditure on investment.
Deger (1986b)	50 DCs 1965-1973	Cross-section estimations	Defence spending has a significant negative effect on investment.
Knight et al (1996)	79 Countries 1971-1985	Panel Data estimation (fixed effect technique)	Defence expenditure has a significant negative effect on investment.

Supply side view, on the other hand, suggests that the complexity of the relationship between defence expenditure and economic performance can be better off represented through the supply side model. Biswas and Ram (1986) argue that there are two main channels through which defence spending effects economic growth, one is through the positive and negative externalities of defence spending to the rest of the economy and the other one is through the possible factor productivity differences between the civilian sector and the defence sector. They suggest that the type of Feder model that based on a simple neoclassical function, where labour, capital, and defence spending enter as inputs, can decompose the effects of defence expenditure on economic growth through these two channels.[84] Biswas and Ram employ the two sectors Feder model to assess the relationship between defence expenditure and economic growth for a sample of 58 countries that consists of two subsamples (17 low-income developing countries and 41 Middle-income developing countries) over the periods 1960-1970, and 1970-1977. The results of cross-section estimates for both subsamples over the two periods suggest the absence of any significant externalities effect from defence expenditure to civilian output. The results also show the lack of any

[84] They used a two sectors model developed initially by Feder (1983) to capture the effects of exports sector on economic growth, Biswas and Ram used Feder model to analyse the effect of military expenditure on economic growth where the economy is divided to two sectors, military sector (M) and civilian sector (C). Assuming labour (L) and capital (K) are the only inputs in each sector, and that the military sector (M) output has externalities effects on the civilian output (C). Thus, the production functions of two sector can be written as:

$$C = C(L_C, K_C, M), \quad M = M(L_M, K_M)$$

The total usage of inputs can be expressed as:

$$L_C + L_M = L, \quad K_C + K_M = K$$

Assume Y is the total output of the two sectors ($Y = C + M$), the model allows the marginal productivities of labour L and that of capita K to differ across the two sectors. Thus, $M_L/C_L = M_K/C_K = 1+\delta$, and C_M (∂ C/∂ M) captures the externalities effects of military sector on the civilian sector. δ is the factor productivity difference between the two sectors. With few assumptions and some manipulations Feder shows that one can derive the following econometric specification:

$$y = \alpha (I/Y) + \beta (l) + [(\delta/1+\delta) - \theta] m (M/Y) + \theta m$$

Where (y) is the growth rate of output, (I/Y) is the ratio of investment (I), and (M/Y) is the ratio of military spending (M) to total output (Y), (l) is the growth rate of labour (L), $\theta = C_M [M/(Y- M)]$, and (m) is the growth rate of military spending (M). This model allows to estimate separately the externality effects through the term (θ m) and the factor productivity effect through the term $[(\delta/1+\delta) - \theta] m (M/Y)$ in the previous equation.

significant factor productivity differences across the two sectors. The study concludes that these results suggest that defence spending neither helps nor harms the economic growth in developing countries.

Feder model has widely been used in the literature of defence and economic growth nexus, and usually quoted as Feder-Ram type. Mintz and Stevenson (1995) for example, construct a three-sectors Feder-Ram model, that consist of civilian sector, military sector and non-military public sector, to investigate the effect of defence spending on economic growth for a sample of 103 countries over different periods between 1950-1985. They used the time series data to estimate the model for each county in the sample. The results indicate that the non-military public spending has a significant positive effect on economic growth for most countries in the sample, whereas defence expenditure appears to have no significant effect on economic growth for most countries. Thus, the study suggests that the governments should not be encouraged in expanding military programs for economic purpose.

Murdoch et al (1997) also considers a three-sector Feder-Ram model for number of Asian and Latin American countries (8 Asian countries and 16 Latin American countries) over the period 1955-1988. The reported results are based on the estimates of time series data for each country in the sample, as well as on the estimates from pooled panel data for each cohort (Asian countries and Latin American countries). Time series estimates were inconclusive about the impact of defence spending on economic growth, whilst those drawn from the pooled panel data indicate that defence expenditure and other government's outlays are both growth promoting in both subsamples; Asian countries and Latin American countries. However, the results

imply that defence spending and other forms of government expenditure are more productive in Asian countries than in Latin American countries.

Although the Feder-Ram model type has widely been used in the defence literature it has been criticised on several grounds even from Ram (1995) him self. Recently Alexander and Hansen (2004) report several shortcomings of the models include some theoretical misspecifications and econometrics weaknesses such as, simultaneity bias, a high possibility of multicollinearity between the last two terms in the estimated equation (see the previous footnote), the model is static and without lagged dependent variable…etc, see also Dunne et al (2005) for future details.

Other group of studies employs simultaneous equation models (SEM) which incorporate both the demand and supply sides, to assess the interrelationships that characterize the defence-development nexus. Deger and Sen (1983), and Deger (1986a) argue that since there are number of channels through which defence expenditure may influence economic growth positively and/or negatively: the spin-offs effects, indirect effect on saving and investment, balance of payment problem(if large armaments are imported), the SEM therefore may provide better insight about these interrelationships.[85] The demand-supply model has been employed in the defence literature and is known, by and large, as "Deger type" model.

[85] Different SEM frameworks have been proposed in the literature, Deger and Sen (1995), for instance suggest the 4-equations SEM to represent the interrelationships between defence expenditure and other economic variables as follow:

$$G= a_0 + a_1 s + a_2 m + a_3 B + a_4 Z1$$
$$S= b_0 + b_1 m + b_2 g + b_3 B + b_4 Z2$$
$$B= c_0 + c_1 m + c_2 g + c_3 Z3$$
$$M= d_0 + d_1 Z4$$

where g is the growth rate of GDP, S is saving ratio, m is defence burden, B is the trade balance share in GDP, Z_i are a set of exogenous variables chosen through data specification, and (a_i, b_i, c_i, d_i) are the sets of parameters.

Deger (1986b) constructs a simultaneous equation model that consists of three equations (growth equation, saving equation, and military burden), to investigate the interrelationships among defence burden, saving, and economic growth for a sample of 50 de veloping countries over the period 1965-1973. Based on three stage least squares (3SLS) estimates, the results report a positive significant effect from defence burden to economic growth, but a larger significant negative effect on saving from the defence burden appears to out-weighted the positive effect on gr owth. The overall effect of defence burden is negative. Klein (2004) analyses the effect of defence expenditure on economic growth for Peru over the period 1970-1997, using the Deger type model of three simultaneous equations. Results estimates of the 2SLS and 3SLS indicate a positive direct effect on growth from defence burden, yet the overall effects of defence burden seem to retard growth. The indirect adverse effects of defence burden on saving overweight the positive direct effect.

Moreover, Hou (2009) models the defence-development relationship in India for the period 1970-2003, on the notion of Deger type model that consists of four simultaneous equations, growth equation, saving equation, balance of trade equation, and defence equation. Similar to the earlier findings, the reported estimate of GMM suggest a significant direct positive effect of defence outlay on e conomic growth, however, the negative indirect effects of defence spending on saving and on balance of trade dominate the positive direct effect. The study concludes as the empirical findings suggest that an increase in defence expenditure is likely to reduce the long run economic growth rate in India.

The Deger type model, however, has been criticized for lack of well established theoretical ground as well as the ad hoc empirical specifications. Hartely (2006)

argues that one of the shortcomings of Deger model type is that military demand equation is limited and less satisfactory since it is not based on a demand for military expenditure function.

Table 3.2: Literature Survey (Supply-Side Model "Feder-Ram type" and Deger model type)

Auther(s)	*Sample*	*Remarks*	*Main Conclusion*
Feder-Ram type			
Biswas and Ram (1986)	58 DC 1960-1970 and 1970-1978	Cross-section estimations	Defence expenditure has no significant effects on economic growth.
Mintz and Stevenson (1995)	103 Countries	Longitudinal time series estimations	Defence expenditure appears to have no significant effects on economic growth for most countries.
Murdoch et al (1997)	24 DCs (8 Asian and 16 Latin American) over different periods between 1955-1988	Time-series estimation for each country as well as pooled panel estimation for each group: (Asia countries and Latin American countries).	Time series results were inconclusive about the impact of defence expenditure on economic growth. Results of pooled panel data, on the other hand, suggest a positive effect from defence expenditure to economic growth in both sub-samples.
Deger model type			
Deger (1986a)	50 DCs 1965-1973	Cross-section estimations	Defence spending has a significant positive effect on growth rate of output, but carries a larger negative effect on saving. The overall impact of defence expenditure is negative.
Klein (2004)	One country (Peru)	Time series estimation (2SLS and 3SLS techniques)	Defence expenditure has direct positive effect on economic growth, but also has a negative significant effect on saving. The overall effect is negative. Defence expenditure retards economic growth.
Hou (2009)	One country (India)	Time series estimation (GMM)	Direct positive effect from defence outlay to economic growth and negative indirect effect on saving. The overall impact of defence expenditure is negative.

On the other hand, Dunne et al (2005) note that the models that widely considered in defence literature to investigate the defence-development relationship, such as Feder-Ram type, have not been considered in the mainstream growth literature. They argue that the well-established growth models employed in mainstream growth literature, such as that of Barro or that of Solow may provide more promising avenue to assess the relationship between defence and economic growth. Number of studies in defence-growth relationship have considered Solow model to analyse such relationship.[86]

Knight et al (1996) employed the Augmented Solow model that incorporates the defence variable along with other controlled variable to estimate the effect of defence burden on economic development for a sample of 79 countries over the period 1971-1985. The results of the panel data estimates show a significant negative impact from defence burden to economic growth. Moreover, the estimated results of the model without the military expenditure have shown that the inclusion of military variable into the model caused a reduction in the absolute size of the coefficients of other explanatory variables (investment, human capital, and openness variables). The study concludes that the defence burden seems to harm the economic development through crowding out other form of spending and by raising the trade restrictions intensity.

[86] The main assumption on which the impact of defence burden on economic growth is derived in the context of Solow model is through the effects of military burden (M/Y) on technological progress. This assumption has been criticised, however, where the defence spending may have ad hoc direct effect (externalities) on growth (Dunne et al, 2005). Thus, considering Augmented Solow model perhaps is more appropriate.
The augmented Solow model with defence variable can be written as:

$$G = \alpha_0 + \alpha_1 \ln y_0 + \alpha_2 \ln k + \alpha_3 \ln h + \alpha_4 \ln(n+g+\delta) + \alpha_5 \ln m$$

Where G is the growth rate of output per capita, y_0 is initial output per capita, k is investment, h is human capital, $(n+g+\delta)$ is the growth rate of effective labour and the depreciation rate, and m is military burden.

Yakovlev (2007) analyses the effects of defence expenditure, and net arms exports on economic growth using augmented Solow model for a sample of 28 countries over the period 1965-2000. The results of panel data estimates indicate that both defence burden and net arms exports appear to retard the economic growth in the study sample. Hou (2009) also consider the augmented Solow model for a sample of 36 developing countries over the period 1975-2004. Her findings, based on cross-section and panel data techniques, show a negative direct effect from defence spending to economic growth. She further investigates the possibility of peace dividends after the Cold War by estimating the model for two sub periods: "Cold War" and "Post Cold War".[87] The results support the existence of peace dividends in the sample, the negative effect of defence expenditure on economic growth has diminished for the post Cold War period relative to that of Cold War period. The study concludes that the estimated results significantly indicate that defence expenditure retards economic growth in developing countries.

In fact, there are countless numbers of empirical works on the defence- development relationship, where various theories, hypothesis, and techniques have been applied to investigate the form of the relationship between the two variables.[88] For the purpose of this study, however, we will further survey some of the empirical works that have focused on the GCC countries and on Middle East region as whole with a summary table of the surveyed empirical studies is provided in Table 3.4.

[87] The decline in military expenditure in the world after the end of Cold War 1990 is assumed to stimulate the economic development in developing countries.

[88] For comprehensive surveys regarding the models that have been considered in defence-development nexus as well as the empirical works that have been carried out in the field see, for example, Deger and Sen (1995), Ram (1995), and Hou et al (2009)

Table 3.3: Literature survey: (Solow Model)

Auther(s)	*Sample*	*Remarks*	*Main Conclusion*
Knight et al (1996)	79 Countries 1971-1985	Panel Data estimation (fixed effect technique)	Defence expenditure has a significant negative effect on economic growth.
Yakovev (2007)	28 Countries 1965-2000	Panel Data estimation (fixed effect, random effect, and GMM techniques)	Defence expenditure and net arms exports both have negative impact on economic growth.
Hou (2009)	36 DCs, 1975-2004	Cross- section and Panel Data estimations (GMM technique)	Defence spending has significant negative impact on economic growth. Findings also support the existence of peace dividends as results of the end of Cold War.

The high defence burden that characterized most countries in the Middle East region has drawn the attentions of some researchers, as mentioned earlier, to assess the impact of such heavy burden on the development process in the region. Lebovic and Ishaq (1987) observed the striking tendency in most countries in the region to higher defence burden, the region defence expenditures between the 1970s and early 1980s account for one-third of that of developing countries and around one half of the world arms imports. They analyse the impact of defence burden on economic growth in the region by constructing a system of simultaneous equations (Deger type Model) which consists of three equations – growth equation, investment equation, and military burden equation – for a sample of 17 Middle Eastern countries over the period 1973-1982. Similar to that of Frederiksen and Looney's classification, the study groups the sample into two sub-groups "oil-exporting" countries and "non-oil-exporting" countries. The results of pooled panel suggest a significant negative impact from defence expenditure to economic growth and to investment in non-oil-exporting countries. The results, however, suggest the absence of statistically significant pattern for the whole sample. On the other hand, the data limitation for most oil-exporting countries prevents the study from identified the form of the relationship between economic growth and military expenditure in those countries.

Looney (1991) also examines the impact of the heavy defence burden on the industrial development in the Arab countries. The study tries to assess whether the military expenditure provides positive externalities to the industrial activities in the region, or it just simply depresses the industrial development by diverting the resources away from industrial activities. For a sample of 20 Arab countries over the period 1974-1985, Looney estimates ad hoc equations where the manufacturing share of the total

output is regressed on military expenditure and other forms of government expenditures along with some controlled variables. The results show that the military expenditure has no significant impact on the industrial development, whilst the non-defence government expenditure appears to retard the industrial expansion in the region. The study concludes that the reallocation of government expenditure from public consumption to capital formation perhaps is more effective policy to expand private sector development in the Arab countries rather than cut-off defence expenditure.[89]

Another work by Looney (1999), has focused only on one oil-exporting country in the region, Saudi Arabia, which is known to be a highly defence spending developing country. Looney argues that the share of military expenditure in Saudi Arabia accounts, on average, for one-third of the government budget allocations. The study investigate whether this high share of defence expenditure has been at the expense (tradeoffs) of other budget categories, such as infrastructure, economic services, health and education, transport and communication…etc. A cointegration analysis in the context of ECM is carried out between defence expenditure and each category of government budget over the periods 1979-1995. The general pattern that comes out of the findings is that change in defence expenditure has a significant large impact on the adjustment of other major budget categories. The impact of increasing defence expenditure tends to be positive in the short-run for both economic and human services; however, it comes at the expense of allocations to the economy in the long-run. For human resources development and health services sectors no tradeoffs with

[89] Looney (1994) duplicates his work again with slightly longer span of data 1974-1987, the results, however, were similar.

defence expenditure appears to occur. Defence and social sectors both seem to be more protected from budgetary cuts during period of austerity.

Al-Yousif (2002) constructs Granger-causality test within a multivariate ECM framework to analyse the direction of causation between defence expenditure and economic growth for each country in a sample of six Arabic Gulf states (Bahrain, Iran, Kuwait, Oman, Saudi Arabia, and UAE) over the period of 1975-1998. The results tend to be country specific and no generalization can be made across countries, whilst causality appears to run from defence to growth for one country, it is a bi-directional or independent relation for another country.[90] The study concludes that the defence expenditure decisions should be based on t he socio-economic circumstances for individual country, and calls for further empirical studies using time series data for individual countries.

Abu-Bader and Abu-Qarn (2003) chose three Middle Eastern countries (Egypt, Israel, and Syria) in particular, which have been the major participants in the Arab-Israeli war, to examine the relationship between military expenditures and economic growth over the period 1967-1998. They employ Granger-Causality test within a multivariate ECM framework where the government expenditure broken down into civilian and military expenditures. The reported results suggest that military expenditure has a negative impact on economic growth for all three countries, whilst the government civilian expenditure has a positive impact on the economic growth in Egypt and Israel but negatively affects the long-run economic growth in Syria. Their results future suggest that the defence expenditure appears to be independent from economic growth

[90] Results of the study based on relatively low span of time series (23 observations); therefore, they should be viewed with caution.

and other government outlays, which may suggest that the military expenditure in the Middle East is determined by ge opolitical atmosphere rather than by economic factors.

Moreover, Yildirim et al (2005) investigate the relationship between defence expenditure and economic growth for a sample of 13 Middle Eastern countries over the period 1989-1999, by constructing a two-sector Feder-Ram model that consists of civilian sector and defence sector. Using cross-section and dynamic panel techniques, the reported results reflects a significant positive effect from defence expenditure to economic growth. The results also indicate that the military sector seems to be more productive than the civilian sector. Perhaps that is because of the high-technology involvement within the military sector compare to the civilian sector as the analysis suggests.

Table 3.4 provides a summary of all empirical studies on the Middle East region that reviewed in this study.

Table 3.4: Literature Survey on Defence and Economic Development in the Middle East region

Author	*Sample*	*Model*	*Remarks*	*Main Conclusion*
Lebovic and Ishaq (1987)	17 DCs (Middle East) 1973-1982	Deger type model (Three equations: growth equation, investment equation, and defence equation)	Sub-samples (oil-exporting countries, and non-oil-exporting countries) pooled panel estimation (2SLS).	Defence expenditure has a significant negative effect on both economic growth and investment in non-oil-exporting countries. However, no results were obtained for oil-exporting countries, and no significant relationship is found between the two variables for the whole sample.
Looney (1991, 1994)	20 DCs (Middle East) 1974-1985 (Looney 1991), and 1974-1987 (Looney 1994)	Ad hoc equation where the share of manufacturing of total output is regressed in defence burden and other controlled variables.	Cross-section estimations	Military expenditure has no significant impact on the industrial development,.
Looney (1999)	one country (Saudi Arabia) 1979-1995	Cointegration and ECM, a trade-offs analysis between defence share and each category of budgetary allocations	Time series estimation	The impact of increasing defence expenditure tends to be positive in the short-run for both economic and human services; however it comes at the expense of allocations to the economy in the long-run
Al-Yousif (2002)	6 DCs 1975-1998	Granger-causality test within ECM	Time series estimation	No generalization can be made across countries; the results tend to be country specific.
Abu-Bader and Abu-Qarn (2003)	3 countries 1975-1998 (Egypt), 1967-1998 (Israel), and 1973-1998 (Syria)	Granger-causality test within ECM	Time series estimation	Military expenditure has a negative impact on economic growth for all three countries.
Yildirim et al (2005)	13 DCs (Middle East) 1989-1999	Two sectors Feder-Ram model: civilian sector and defence sector	cross-section and dynamic panel estimation (fixed-effect and GMM)	Defence spending has a significant positive effect on economic growth.

3.4 EMPIRICAL MOTHODOLOGY

The predictions of economic theory with regard to the form of the relationship between defence spending and economic growth is somewhat ambiguous, whilst the defence spending may carry positive externalities to the economy (direct effects), it may also crowd out other forms of outlays that perhaps are more growth promoting (indirect effects). Robert and Alexander (1990), and Alexander and Hansen (2004) suggest that is why most studies in the field have attempted to address the question empirically. Over the years, since Benoit (1973) work, the empirical works on the defence-growth nexus have been carried out using variety of different approaches as we reviewed some in the previous section. However, Deger and Sen (1995) argue that although a large number of those works have used ad hoc specifications to model the relationship, those specifications and the variables proxies employed have usually implicitly followed the economic theoretical arguments that address the relationship between the two variables, as some were discussed in earlier section (e.g. supply side view, demand side view).

The multiplicity of channels through which defence expenditure affects economic development, nonetheless, has complicated the modelling of the relationship between the two variables, and raised up some econometrics concerns such as exogeneity, simultaneity bias, and causality that associated with the estimates of a single equation used to capture the relationship between the variables (Deger, 1986a; Deger and Sen, 1995).[91] They propose the use of simultaneous equations model – Deger type model – as a viable way to model the interrelationships between defence spending and

[91] Earlier section presents some econometrics problems that associated with some techniques used in the literature. However, Ram (1995), and Hartley (2006), provide some comprehensive critical discussions on the econometrics issues of the existing empirical works.

economic development. Other scholars in the field, Ram (1995) and Hartley (2006) among others, also recommend the system of simultaneous equations model to be considered whenever data allows; a co mplex simultaneous equation model may capture the total effects of defence expenditure where it distinguishes between demand side effects (such as crowding out effects on i nvestment) and supply side effects (spin-offs from military expenditure), as well as it can control for the problem of simultaneity bias among variables.

Due to data availability for most country in our sample the use of the system of simultaneous model is beyond the scope of this study. The limited number of countries in our sample also makes the use of cross-section and pooled panel techniques not encouraging. Ram (1995) suggests that findings from cross-section studies and that from single-country studies should be viewed as complimentary to each other rather than competing alternatives.[92] Using time series data for four individual countries, the study constructs an econometrics specification based on the conventional production function model as an attempt to reflect the relationship between defence and economic development in the GCC countries.[93]

The conventional production function in the form of Cobb – Douglas model is as follow:

$$Q = A K^{\alpha} L^{\beta}$$

Where Q is the total output, K is country's capital stock, L is labour force, and A is technological progress. The logarithm form of the equation is as follow:

[92] Ram argues that cross-section data may reveal important inferences about the defence-development nexus, once reasonable evidences from individual-country studies have accumulated.
[93] This approach is widely common one in measuring the impact of public capital on economic growth as we shell see in the next chapter.

$$\ln Q = a + \alpha \ln K + \beta \ln L$$

Real GDP will represent the level of income Q, and the real gross capital formation is used as proxy for the capital stock K since data on the stock of capital are not available.[94] Due to the lack of data on the labour force for long period in all countries in the sample the Population variable is used as proxy for Labour force as change in labour force show little volatility in short-run, and this proxy has been considered as an indicator of labour force, see for example Biswas and Ram (1986), Lebovic and Ishaq (1987). The model can be augmented with military variable as proxy for technological progress as well as to capture the causal relationship, if any, between economic development and real defence spending D. The econometric model of the previous equation can be written, after augmented with defence variable D, as follow:

$$\text{Ln GDP} = \alpha_0 + \alpha_1 \ln K + \alpha_2 \ln L + \alpha_3 \ln D + \varepsilon \qquad (1)$$

Where GDP is the level of real GDP, K, the proxy of capital stocks "the real gross capital formation", L is population variable as proxy for labour force, D is the real defence expenditure of a country, and ε is the error term. All variables are measured in the real terms of 2000 prices. In order to develop the dynamics of the model as well as to avoid the simultaneity bias, the study employs the Vector Autoregressive (VAR) framework to estimate the previous equation, equation 1.

The Vector Autoregression model VAR is a reliable framework that has widely been used in the economics literature. VAR provides a powerful and reliable approach to data description, forecasting, structural inference, and policy analysis (Sim, 1980). A

[94] Investment figures are usually used to measure a country's capital stocks in literature of the impact of capital on growth, see for example Balasubramanyam et al (1996), Greenaway et al (2007). We follow Jorgenson (1973) and (1980) by constructing a series of capital stocks using capital formation data. However, we report here the results using the published data of capital formation since the resultant series yield identical statistical results to those of the actual one.

VAR approach treats each variable in the system as function of the lagged values of all endogenous variables in the system and thus simultaneity is not an issue and OLS yields consistent estimates. Although the individual coefficients in the VAR system are usually difficult to interpret, the VAR framework provides a systematic way to analyse the dynamic response of the system from random disturbance (Stock and Watson, 2001). From the VAR it self it is possible to extract some information about the reaction of all variables in the system to a sudden disturbance in the value of a given variable, and how long it would take such impact to work through the system.[95] Such information can be revealed through the examination of the so-called impulse response function IRF of the VAR system which could be more informative than the estimated coefficients of the VAR system.

Impulse responses depict the responsiveness of the dependent variables in the VAR system to a one unit shock to each innovation; error, of the VAR system – assuming that this error returns to zero in the following periods and that all other errors in the system are constant (Stock and Watson, 2001)–. These are one-off disturbances, and give some information about the short-run impact of the variables on each other.

Furthermore, the subsequent development on multivariate unit roots, see for example Johansen (1988, 1992, 1995), makes it possible, when all variables in the system are not level stationary I (0), to examine the existence of possible long-run relationships between the variables in the VAR system. However, the presence of long-run relationship would require the discovery of cointegration relationships between particular variables, and then the estimation of vector error correction model (ECM).

[95] Although F-test suggests which variables have significant impact on the future values of other variables in the system, it is not able to explain the sign of the relationship or the lengths of time these effects need to take place (Brooks, 2008).

Two or more variables are said to be cointegrated if they possess the same order of integration (same I(p)), and the linear combination of them ε_t is level stationary, integrated of order zero I(0). Engle and Granger (1987) argue that if two or more variables are cointegrated then, this may reveal inherited long run relationship between them.

Thus, a VAR with p lags is as follow:

$$y_t = A_1\, y_{t-1} + \ldots + A_p\, y_{t-p} + \varepsilon_t$$

Where y_t is a k-vectors of unit root non-stationary variables, As are vectors of βs coefficients, and ε_t is a vector of errors "innovations". To employ the Johansen cointegration test the previous equation needs to be formulated into a vector error correction model (ECM) of the form:

$$\Delta y_t = \prod y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t$$

Here: $\prod = \sum_{i=1}^{p} Ai - I$; and, $\Gamma i = -\sum_{j=i+1}^{p} Aj$

Granger's representation theorem suggests that if the coefficient matrix Π has reduced rank r < k, then the long-run matrix can be written as:

$$\Pi = \alpha\beta' \;:\; \alpha = k \times r,\;\; \beta' = r \times k,$$

Where: r is the number of cointegration relationships between the variables (the rank of the matrix Π), β is the matrix of the coefficients in the cointegration relationships between the k variables, and α is the matrix of the speed of adjustment parameters in the VEC model. To determine the number of cointegration relationships in the VAR system, the trace statistic test and the Maximum eigenvalue statistics test of

Johansen's approach are employed. [96] The existence of cointegration between the variables in the system may imply the presence of cointegration space, but that does not necessarily imply these relationships are identified/unique (have a meaningful economic insight). Normalization is a common practice to identify a long-rung cointegration relationship (CV) between the variables, by imposing restrictions on (βs) the coefficients of the variables in the cointegration vectors/equations, and/or on those of their loading vectors (αs), the speed of adjustment coefficients, in the VEC model. Restrictions imposed on these coefficients usually follow the economic theory implications about the possible relationships between the variables in the system. To identify the cointegration vectors in the system the theoretical implications from the underline theoretical argument of our model "production function" will be considered. However, it might not be possible to restrict a given CV to have the structure that the theory suggests.

3.5 SOURCES OF DATA

The data of the variables employed in the analysis are time series data for 4 individual GCC countries (Qatar and Kuwait are excluded due to the lack of historical data for Qatar and irregularity in Kuwait data). The data for the variables, Gross Domestic Product (GDP), Gross Capital Formation, and population, are all obtained from the International Monetary Fund publication "*international Financial Statistic"(2009).* The Data for military expenditure up to 1988 is obtained from different issues of the

[96] Johansen's maximum likelihood approach consists of two cointegration tests, the Trace statistic and the Maximum eigenvalue statistic:

$$LR_{tr}(r) = -T\sum_{i=r+1}^{k}\ln(1-\lambda_i)\text{ , and }\ LR_{\max}(r, r+1) = -T\ln(1-\lambda_{r+1})$$

These tests statistics are computed for r = 0, 1, . . ., k-1. Where r is the number of cointegration vectors under the null hypothesis, and λs are the estimated eigenvalues from Π matrix.

Stockholm International Peace Research Institute (SIPRI) "Year *Book on World Armament and Disarmament",* whilst data from 1988 onw ard is obtained from database of the SIPRI website "www.sipri.org".[97] Yet the accuracy of military expenditure data is problematic, since the original source of the data viz. governments use different procedures and standards for data collection and have the motive to hide the actual figures from critics and foreign adversaries, (Lebovic and Ishaq, 1987; Dunne and Uye, 2009).

The different sample periods are as follow: Bahrain (1975 – 2005), Oman (1975 – 2007), Saudi Arabia (1963 – 2008), and United Arab Emirates (UAE) (1972 – 2005).[98]

[97] Most studies in the field employ the data from SIPRI, Al-Yousif (2002) argues that SIPRI data is preferable since it covers most countries in the world for a longer period of time compare to other sources of military data such as *World Military Expenditure and Arms Transfer* by US Arm Control and Disarmament Agency (ACDA), the *Government Financial Statistics* of IMF …etc. The SIPRI data is also available in the current and constant prices of the local currencies and in the US dollar.

[98] Data of military expenditure for Bahrain and United Arab Emirates (UAE) are missing form 2006 and onward.

3.6 EMPIRICAL INVESTIGATION

3.6.1 UNIT ROOT TESTS

We begin the empirical analysis, as in first chapter, with unit root tests in order to determine the order of integration of each variable considered. Two alternative unit root tests, the Augmented Ducky-Fuller (ADF) test and Philips-Perron (PP) test, are considered here to assess the degree of integration (stationarity) of each variable in the sample. The results of both tests for the level and the first difference forms of each variable for all countries are reported in Table 3.5. The tests statistics of both tests ADF and PP show that the null hypothesis of a unit root in the level form of all four variables (Gross Domestic Product GDP, Capital formation K, Defence expenditure D, and population L) cannot be rejected in all countries in our sample.

In case of Bahrain and Oman, both tests suggest that all four variables are first difference stationary I(1) at 5% level of significant or better except population variable which is found to be first difference stationary at 10% level based on ADF but not on PP. However, a third unit root test - Kwiatkowski-Phillips-Schmidt-Shin – KPSS test shows that the population variable L is first difference stationary at 5% level of significant in both countries.[99] The results of the unit root tests for the other two countries, Saudi Arabia and UAE, shows that all four variables are first difference stationary I(1) at 5% level of significance or better.

[99] The test statistics of KPSS test for L variable for both countries is as follow: t-stat [ ].and the 5% level ( ): Bahrain [0.080] (0.146), Oman [0.098] (0.146).

Table 3.5 : Unit Root Tests:

H0: the variable has a unit root

Country	Variables	Order of integration	ADF	K	P-P	L
Bahrain	GDP	I (0)	2.133	0	2.079	2
	K	I (0)	0.754	3	0.668	1
1975- 2006 (32)	D	I (0)	1.858	5	1.134	4
	L	I (0)	-3.599	1	-1.915	0
	ΔGDP	I (1)	-4.117***	0	-4.162***	3
	ΔK	I (1)	-2.241**	2	-3.603**	0
	ΔD	I (1)	-4.632***	7	-3.616**	3
	ΔL	I (1)	-1.882*	0	-1.550	3
Oman	GDP	I (0)	-0.699	0	-0.698418	6
	K	I (0)	0.832	0	0.667869	1
1975 - 2007 (33)	D	I (0)	-2.019	0	-2.024382	1
	L	I (0)	-3.027	6	-0.724775	4
	ΔGDP	I (1)	-4.689***	0	-4.632***	9
	ΔK	I (1)	-4.415***	0	-4.415***	0
	ΔD	I (1)	-5.843***	0	-5.803***	2
	ΔL	I (1)	-1.735*	5	-1.548	4
Saudi Arabia	GDP	I (0)	-1.727	1	-1.585	1
	K	I (0)	-1.495	2	-1.881	4
1963 - 2008 (46)	D	I (0)	-2.430	0	-2.434	1
	L	I (0)	-2.594	4	-1.796	5
	ΔGDP	I (1)	-3.899***	1	-3.698***	5
	ΔK	I (1)	-2.408**	1	-3.129***	4
	ΔD	I (1)	-6.015***	0	-6.056***	3
	ΔL	I (2)	-1.991**	2	-1.896*	3
UAE	GDP	I (0)	-2.366	0	-2.492	3
	K	I (0)	-2.272	0	-2.483	3
1972 - 2005 (34)	D	I (0)	-1.364	5	1.134	4
	L	I (0)	1.164	3	-0.186	5
	ΔGDP	I (1)	-4.373**	0	-4.300***	1
	ΔK	I (1)	-3.440**	0	-3.440**	0
	ΔD	I (1)	-4.632***	7	-3.616**	3
	ΔL	I (1)	-5.175***	3	-3.082**	4

Note: k is the degree of augmentation in ADF tests determined automatically based on (SIC). L is the bandwidth determined automatically based on (Newly-West Bandwidth).
Three asterisks *** indicates the significance at 1%, two asterisks ** indicate the significance at 5%, and one asterisk * indicates the significant at 10% level.

The second step in our analysis is to estimate a stable VAR system for each country in the sample, and try to extract the impulse responses and variance decompositions for

each VAR.[100] Cointegration test then is carried out to test for a possible stable long run relationship between the variables in each VAR system. The maximum likelihood method of Johansen (1988) is considered here to detect the presence of cointegration among the variables. If cointegration exists, we identify the cointegration vector (CV) and estimate the Vector Error Correction Model (ECM). The empirical analysis for each country in our sample is as follow:

3.6.2 BAHRAIN

3.6.2.1 VAR ESTIMATION, IMPULSE RESPONSES, AND VARIANCE DECOMPOSITIONS

To determine the appropriate lag length for a VAR is, in practice, the first step to identify a stable VAR system. The test for lag length suggests the system is stable with one lag; the roots of the companion matrix are all less than one in absolute value. Moreover, the VAR produces residuals that have reasonable properties: they are normally distributed and there is neither auto-correlation nor heteroskedasticity, Appendixes A1. Thus, we carry on and test for cointegration, but first we would be interested in examine the dynamic of the VARs system using both the impulse responses and variance decompositions methods and see if they can be revealing.

[100] The graphs of the variables show that most variables have trend; and thus a trend was included in the VARs.

3.6.2.2 IMPULSE RESPONSES

We provide here the impulse responses of GDP to the shocks in the other three variables – capital K, Defence D, Labour L - in the VAR system. Both the impulse response functions of Cholesky decomposition and those of Generalized Responses of Pesaran and Shin (1998) are depicted here with two standard error bands above and below the function as in Figure 3.2.

The Cholesky responses of GDP from one-off innovations to defence D are similar in time-profile and magnitude to those produced by generalized responses: and are not too dissimilar with those with respect to innovations to capital K as in Figure 3.2. Thus, as the correlation matrix of the residuals from VAR suggests, the ordering of the variables in VAR does matter but only slightly. [101] The plotted responses in figure 3.2 show that after the one-off innovations to defence D, income Y increases constantly for three years before it starts slowly receding over the periods. This finding for Bahrain is in line with Benoit's argument of positive effect of defence spending on economic development in developing countries. Defence spending may carry some benefits to Bahraini economy; through the engagement of military programs in some public works – e.g. roads, airports, communication networks – as well as the process of modernization. Technological and skills transfer could be another channel through which Bahraini economy has benefited from defence expenditure. Bahrain, as other GCC countries, has a tied relationship with the some of

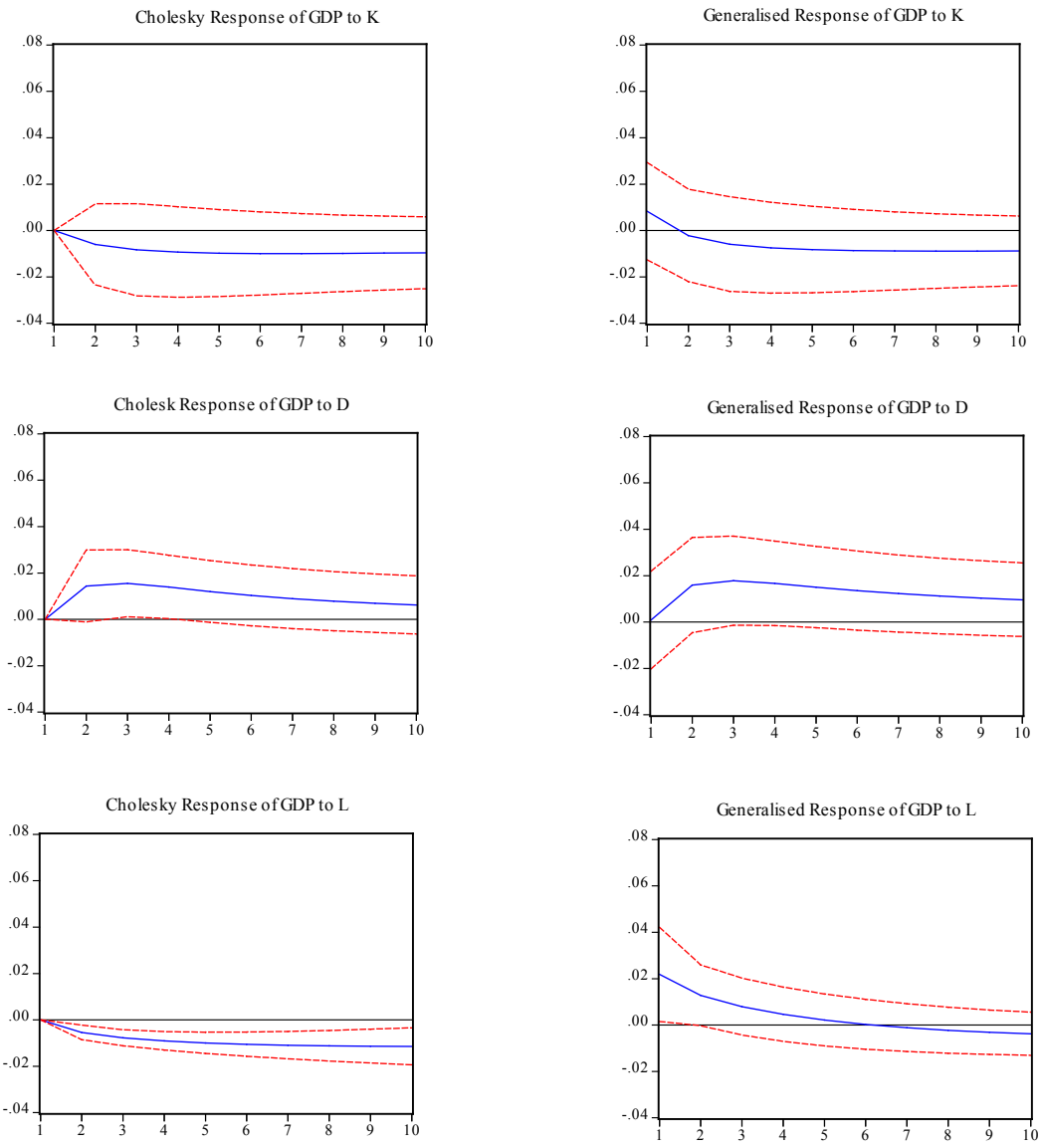
[101] Cholesky decomposition assumes that the correlation between the residuals across the equations is zero. If, however, the condition does not hold the impulse responses will depend upon the order in which the variables have entered in the VAR system. The Generalized responses method of Pesaran and Shin (1998) provides an alternative way to proceed in such case by placing the targeted variable, upon which the impulses are being evaluated, at first. The rest of the variables are ordered according to the correlation among the variables.

the most powerful countries in the world, United States and United Kingdom, which have the most advance technologies and skills in many fields including defence. Bahrain had been under the British maritime protection since 1835 until 1971 (Ulrichsen, 2009), and the year of 1998 marked the 50th anniversary of the American naval command presence in Bahrain (U.S Middle East Force), with the American Fifth Fleet headquartered there since 1995 (Katzman, 2008).[102]

Shocks to capital (K) and Labour (L) variables seem to have adverse effects on GDP. GDP responses negatively to an increase in both variables and these negative impacts appear to persist over the periods as in figure 3.2. The negative impact of capital (K) on GDP could be attributed to the inefficiency in allocating investments in the economy as it is the case in many countries in the Middle East region (see for example, Makdisi et al, 2003; Harb, 2009). The negative impact of Labour (L) on GDP perhaps related to the proxy used for labour force, population, as being inadequate proxy for labour force. Growing population, with low human capital formation – in a small undiversified economy that has witnessed decline in oil exports for many years (Ulrichsen, 2009) – may have negative impact in the economy.

[102] Citing Bahrain limited income, U.S military aids to Bahrain have been supported by the Congress and the successive Administrations (Katztman, 2008), which may have been beneficiary to Bahrain's economy. For example, Bahrain receives about $200,000-$400,000 a year worth of IMET (International Military Education and Training) as military training assistance form United States, (Cordesman, 1998).

Figure 3.2: Impulse responses of real GDP for Bahrain



3.6.2.3 VARIANCE DECOMPOSITIONS

Variance decompositions offer another method to analyse the dynamic of the VAR system which, to some extent, gives similar information to that drawn of the impulse responses functions (Brooks, 2008). They break down the variation of the dependent variables into the component shocks to the VAR system. In other word, each variable

is explained as linear function of its own current innovations and the lagged innovations of all variables in the system. Thus, variance decompositions may measure the relative importance of each random innovation in affecting the variables in the VAR system.[103]

Table 3.6 reports the contributions of the variation in GDP attributable to the variations in the other three variables – Defence D, capital K, and Labour L - . As it can be seen from Table 3.6, as time moves on after an innovation, the variation in GDP owes more and more to variations in the other three variables. The variance of GDP is influenced consistently throughout the periods by that of defence D, settling at around 14% after 5 pe riods. The contributions of the variations of capital K and labour L in the variation of GDP also increase after period 2, rising gradually over the periods to amount for 10% and 11% respectively after 10 periods have elapsed.

Table 3.6: Variance Decompositions of GDP for Bahrain

Period	*S.E.*	*GDP*	*K*	*D*	*L*
1	0.057	100.000	0.000	0.000	0.000
2	0.065	93.677	0.844	4.792	0.685
3	0.070	86.973	2.137	9.069	1.819
4	0.073	81.527	3.530	11.782	3.160
5	0.076	77.147	4.888	13.362	4.601
6	0.079	73.511	6.161	14.243	6.083
7	0.081	70.401	7.331	14.701	7.566
8	0.083	67.678	8.396	14.901	9.023
9	0.084	65.259	9.361	14.945	10.433
10	0.086	63.084	10.23	14.894	11.786

Note: S.E is the forecast error of the variable at the giving forecast horizontal.

[103] Eviews 6 user's guide (2007). Like impulse responses the order of the variables in the VAR system is important for variance decompositions.

Such information along with those drawn from the impulse responses leads us on to attempts to identify possible long – run relationships between the variables in the VAR system.

3.6.2.4 VECM AND COINTEGRATION RELATIONSHIP

The existence of long-run relationship between the variables in the system would requires the presence of cointegration relationships between particular variables, and then the estimation of vector error correction model (ECM). The Johansen maximum likelihood method, which consists of two alternative likelihood ratio tests, the Trace statistic test and the Maximum Eigenvalue test, is carried out here to detect the presence of cointegration. In detecting the presence of cointegration, the choice here is between Model 3 and Model 4 of Johansen (1995). Model 3 excludes the trend from the cointegration vectors (CV) whilst Model 4 restricts the trend to lie in the cointegration space. The results statistics of both tests "Trace statistic" and "Maximum Eigenvalue test" for both Models "Model 3" and "Model 4" are based on the maximum likelihood estimates of VAR of order 1, and they are reported in Appendix A1**.**

We note that under both models there are two cointegration vectors (2CVs), according to both likelihood ratio tests "the Trace statistic" and "Maximum Eigenvalue test", and they are significant at 5% level as in Appendix A1**.** This means that we can use Johnsen's Likelihood Ratio test χ^2 to test for the presence of trend (Model 4) versus the restricted model of no trend (Model 3) in the CVs. The test has degrees of freedom equal to the rank of the matrix (r), that is, the number of CVs. The test

statistic was calculated and the outcome was; $\chi^2(2) = 5.185$, which is below the 5% critical value of 5.99.[104] Thus, we accept the restriction implied by Model 3 that there is no trend in the CVs, the link between the variables in the long-run is independent of any time element.[105]

The presence of cointegration relationships between the variables in the system may indicate the existence of cointegration space, however that dose not, necessarily, imply these relationships are identified/unique (have a meaningful economic insight). Normalization is a common practice to identify a long-rung cointegration relationship (CV) between the variables, by imposing restrictions on (βs) the coefficients of the variables in the cointegration vectors/equations, and/or on those of their loading vectors (αs), the speed of adjustment coefficients, in the VEM. Restrictions imposed on these coefficients usually follow the economic theory implications about the possible relationships between the variables in the system. However, it might not be possible to restrict a given CV to have the structure that the theory suggests.

Based on our model, the production function, a long-run relationship between income Y and the other three variables, capital K, labour L, and defence D could be identified. Taking into account the variables in the model we were able to identify two cointegration relationships as they are reported in Table 3.7, and graphed in figure

[104] The Likelihood ratio χ^2 test = - $N\sum_{i=1}^{r}\left[\ln(1-\lambda_{m,i}) - \ln(1-\lambda_{n,i})\right]$. Where N is the number of observations, r is the rank of the matrix, the subscripts: m and n refer to model 4 and model 3 respectively, and λs are the eigenvalues for each cointegration rank, up to r.

[105] In simple terms, if the eigenvalues across the two competing models for a given rank of the matrix (number of CVs) are identical, then the two Log Likelihoods are identical and thus, restricting the trend to be 0 in each potential CV is "exactly" correct.

3.3.[106] The LR test for binding restrictions with probability of (0.738), which is greater than (0.05), implies that the restrictions do hold and hence the βs coefficients are unique, all coefficients are statically significant (different from zero). The first cointegration vector is normalised on capital K (setting the coefficient of K in first CV to 1), and may implies a long-run relationships between K and both GDP and D. Converting it into equation indicates that in the long-run the level of GDP has positive impact on the level of K, whilst defence expenditure D negatively effects the level of capital formation K which may imply that the defence spending may crowd out other form of investments.

The second cointegration vector is normalised on GDP and based upon the long-run relationship between GDP and the other three variables K, D, and L as predicted by the underline theoretical argument from the production function. When converting into equation it indicates that in long-run the levels of capital K, labour L, and defence D carry positive effects on the level of GDP. Future manipulation on the equation shows that the elasticity of GDP per capita (log (GDP/L)) with respect to both K and D is 0.270 and it is statistically significant for both. This result supports the underline argument of positive impact of defence expenditure on economic development in some developing countries. Defence expenditure may have favoured Bahrain's economy, as mentioned earlier, via its contribution in the accumulation of capital stock, the process of modernizations, as well as technological progress through technological transfers. Coefficients that are not significant in the cointegration vectors CVS βs and those of the speed of adjustment αs can be set to zero in the

[106] Although the graphs of CVs look as they are not stationary, both cointegration vectors are stationary I(0) at 5% level of significance or better: First CV1 is level stationary I (0) according to KPSS unit root test with LM stat being (0.133) which is below the 5% critical value of (0.146). And the second CV is I (0) according to ADF unit root test with t-stat being (-4.068) and probability of (0.000).

process of identifying the cointegration vectors CVs, see Johansen (1995b) for further details.

Table 3.7: Identified Cointegration Equations for Bahrain

Cointegration Restrictions:
β (1,2)=1, β (2,1)=1, β (2,4)=-1
β (2,2)= β (2,3), β(1,4)=0
α(1,1)=0, α(1,2)=0
α (3,1)=0
Convergence achieved after 17 iterations.
Restrictions identify all cointegrating vectors
LR test for binding restrictions (rank = 2):

Chi-square(4)	1.982740
Probability	0.738934

Cointegrating Eq:	CointEq1	CointEq2
GDP(-1)	-3.397358	1.000000
	(0.24782)	
	[-13.7089]	
K(-1)	1.000000	-0.270425
		(0.02727)
		[-9.91645]
D(-1)	0.468119	-0.270425
	(0.15572)	(0.02727)
	[3.00607]	[-9.91645]
L(-1)	0.000000	-1.000000
C	17.51715	-5.470722

Note: the notations for the coefficients β and α are as follow: $\beta_{i\,j}$ is the coefficient of j^{th} variable in cointegration vector i. and $\alpha_{i\,j}$ is the adjustment coefficient in the VEC equation i with respect to the error correction term from cointegration vector j.
( ) =standard error: [ ] = t-stats

To check whether these two identified cointegration vector can be informative, in essence that their predicted values for their dependent variables did no converge too far from their actual values. We employ the series of GDP and K given by first and second vectors to forecast their long-run values across the extended data set against

their actual values as they graphed in Figure 3.3.[107] The graph shows that the long-run values of K appear to converge a bit far from their actual values, and thus the long-run relationship predicted by the first CV may not be very informative. On the other hand, the long-run values of GDP appear to wander around their actual values and seem to have similar trend of those of the actual values. Such results may imply that the long-run relationship anticipated by the second CV2 may hold, and thus the defence expenditure may have positive long-run relationship, along with K and L, with economic development, which may have some inferences for Bahrain's policy makers.

The results from the dynamic specification of VEC show that there are no current or lagged values of the first differences of the 4 variables, since the VAR contains only 1 lag. We note that the retained adjustment coefficients (the αs) are all statistically significantly different from zero as in Table 3.8. Furthermore, we can conclude GDP is the "weakly exogenous" variable in the system: that is, it is not influenced by the disequilibrium in the 2 long-run relationships. In a weak sense, it "causes" them: that is as far as we can say, since by definition in any cointegration equation there can be no cause and effect. The variables have to "see saw" together: so that a "sudden" movement in any one automatically prompts adjustments in all the others. However, it is changes to real aggregate output that kick starts changes in the capital stock, military expenditure and population: essentially, since our variables are measured in logs, an increase/decrease in the growth of real output generates movements in the rates of growth of the other variables.

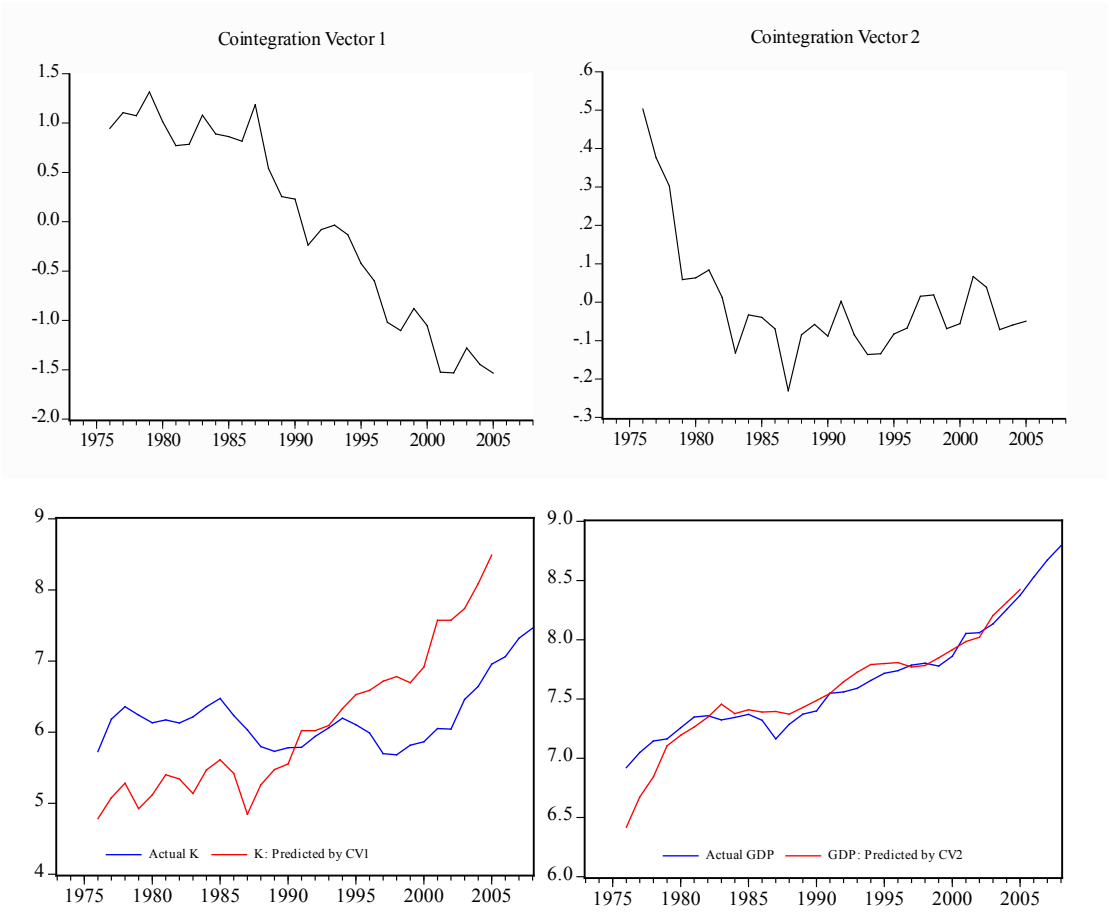
[107] The long-run values are calculated by subtracting the cointegration vector from the actual values of the concern variable lagged once since the CV is the residuals from the cointegration equations between the variables lagged once. Thus, for example, the long-run value of GDP= GDP_{-1} - CV2

Table 3.8: VEC Estimation for Bahrain

Error Correction:	GDP	K	D	L
CointEq1	0.0000	-0.0660	0.0000	0.0073
	(0.0000)	(0.0252)	(0.0000)	(0.0004)
	[NA]	[-2.614]	[NA]	[17.422]
CointEq2	0.0000	0.5179	0.8720	0.0238
	(0.0000)	(0.1825)	(0.2124)	(0.0031)
	[NA]	[2.8371]	[4.1056]	[7.6820]
C	0.0536	0.0445	0.0873	0.0328
	(0.0130)	(0.0283)	(0.0319)	(0.0004)
	[4.12020]	[1.57100]	[2.73674]	[66.4300]

Note: ( ) =standard error: [ ] = t-stats

Figure 3.3: Cointegration Relationships, and Actual Values of the Variables and Values Predicted by Their Cointegration Vectors



3.6.3 OMAN

3.6.3.1 VAR ESTIMATION, IMPULSE RESPONSES, AND VARIANCE DECOMPOSITIONS

The appropriate lag length for VAR is tested, and the results suggest that the system is stable with one lag; the roots of the companion matrix are all less than one in absolute value. Moreover, the VAR produces residuals that have reasonable properties: where they are normally distributed, there is neither auto-correlation nor heteroskedasticity as in Appendix A2. Thus, again we carry on and examine the dynamic of the VARs system using both the impulse responses and variance decompositions methods.

3.6.3.2 IMPULSE RESPONSES

We observe that the correlation matrix of residuals in the VAR implies that the order of the variable into VAR may need to be considered. Moreover, the impulse responses provided by Cholesky are different from those produced by Generalized responses as in Figure 3.2, which suggests the order of the variables into VAR does matter. We provide here the impulse responses of GDP to the shocks in the other three variables – capital K, Defence D, Labour L - in the VAR system. Thus we analyse the Generalized response.

The plotted Generalized responses of GDP from a shock to defence D shows that at the start GDP shifts upward in the first period then decrease gradually throughout until it becomes normal and dies out after 10 periods as in Figure 3.4. This finding

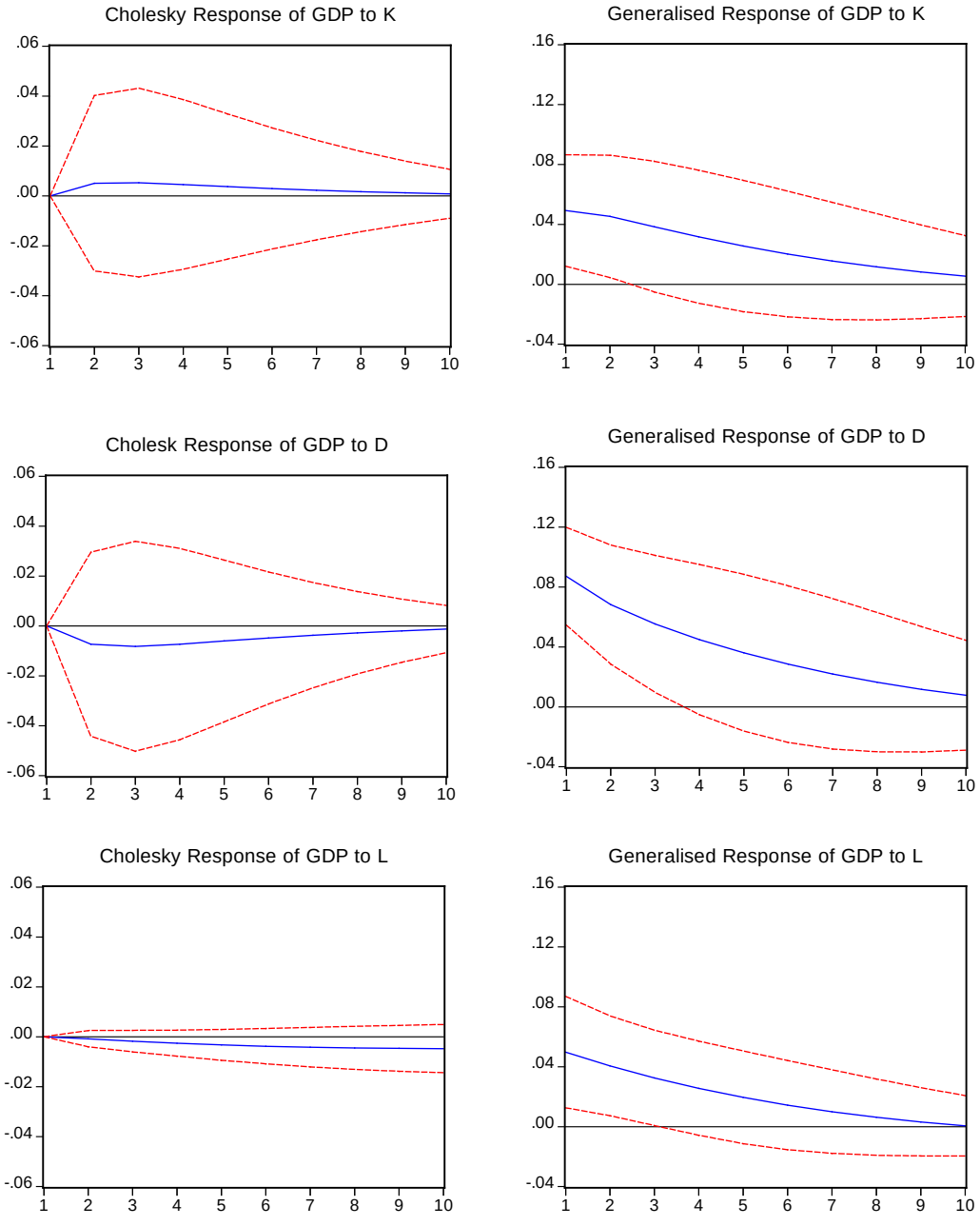
may suggests that defence expenditure has positive effect on economic development in Oman. Defence spending may have been supportive to Omani economy through the contributions of military programmes in some public works that could serve the civilian sectors, in addition to the role of military programmes in the process of modernization, where Oman, as most GCC states, has relatively low human capital formations. Yildirim et al (2005) argue that military arm forces in the Middle East region play an important socio-economic role by absorbing excess labour that might otherwise be unemployed. Technological and skills transfer also may have been another avenue through which Omani economy has gained from defence expenditure, where Oman as other GCC countries, has a tied military relationship with United States and United Kingdom. Oman has long had military relationship with US and UK. Oman received first military assistance from U.S.A and UK against the Dhofar rebels in 1964 which was defeated by 1975 (Katzman, 2005). Moreover, Oman signs a military agreement with US in 1981 that has regularly been renewed, and allows access of the US military to building cantonments, shelters, air bases, and ports. In return Oman received around $320 million fund to build and develop these facilities, it also provides Oman with $199.1 million worth of Foreign Military Sales (FMS) between 1980 and 1990, and about $853,000 in International Military Education and Training fund (IMET) (Cordesman, 1998).[108]

Shocks to capital K and Labour L variables seem to have similar impact on GDP, GDP shift upward after a shock to both variable K and L, and slowly decreases as time moves until it normalized and dies out after 9 periods. This finding suggests that

[108] Oman also works closely with UK; there are some British solders run training programmes for Omani army, in addition to some British officers seconded to Omani Navy and to Omani air force (Cordesman, 1998).

both capital K and labour exert positive impacts on the level of output in Omani economy as the underline theoretical argument from the production function suggests.

Figure 3.4: Impulse responses of real GDP for Oman



3.6.3.3 VARIANCE DECOMPOSITIONS

Table 3.9 reports variance decompositions of GDP. The table shows that through all the periods, most of the variation in GDP is attributable to its own variations (over 98% after 10 periods have elapsed). The variation of the other three variables in the system - Defence D, capital K, and Labour L – have marginal contributions in the variation of GDP through out the periods.[109] Implication of variance decompositions analysis may suggests that the GDP variable is the key variable in the system, changes in the GDP seems to carry an influential impact over the variables in the system.

Table 3.9: Variance Decompositions of GDP for Oman

Period	*S.E.*	*GDP*	*K*	*D*	*L*
1	0.110971	100.0000	0.000000	0.000000	0.000000
2	0.144319	99.61392	0.123600	0.259543	0.002937
3	0.163381	99.33169	0.201777	0.452964	0.013568
4	0.175008	99.15435	0.244039	0.568196	0.033411
5	0.182174	99.03595	0.267136	0.634280	0.062631
6	0.186535	98.94769	0.279985	0.671606	0.100716
7	0.189109	98.87415	0.287084	0.692084	0.146683
8	0.190558	98.80733	0.290840	0.702641	0.199187
9	0.191319	98.74329	0.292638	0.707445	0.256626
10	0.191683	98.68032	0.293324	0.709082	0.317277

Note: S.E is the forecast error of the variable at the giving forecast horizontal.

Thus, again we carry on our analysis and try to identify possible long – run relationships between the variables in the VAR system.

[109] We examined the variance decomposition of the other variables in the system, where we notice that the contribution of the variation of GDP in those of D and K is over 60% and 19% in the first period and continue to rise over the periods up to 88% and 70% respectively after 10 periods have passed.

3.6.3.4 ECM AND COINTEGRATION RELATIONSHIP

The cointegration test of Johnsen maximum likelihood method is conducted here to detect the presence of long-run cointegration relationships between the variables in the system. The results statistics of both tests "Trace statistic" and "Maximum Eigenvalue test" for the two alternative Models of Johansen "Model 3" and "Model 4" are based on the maximum likelihood estimates of VAR of order 1, and they are reported in Appendix A2**.**

We note that under both models there are two cointegration vectors (2CVs), according to both likelihood ratio tests, and they are significant at 5% level as in Appendix A2. Johnsen's Likelihood Ratio test χ^2 for the presence of trend (Model 4) versus the restricted model of no trend (Model 3) in the CVs, suggests that a trend should be included in the cointegration vectors CV, where LR test statistic : $\chi^2(2) = 11.724$ which is greater than the 5% level of 5.99. Thus, we accept the restriction implied by Model 4 that trend should be included in the CVs; the link between the variables in the long-run is not independent of time element.

Based on our model, the production function, we were able to identify two cointegartion relationships as they are reported in Table 3.10 and graphed in Figure 3.5.[110] The LR test for binding restrictions with probability of (0.635), which is greater than (0.05), implies that the restrictions do hold and hence the βs coefficients are unique, all coefficients are statically significant (different from zero). Same as before the first cointegration vector is normalised on capital K and may implies a

[110] Both cointegration vectors are stationary I(0) at 5% level of significance with intercept and trend according to KPSS unit root test with LM stat for the first CV1 is (0.113), and (0.115) for the second CV2 which for both below the 5% critical value of (0.146).

long-run relationships between K and both GDP and D. similar to Bahrain, by converting the vector into equation indicates that in the long-run the level of GDP has a positive impact on the level of K, whilst the level of D carries a negative impact on K, which may indicate a high opportunity cost of defence expenditure on K.

The second cointegartion vector is normalised on GDP and based upon the long-run relationship between GDP and the other three variables K, D, and L as predicted by the underline theoretical argument. When converting into equation it indicates that in long-run the levels of capital K, labour L, and defence D carry positive effects on the level of GDP. Future manipulation on the equation shows that the elasticity of GDP per capita (log (GDP/L)) with respect to both K and D is 1. This result supports the underline argument of positive impact of defence expenditure on economic development in some developing countries. Same as for Bahrain, the defence expenditure may have favoured Oman's economy through its contribution in the capital stock accumulation, the process of modernizations, as well as skills and technological progress through technological transfer.

Again, we calculate the long-run relationships to check whether these two identified cointegration vector can be informative. We employ the series of GDP and K given by first and second vectors to forecast their long-run values across the extended data set against their actual values as they graphed in Figure 3.5. The graph of the two cointegration vectors show that the long-run values of K and that of GDP appear to converge far from their actual values, and thus the long-run relationships predicted by the CVs have little to say about the long-run relationships between the variables in the system.

Table 3.10: Identified Cointegration Equations for Oman

Cointegration Restrictions:
β (1,2)=1, β (2,1)=1, β (2,4)=-1
β (2,2)=-1, β (2,3)=-1, β (1,4)=0
α(1,1)=0, α (1,2)=0
Convergence achieved after 717 iterations.
Restrictions identify all cointegrating vectors
LR test for binding restrictions (rank = 2):
Chi-square(4) 2.552147
Probability 0.635323

Cointegrating Eq:	CointEq1	CointEq2
GDP(-1)	-0.386117	1.000000
	(0.11416)	
	[-3.38217]	
K(-1)	1.000000	-1.000000
D(-1)	0.868592	-1.000000
	(0.10082)	
	[8.61519]	
L(-1)	0.000000	-1.000000
Trend	-0.299088	0.253779
	(0.01119)	(0.00875)
	[-26.7221]	[29.0114]
C	0.561946	-3.479372

Note: the notations for the coefficients β and α are as follow: $\beta_{i\,j}$ is the coefficient of j^{th} variable in cointegration vector i. and $\alpha_{i\,j}$ is the adjustment coefficient in the VEC equation i with respect to the error correction term from cointegration vector j.
( ) =standard error: [ ] = t-stats

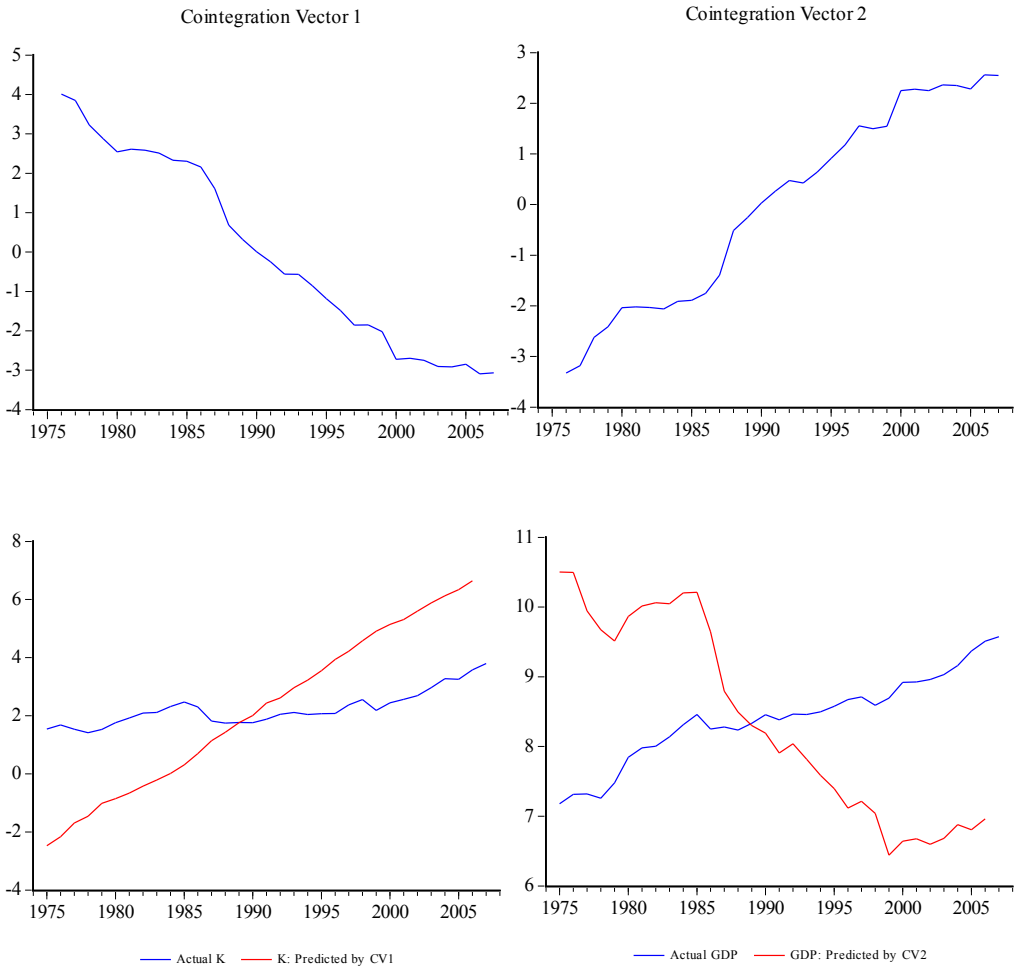
The results from the dynamic specification of VEC in Table 3.11 show that there are no current or lagged values of the first differences of the 4 variables, since the VAR contains only 1 lag. The retained adjustment coefficients (the α s) are all statistically significantly different from zero. Furthermore, we notice that GDP is the "weakly exogenous" variable in the system: that is, it is not influenced by the disequilibrium in the 2 long-run relationships. Changes to real aggregate output GDP appear to kick starts changes in K, D and L.

Table 3.11: ECM Estimates for Oman

Error Correction:	GDP	K	D	L
CointEq1	0.000000	1.641848	0.786321	0.032600
	(0.00000)	(0.41455)	(0.22399)	(0.00820)
	[NA]	[3.96059]	[3.51048]	[3.97552]
CointEq2	0.000000	2.037896	0.969831	0.033070
	(0.00000)	(0.50742)	(0.27418)	(0.01004)
	[NA]	[4.01616]	[3.53723]	[3.29470]
C	0.074924	0.070486	0.038538	0.034046
	(0.02021)	(0.02801)	(0.02141)	(0.00054)
	[3.70653]	[2.51670]	[1.80004]	[63.3869]

Note: ( ) =standard error: [ ] = t-stats

Figur 3.5: Cointegration Relationships, and actual values of the variables against the values predicted by their cointegration vectors



3.6.4 SAUDI ARABIA

3.6.4.1 VAR ESTIMATION, IMPULSE RESPONSES, AND VARIANCE DECOMPOSITON:

Following the same steps, the appropriate lag length for VAR is tested, and the results suggest that the system is mathematically stable with 4 lags; the roots of the companion matrix are all less than one in absolute value. Moreover, the VAR produces residuals that have reasonable properties: although they are not normally distributed, there is neither auto-correlation nor heteroskedasticity (see diagnostic tests Appendix A3. Thus, again we carry on and examine the dynamic of the VARs system using both the impulse responses and variance decompositions methods.

3.6.4.2 IMPULSE RESPONSES

We observe that the correlation matrix of residuals in the VAR implies that the impulse responses from Cholesky decomposition and those from Generalised responses of Pesaran and Shin (1998) may have similar information. The impulse responses provided by Cholesky are similar in time-profile and magnitude to those produced by Generalized responses as in Figure 3.6, which suggests that the order of the variables into VAR may not be very important. We provide here the impulse responses of GDP to the shocks in the other three variables – capital K, Defence D, Labour L - in the VAR system.

The plotted responses in Figure 3.6 show that after the one-off innovations to defence D, GDP increases gradually for five years, but constantly falls throughout the rest of the periods. Thus, again this finding for Saudi may indicates that defence expenditures may carry positive externalities to the Saudi economy in the short-run. Saudi Arabia is among the highly defence spending developing countries in the world – defence expenditures amount on average over 30% of the government budget shares (Looney, 1999). The externalities from such big outlays may have been supportive to the economy in some ways such as infrastructure projects launched by the military, the process of modernization where Saudi has relatively low rate of human capital formation with relatively large percent of nomadic people in the population.

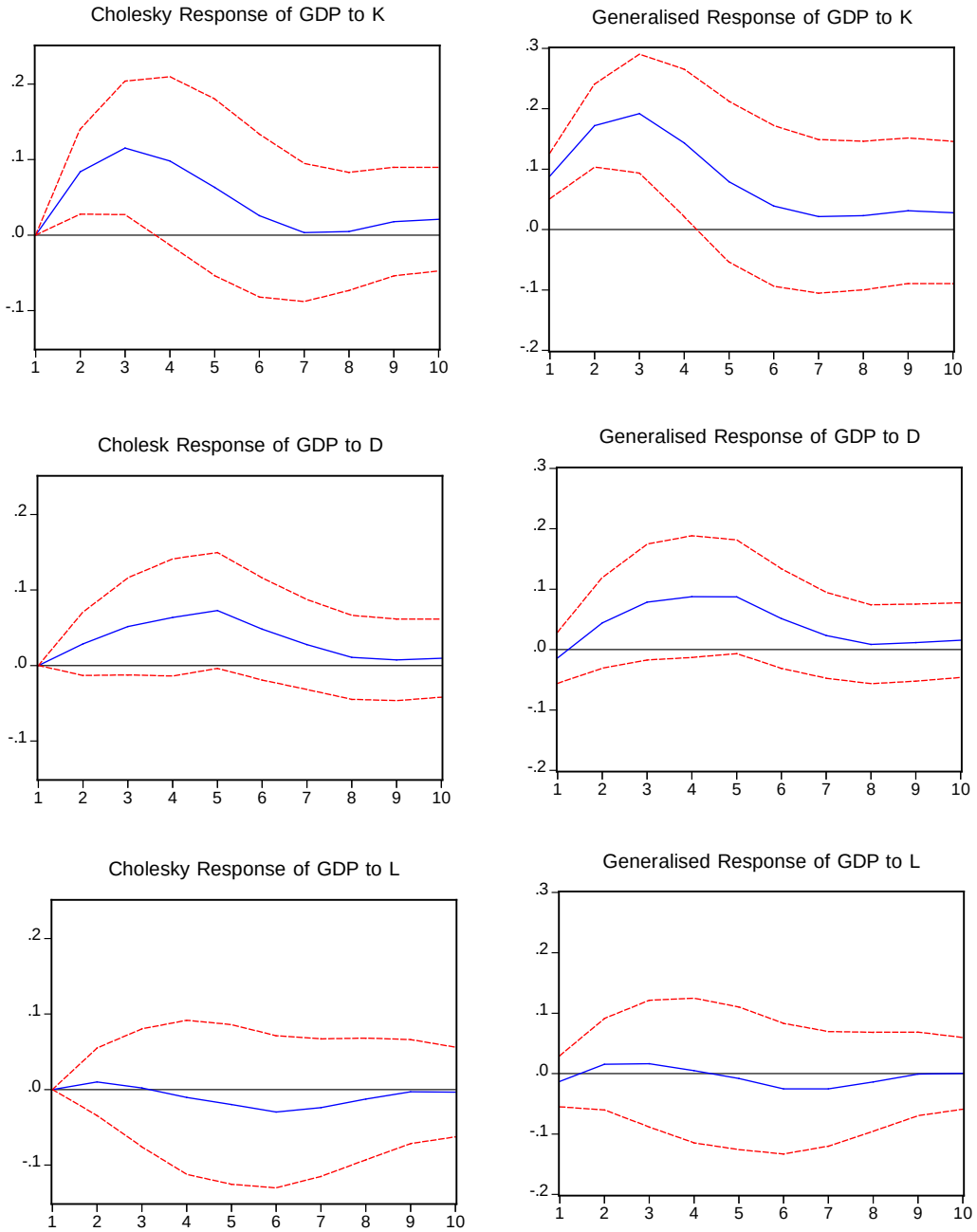
Moreover, as most GCC countries Saudi has long had close military ties with United States and United Kingdom, US military presence in Saudi goes back to 1943 where US first leased port and air base facilities in Dharan in the east coast. Saudi has Military Training Mission Agreement with the US which was renewed in 1992, Saudi also has purchased over $16 billion worth of US military construction services during the late 1970s and the 1980s in addition to supervised military constructions that worth billions of dollars more (Cordesman, 1998).[111] Thus, Technological and skills transfers from major industrial countries perhaps have been another channel through which Saudi economy benefited from defence expenditure.

The plotted response of GDP from one-off shock to capital K shows that, GDP immediately increases, doing so for three years, but falls consistently over the period

[111] Saudi Arabia has always have major defence contracts with some major arms exports countries mainly US, UK, and some other NATO members, where some of these contracts can amount for over US $50 billion in some years, Saudi's arms agreements from 1997 to 2004 reached over US $10 billion Hasbani (2006). For example, in 2010 Saudi Arabia and UAE signed arms agreement with US that amount for US$60 billion each (New Your Times, 21-Oct 2010)

until it dies out. This may indicate that capital positively affect the level of output, as our model, production function, suggested. A shock to labour L seems to have little effect of GDP as it can be seen from Figure 3.6 after a tiny increase for two years, it falls slowly for another five years, before it starts recovering and dies out over the period.

Figure 3.6: Impulse responses of real GDP for Saudi Arabia



3.6.4.3 VARIANCE DECOMPOSITIONS

The variance decompositions of GDP are calculated and reported in Table 3.12. The table shows that after an innovation, the contributions of the variation of D and that of K in the variation of GDP increase gradually over the periods to amount for over 11% and over 24% respectively after 10 periods have elapsed. The variations in GDP appear to be influenced throughout the periods by the variations of the other variables on the system. However, the variation of L has little contribution to the variation of GDP relative to other variables; GDP is marginally affected by the variation in labour proxy L until 5 periods have passed.

Table 3.12: Variance Decompositions of GDP for Saudi Arabia

Period	S.E.	GDP	K	D	L
1	0.137599	100.0000	0.000000	0.000000	0.000000
2	0.234068	85.44531	12.87292	1.492371	0.189399
3	0.310749	75.19413	21.08893	3.604642	0.112300
4	0.348609	68.95912	24.67237	6.190671	0.177832
5	0.365384	64.49380	25.44667	9.603279	0.456249
6	0.371842	62.91826	25.04973	10.95602	1.075997
7	0.374825	62.54395	24.66002	11.32528	1.470745
8	0.376407	62.64991	24.46909	11.31127	1.569728
9	0.377876	62.67174	24.50246	11.26240	1.563397
10	0.379042	62.52126	24.65972	11.25689	1.562138

Note: S.E is the forecast error of the variable at the giving forecast horizontal.

Thus, such considerations along with those drawn from the impulse responses lead us on to try to identify possible long – run relationships between the variables in the VAR system.

3.6.4.4 VECM AND COITEGRATION RELATIONSHIP:

The cointegration test of Johnsen maximum likelihood method is conducted here to detect the presence of long-run cointegration relationships between the variables in the system. The results statistics of both tests "Trace statistic" and "Maximum Eigenvalue test" for the two alternative Models of Johansen "Model 3" and "Model 4" are based on the maximum likelihood estimates of VAR of order 4, and they are reported in Appendix A3.

We noted that under both models there are two cointegration vectors (2CVs), according to both likelihood ratio tests, and they are significant at 5% level as in Appendix A3. Johnsen's Likelihood Ratio test χ^2 for the presence of trend (Model 4) versus the restricted model of no trend (Model 3) in the CVs, suggests that a trend should be included in the cointegration vectors CV, where LR test statistic : $\chi^2(2) =$ 16.926 ,which greater that the 5% level of 5.99.

The two cointegration relationships were identified as they are reported in Table 3.13 and graphed in Figure 3.7.[112] The LR test for binding restrictions with probability of (0.157), which is greater than (0.05), implies that the restrictions do hold and hence the βs coefficients may be unique, all coefficients are statically significant (different from zero). Same as for other countries in our sample, the first cointegration vector is normalised on capital K and may implies a long-run relationships between K and the other three variables in the system, GDP, D, and L. converting it into equation

[112] The finding of unit root test suggests that: First CV1 is level stationary I(0), with intercept and trend, according to KPSS unit root test with LM stat being (0.119) which is below the 5% critical value of (0.146). And the second CV is I (0) at 5% level, with intercept and no trend, according to ADF unit root test with t-stat being (-3.3294) and probability of (0.019).

indicates that in the long-run the level of GDP and that of labour have a positive impact on the level of K, whilst the level D carries a negative impact on K. The negative impact of defence expenditure on capital may indicate that the defence expenditures crowd out other form of investments, and therefore have a relatively high opportunity cost.

The second cointegration vector is normalised on GDP and based upon the long-run relationship between GDP and the other three variables K, D, and L as predicted by the underline theoretical argument. Converting it into equation it indicates that in long-run the levels of capital K, labour L carry positive effects on the level of GDP. Defence D, however, appears to negatively affect the level of output, with a relatively big elasticity of 2.56, which may just confirm the high opportunity cost of defence expenditures predicted by CV1 that defence spending may crowd out other form of outlays that could be more growth promoting, considering the relatively high budget allocation to defence in Saudi Arabia - Saudi Arabia has the highest military expenditure per capita and per soldier in the world (Looney, 1999) -. Furthermore, Saudi, as well as most GCC members, with such high military expenditures has not been even close in terms of military industries or technological transfers to some other developing countries with relatively high military expenditures such as Iran, Pakistan, Turkey and North Korea (Hasbani, 2006).

Table 3.13: Identified Cointegration Equations for Saudi Arabia

Cointegration Restrictions:
β(1,2)=1, β (2,1)=1
β (2,4)=-1
α(2,1)=0, α (2,2)=0
α (4,2)=0
Convergence achieved after 645 iterations.
Restrictions identify all cointegrating vectors
LR test for binding restrictions (rank = 2):
Chi-square(2) 3.699169
Probability 0.157303

Cointegrating Eq:	CointEq1	CointEq2
GDP(-1)	-1.936890	1.000000
	(0.42008)	
	[-4.61075]	
K(-1)	1.000000	-3.491870
		(0.45703)
		[-7.64038]
D(-1)	1.131525	2.568097
	(0.37420)	(0.46591)
	[3.02387]	[5.51196]
L(-1)	-3.905289	-1.000000
	(1.03709)	
	[-3.76562]	
Trend	0.108139	0.065710
	(0.03029)	(0.02401)
	[3.56994]	[2.73656]
C	14.58220	-15.90503

Note: the notations for the coefficients β and α are as follow: $\beta_{i\,j}$ is the coefficient of j^{th} variable in cointegration vector i. and $\alpha_{i\,j}$ is the adjustment coefficient in the VEC equation i with respect to the error correction term from cointegration vector j. ( ) =standard error: [ ] = t-stats

The long-run relationships predicted by the cointegration vectors are calculated to check how informative these two identified cointegration vector can be. Again, we employ the series of GDP and K given by first and second vectors to forecast their long-run values across the extended data set against their actual values as they graphed in Figure 3.7. Although, the graph of the two cointegration vectors show that the long-run values of K and that of GDP appear to converge a bit far from their

actual values sometimes, they however seem to wander around their actual values most of the time and appear to have similar trend of those of the actual values. Thus the long-run relationships predicted by the CVS may indicate some information about the expected long-run relationships between the variables in the system.

The results from the dynamic specification of ECM, Table 3.14, show that in the shot-run defence expenditure have a negative impact on the level of GDP, the lagged dynamic of defence expenditure on GDP equation are all negative and significant (different from zero). Defence expenditure, therefore, appears to have opportunity cost in the short-run too, as it may have been crowding out other forms of expenditures in the short-run. We also notice that the retained adjustment coefficients (the α s) are all statistically significantly different from zero. Moreover, results suggest that the capital variable K is the "weakly exogenous" variable in the system: that is, it is not influenced by the disequilibrium in the 2 long-run relationships. The changes to level of K appear to kick starts changes in the GDP, D and L

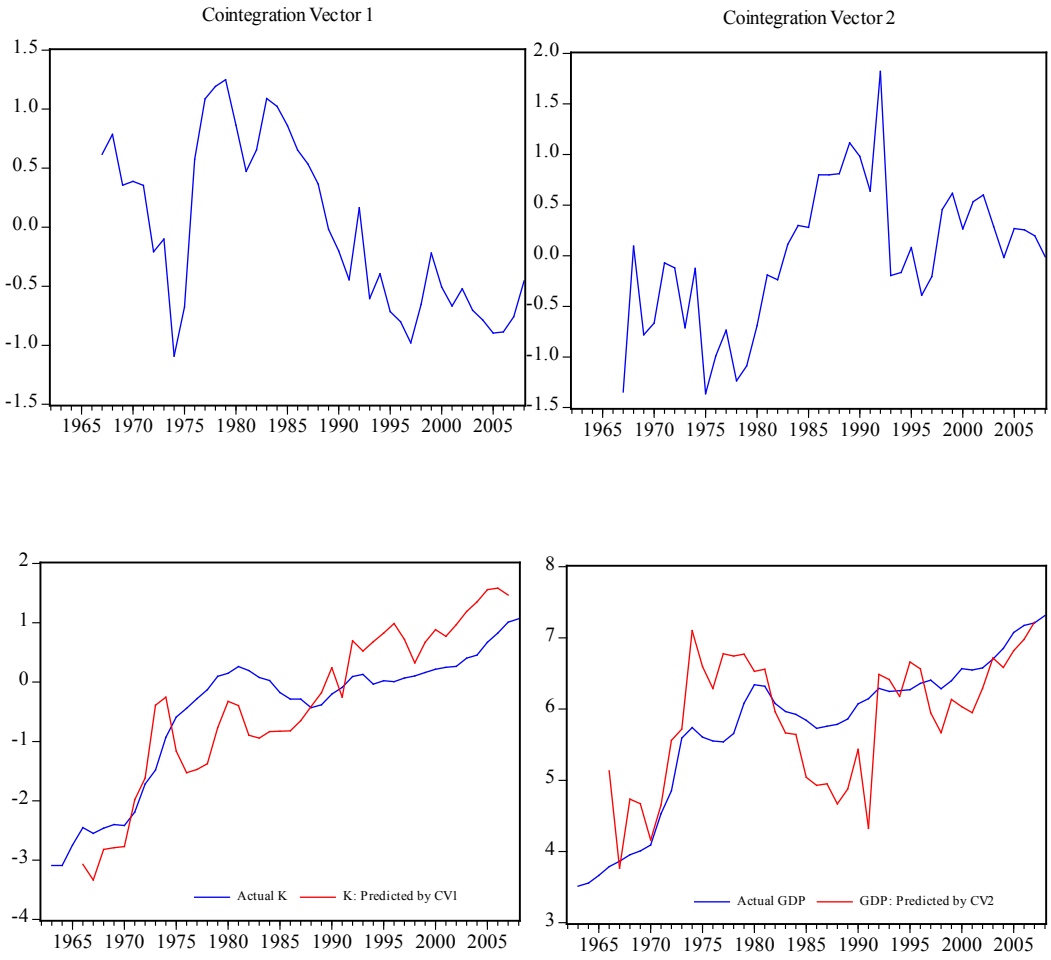
Table 3.14: ECM Estimation for Saudi Arabia

Error Correction:	GDP	K	D	L
CointEq1	0.507165	0.000000	-0.243620	0.000862
	(0.11227)	(0.00000)	(0.10356)	(0.00037)
	[4.51746]	[NA]	[-2.35244]	[2.32719]
CointEq2	0.200354	0.000000	-0.455226	0.000000
	(0.07468)	(0.00000)	(0.07203)	(0.00000)
	[2.68293]	[NA]	[-6.31975]	[NA]
GDP(-1)	0.637893	0.446462	0.035995	0.001279
	(0.19394)	(0.15294)	(0.14157)	(0.00064)
	[3.28906]	[2.91917]	[0.25425]	[2.00689]
GDP(-2)	0.043432	-0.045000	0.011347	0.000918
	(0.20656)	(0.16289)	(0.15078)	(0.00068)
	[0.21026]	[-0.27626]	[0.07525]	[1.35234]

GDP(-3)	-0.069982	0.077413	0.101496	0.000180
	(0.20791)	(0.16395)	(0.15177)	(0.00068)
	[-0.33660]	[0.47216]	[0.66876]	[0.26357]
K(-1)	1.363763	0.386282	-0.114771	-0.000129
	(0.38473)	(0.30339)	(0.28084)	(0.00126)
	[3.54476]	[1.27322]	[-0.40867]	[-0.10219]
K(-2)	0.657021	0.172847	-0.371141	0.001853
	(0.34359)	(0.27095)	(0.25081)	(0.00113)
	[1.91222]	[0.63793]	[-1.47977]	[1.64073]
K(-3)	0.224528	0.422010	-0.324481	0.001450
	(0.28849)	(0.22750)	(0.21059)	(0.00095)
	[0.77829]	[1.85499]	[-1.54083]	[1.52892]
D(-1)	-0.930238	-0.165240	0.181437	-0.001359
	(0.33795)	(0.26650)	(0.24669)	(0.00111)
	[-2.75257]	[-0.62003]	[0.73547]	[-1.22321]
D(-2)	-0.638436	-0.101507	0.054495	-0.001006
	(0.26316)	(0.20753)	(0.19210)	(0.00087)
	[-2.42602]	[-0.48913]	[0.28368]	[-1.16345]
D(-3)	-0.449291	-0.131975	-0.135872	1.11E-05
	(0.18176)	(0.14333)	(0.13268)	(0.00060)
	[-2.47194]	[-0.92077]	[-1.02409]	[0.01859]
L(-1)	-10.27330	-16.03432	-121.2395	2.392859
	(44.5165)	(35.1051)	(32.4956)	(0.14633)
	[-0.23078]	[-0.45675]	[-3.73096]	[16.3527]
L(-2)	55.08102	51.96604	227.6609	-1.982420
	(84.6728)	(66.7719)	(61.8084)	(0.27832)
	[0.65052]	[0.77826]	[3.68333]	[-7.12269]
L(-3)	-61.40367	-36.95753	-100.0054	0.549076
	(45.2905)	(35.7155)	(33.0606)	(0.14887)
	[-1.35577]	[-1.03478]	[-3.02491]	[3.68823]
C	0.686469	0.038020	-0.128183	0.001276
	(0.19650)	(0.15496)	(0.14344)	(0.00065)
	[3.49340]	[0.24535]	[-0.89362]	[1.97568]

Note: ( ) =standard error: [ ] = t-stats

Figur 3.7: Cointegration Relationships, and Actual Values of the Variables Against the Values Predicted by Their Cointegration Vectors



3.6.5 UNITED ARAB EMIRATES (UAE)

3.6.5.1 VAR ESTIMATION, IMPULSE RESPONSES, AND VARIANCE DECOMPOSTIONS

To determine the lag structure, the appropriate lag length for VAR is tested, and the results suggest that the system is mathematically stable with 2 lags; the roots of the companion matrix are all less than one in absolute value. Moreover, the VAR produces residuals that have reasonable properties: there is neither auto-correlation nor heteroskedasticity although they are not normally distributed, (see Appendix A4). Thus, again we carry on and examine the dynamic of the VARs system using both the impulse responses and variance decompositions methods.

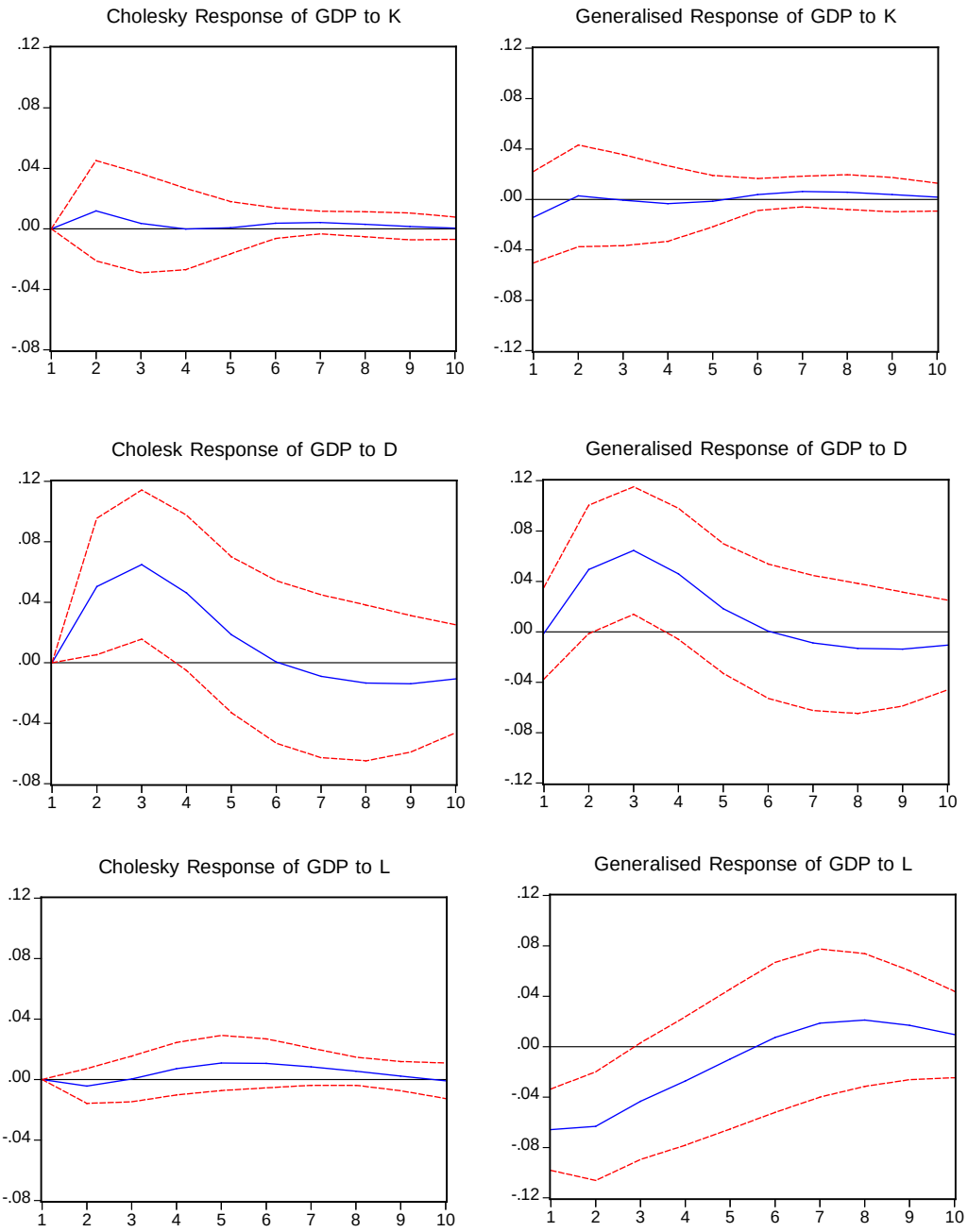
3.6.5.2 IMPULSE RESPONSES

The correlation matrix of residuals in the VAR implies that the order of the variables may need to be considered. A relatively high correlation between GDP and L at (0.65) gives indication that the use of Cholesky decomposition may not give unique impulse responses. However, we notice that the Cholesky responses of GDP from one-off shock to D are similar in time-profile and magnitude to those produced by Generalised responses: and are not too dissimilar for those with respect to K as in Figure 3.8, which may suggest that the order of the variables into VAR does matter but only slightly. Thus, again we provide here both Cholesky responses and Generalised responses of GDP from one shock to each of the other three variables in the system – capital K, Defence D, and Labour L –.

The plotted responses in Figure 3.8 shows that GDP increases gradually for three years after one-off innovations to defence D, but falls constantly for five years before it start recovering and dies out throughout that period. Thus, although this finding may indicates that defence expenditures carry positive externalities to the UAE economy, it however shows that D negatively affects the economy as the time moves. Such finding perhaps is possible where UAE has a relatively heavy defence burden, as some other GCC members, that may generate externalities to the economy in short-run, but the returns on such heavy spending is probably very low in the long-run as the defence facilities may have little to offer to the economy.

The plotted response of GDP from one-off shock to capital K shows that, K has little impact on GDP, after a tiny fall at the start GDP increases for 1 period and becomes normal and so for most of the period. A shock to labour L carries negative impact on GDP, GDP falls at the start after an innovation to L, but gradually increases for 7 periods and then falls and dies out.

Figure 3.8: Impulse Responses of Real GDP for UAE



3.6.5.3 VARIANCE DECOMPOSITIONS

The variance decompositions of GDP are calculated and reported in Table 3.15. The table shows that after an innovation, the contribution of the variation of D in the variation of GDP increases substantially and consistently influences that of GDP throughout the period, settling at over 35% after 5 periods. On the other hand, the contributions of the variations of the other variables, K and L, are very small throughout the periods, GDP are marginally affected by the variation of L until 5 periods have elapsed and settled at 1.7% after 6 periods, whilst the contribution of the variation of K has been marginal throughout the periods.

Table 3.15: Variance Decompositions of GDP for UAE

Period	S.E.	GDP	K	D	L
1	0.101304	100.0000	0.000000	0.000000	0.000000
2	0.131145	84.28022	0.830880	14.78355	0.105353
3	0.149593	69.01895	0.698417	30.20090	0.081728
4	0.158477	63.68382	0.622366	35.41519	0.278628
5	0.160744	62.90199	0.607181	35.75670	0.734131
6	0.161146	62.58990	0.659097	35.57993	1.171074
7	0.162339	62.49487	0.715627	35.36264	1.426865
8	0.164132	62.50198	0.733494	35.25646	1.508061
9	0.165506	62.38930	0.730145	35.37856	1.501988
10	0.166121	62.25777	0.725535	35.52360	1.493097

Note: S.E is the forecast error of the variable at the giving forecast horizontal.

3.6.5.4 VECM AND COINTEGRATION RELATIONSHIP:

The cointegration test of Johnsen maximum likelihood method is conducted here again to detect the presence of long-run cointegration relationships between the variables in the system. The results statistics of both tests “Trace statistic” and

"Maximum Eigenvalue test" for the two alternative Models of Johansen "Model 3" and "Model 4" are based on the maximum likelihood estimates of VAR of order 2, and they are reported in Appendix A4**.**

There are three cointegration vectors (3CVs), according to both likelihood ratio tests, and they are significant at 5% level. Johnsen's Likelihood Ratio test χ^2 for the presence of trend (Model 4) versus the restricted model of no trend (Model 3) in the CVs, suggests that a trend should be included in the cointegration vectors CVs, where LR test statistic : $\chi^2(3) = 26.255$, which greater than the 5% level of 7.815.

We identified the three cointegration relationships as they are reported in Table 3.16 and graphed in Figure 3.9.[113] The LR test for binding restrictions with probability of (0.733), which is greater than (0.05), implies that the restrictions do hold and hence the βs coefficients can be unique. Same as for other countries in our sample, the first cointegration vector is normalised on capital K and may implies a long-run relationships between K and the other variables in the system. Converting it into equation indicates that in the long-run the level of GDP has positive impact on the level of capital K.

The second CV is normalised on GDP as to represent the relationship suggested by the underline argument of the production function. Converting it into equation it indicates that in long – run the levels of capital K, labour L carry positive effects on the level of GDP, whilst the level of defence D has a negative impact on level of

[113] The finding of unit root test suggests that the three CVs are all level stationary I (0) according to ADF unit root test with t-stat [ ] and prob ( ) as follow: CV1 [-3.111] (0.036) intercept and no trend, CV2 [-3.909] (0.024) intercept and trend, and CV3 [-3.608] (0.011) intercept and no trend.

GDP. Again future manipulation on the equation shows that the elasticity of GDP per capita (log (GDP/L)) with respect to D is (-0.464), which is much smaller that that of Saudi. However, as for Saudi, this result may suggests that defence expenditures have high opportunity cost as the military equipments and facilities may have little contributions to the development of other sectors in the economy considering the small size and little diversity in the UAE economy. It may also crowd out other form of outlays that could enhance growth, UAE, as the rest of GCC countries, has a relatively high budget allocation to defence. The third CV is normalised on D and may indicate the demand for defence. Converting it into equation, it shows that in the long – run the level of GDP and that of Labour L have a positive impact on the demand for defence.

The long-run relationships predicted by the cointegration vectors are calculated to check how informative these identified cointegration vectors. Again, we employ the series of GDP, K, and D given by first, second, and third vectors to forecast their long-run values across the extended data set against their actual values as they graphed in Figure 3.9. The graph of the three cointegration vectors show that the long-run values of K, GDP and that of D appear to wander around their actual values most of the time and appear to have similar trend with those of the actual values. Thus, the long-run relationships predicted by the CVs may carry some information about the expected long – run relationships between the variables in the system.

The results from the dynamic specification of ECM, as in Table 3.17, show that in the shot-run defence expenditure have no effect on the level of GDP, the lagged dynamic of defence expenditure on GDP equation is insignificant (not different from zero). On

the other hand, the long-run retained adjustment coefficients (the α s) are all statistically significantly different from zero except the coefficient of CV3 in the defence equation.

Table 3.16: Identified Cointegration Equations for UAE

Cointegration Restrictions:
β(1,2)=1, β (2,1)=1, β (2,4)=-1
β (2,2)=-1, β (1,4)=0, β (3,1)=-1
β (3,2)=0, β (1,1)=-1, β (3,3)=1
β (1,3)=0, α (1,2)=0, α (2,2)=0
Convergence achieved after 450 iterations.
Restrictions identify all cointegrating vectors
LR test for binding restrictions (rank = 3):

Chi-square(3)	1.280804
Probability	0.733696

Cointegrating Eq:	CointEq1	CointEq2	CointEq3
GDP(-1)	-1.000000	1.000000	-1.000000
K(-1)	1.000000	-1.000000	0.000000
D(-1)	0.000000	0.464882 (0.02361) [19.6866]	1.000000
L(-1)	0.000000	-1.000000	-6.323272 (0.51836) [-12.1986]
Trend	-0.007282 (0.00441) [-1.65088]	0.045383 (0.00345) [13.1682]	0.346170 (0.02882) [12.0103]
C	6.084483	-8.283307	4.750096

Note: the notations for the coefficients β and α are as follow: $\beta_{i\,j}$ is the coefficient of j^{th} variable in cointegration vector i. and $\alpha_{i\,j}$ is the adjustment coefficient in the VEC equation i with respect to the error correction term from cointegration vector j. ( ) =standard error: [ ] = t-stats

Table 3.17: ECM Estimation for UAE

Error Correction:	GDP	K	D	L
CointEq1	0.385351	-0.574963	-0.820652	-0.030231
	(0.16671)	(0.07895)	(0.31670)	(0.00327)
	[2.31145]	[-7.28249]	[-2.59125]	[-9.24842]
CointEq2	0.000000	0.000000	-0.879791	-0.030270
	(0.00000)	(0.00000)	(0.32483)	(0.00270)
	[NA]	[NA]	[-2.70850]	[-11.1953]
CointEq3	0.393841	0.388477	-0.275666	0.005426
	(0.12050)	(0.05706)	(0.19028)	(0.00211)
	[3.26845]	[6.80766]	[-1.44875]	[2.56933]
DGDP(-1))	0.431947	-0.037348	0.353533	-0.004584
	(0.22418)	(0.10634)	(0.35320)	(0.00392)
	[1.92675]	[-0.35120]	[1.00095]	[-1.16807]
DK(-1)	-0.049938	-0.224198	-0.105079	0.003767
	(0.15219)	(0.07219)	(0.23977)	(0.00266)
	[-0.32813]	[-3.10560]	[-0.43825]	[1.41414]
DD(-1)	0.035876	-0.205475	0.435550	-0.002388
	(0.14591)	(0.06921)	(0.22988)	(0.00255)
	[0.24588]	[-2.96872]	[1.89471]	[-0.93516]
DL(-1)	-3.987944	3.120128	1.969453	0.830417
	(1.48006)	(0.70208)	(2.33180)	(0.02591)
	[-2.69445]	[4.44412]	[0.84460]	[32.0546]
C	0.307832	-0.158910	-0.105601	0.008795
	(0.09743)	(0.04621)	(0.15349)	(0.00171)
	[3.15966]	[-3.43851]	[-0.68799]	[5.15772]

Note: ( ) =standard error: [ ] = t-stats

Figure 3.9: Cointegration Relationships, and Actual Values of the Variables Against the Values Predicted by Their Cointegration Vectors

3.7 CONCLUSION

The members of the GCC perhaps have the fame worldwide of being highly defence spending countries. They are in fact among the highly defence spending countries in the developing world. They are located in one of the most turbulent region in the World "Middle East" and, hence, the issue of security has proven to be crucial for the rulers of these rich countries; massive amount of money have been allocated to defence and security throughout the time. In this chapter we investigate the role that such heavy expenditures may have on t he development process for four GCC countries. We construct our empirical work in the context of time series analysis and VAR/ECM frameworks over the period of the last four decades.

The emerging results come in contrast, to some extend, with the argument that was suggested by Frederiksen and Looney (1983) that defence expenditure may carry positive effect in the economic development for resource-rich countries, whilst negative impact of defence spending is expected for resource-poor developing countries.[114] Defence expenditure appears to carry a long-run positive and significant effect on the economic development for the relatively resource-poor members of the GCC "Bahrain" and "Oman". It is rather Benoit's argument of positive effects of defence expenditure on the economic growth in developing countries what seems to fit the case of the members of GCC with relatively small level of defence spending "Bahrain" and Oman.

[114] As mentioned, the argument is that resource-rich countries can afford to increase military expenditure without cutting the share of other sectors in the economy (e.g. education and health), whilst resource-poor countries may not.

On the other hand, the heavy defence spending in the resource-rich members of GCC "Saudi Arabia" and "UAE" appears to significantly retard the economic development in both countries. It seems that the heavy defence expenditure in richer countries in the GCC may have come at the expense of other sectors in the economy (e.g. infrastructure, health and education), and, hence, have a higher opportunity cost. This might be true since large amounts of defence expenditure are spent on imported armaments which may have little to offer to other sectors in the economy. Furthermore, despite this heavy expenditure in defence, the level of technological transfer is negligible; neither Saudi Arabia nor any member of GCC have a heavy military industry complex compare to other heavy defence spending developing countries such as India, Iran, and Turkey.

The security of the region perhaps is beyond the security of these countries alone, oil is a strategic good and any disturbance in its supply can hit the security of most countries in the world, especial those with high level of oil consumption such as U.S, which may explain the permanent presence of American force in the region. GCC countries may need to rationalize their defence expenditures to suit the size and the ability of their economies. Come together to establish some ambitious heavy defence industries that can be capable of transferring some technology and skills, perhaps can bring more strength to both the economy and the security of the region. Such heavy projects perhaps can be joint projects with some neighbouring allies such as Egypt and Pakistan.

Furthermore, the chaotic situation that MENA region has been through from early this century; with American invasion of Iraq in 2003, and lately the uprising revolutions in the surrounding countries since December 2010, as well as the political tension

between Iran and most GCC countries, suggests that moving under one security umbrella might be the best viable way for GCC countries to ensure the security of their future.

CHAPTER 4

PUBLIC INFRASTRUCTURE AND ECONOMIC DEVELOPMENT IN SAUDI ARABIA

4.1 INTRODUCTION

This chapter investigates the role of public infrastructures in the economic development for one member of GCC region, Saudi Arabia.[115] With its immense land area, as big as west Europe – around 2.2 million square kilometres - , accompanied with small scattered population – around 6 millions in 1960s - , Saudi Arabia represents a country that is widely fragmented geographically and economically. Such characters have created the necessity for a heavy investment in infrastructures, especially transportations and communications (Looney, 1990). Although the country has barely had any form of public infrastructure prior to 1960s, the massive external windfall of oil exports since early 1970s has allowed Saudi to evolve from traditional agricultural pastoral economy to a relatively advanced-service one within few decades (Costa and Noble, 1986). A series of ongoing five-years economic plans have been initiated since 1970 to elevate the economy from a small fragmented agricultural one to more modern one that is capable of producing consumer and industrial goods and services.[116]

[115] Due to the lack of data form some economic variables for other GCC coutries the work is carried out for Saudi Arabia only.

[116] According to Saudi Arabia Embassy in the USA in a report on Infrastructure and economic in the kingdom (2010), Industrial products amount for over 90 percent of the Saudi's non-oil exports; Saudi's products such as petrochemicals, construction materials, metal goods, plastics and electrical appliance are exported to some 90 countries.

Hundreds of billions of Saudi currency "riyal" have been devoted to public infrastructures since the start of the first economic plan; by the completion of the third economic plan in1985, for example, over 300bn Saudi riyals had been spent on infrastructure development in the country (Looney, 1990).[117] Investment were made in many forms of infrastructures such as sea ports, Air ports, paved roads, electricity distribution networks that connect cities, towns, and villages around the country, telecommunications services, and piped water supply.[118] Connor (2010) argues that infrastructure development in Saudi Arabia is the key factor of transforming Saudi's economy from low-developing one to a fast growing developing economy. Loony and Frederiksen (1985) have also suggested that Saudi Arabia represents an ideal case study to assess the effect of infrastructure development on the development process in the country as Saudi Arabia appears to undertake a strategy of infrastructure led development through massive public investments. For example, infrastructure development received over 150bn riyals in the last two five-year economic plans 2000-2004, and 2005-2009 (SAMA annual report, 2010).

The World Devolvement Report of the World Bank (1994) views infrastructure as an umbrella term for various activities that is usually referred to by many development economists as "social overhead capital" and includes different forms of services such as public utilities (e.g. telecommunications, electricity networks, water and gas supply, sanitation and sewerage system) and public works (e.g. paved roads, major dams and canals for irrigation, sea ports, airports, railways).[119] Infrastructure has

[117] Saudi Arabia has an average exchange rate with US dollar of 3.5 Saudi riyals per dollar during the 1970s and early 1980s, and a fixed exchange rate of 3.75 was adopted since 1987.
[118] Further details on the infrastructure development in the country are presented in the next section.
[119] The report further suggests that due to the production characteristics of natural monopolies for most infrastructure services as well as the wide public interest involved, infrastructures are owned and operated by government in nearly all developing countries.

widely been thought of as an essential base for productive economic activities. Hirschman (1958, as cited in different sources such as Sutcliffe 1964; Looney and Frederiksen, 1981; among others), through his unbalance growth view, perhaps is one of the first economists emphasizes the role of public infrastructure on economic development. A big push to infrastructure through investments in public infrastructures will carry positive externalities to the other sectors in the economy and allow business activities to flourish. Services generated by infrastructure can contribute to economic growth through both supply and demand channels by lowering the cost of production, contributing to the diversification of the economy, and increasing the productivity of other production factors – labour and capital – by (e.g. improving health, reducing time and effort, and reducing wasteful consumptions of water, fuels and land) (Kessides, 1993).

Infrastructure's role comes, for example, in reducing the cost of establishing businesses (electricity, telecommunications, and water, for example, are used in nearly all sectors)[120], increasing economic activities in a country by connecting cities, villages, and regions within the country and with rest of the world (e.g. poverty alleviation in rural areas, cost reduction in transports, increase in the exchanges of goods and services, and allowing for economic of scale)[121], and contributing to environmental sustainability (e.g. clean water and sanitation, safe disposal of wastes, and better monitor of traffic in urban areas), as well as the contribution of

[120] With minimum package of power, telecommunications, and transports; Chain alleviates its rural enterprises to the level that they employ around 18 percent of the labour force – over 100 millions – and contributes with over one third of the country's total output (The World Development Report, 1994).

[121]The new economic geography studies suggest that the transport infrastructure is a central determinant of the location and the scale of economic activity as well as the pattern of trade where transport infrastructure can carry a great impact on the size of the market and hence allow producers to cluster in one central region (Haan et al, 2008).

infrastructure in providing amenities that enhance the quality of life and hence economic performance (Kessides, 1993; The World Devolvement Report, 1994; and O'Fallon 2003, among others).

Gramlich (1994) argues that economists sometimes cannot help it from deceiving themselves, although public capital is considered by most economists as an important factor in the production of total output, it was hardly even mentioned as a potential source of the productivity slowdown in the US economy during the 1970s and 1980s, where public infrastructure investment has sharply declined since 1973, until the work of Aschauer (1989) revealed the expected role of public infrastructure investment in the productivity slowdown. Aschauer examines the impact of public capital in the productivity of private economy of U.S.A, and finds strong positive impact of public capital, especially infrastructure, on the productivity movement of the private sector. He suggests that the fall in public investment during the 1970s and 1980s perhaps is the potential cause of the productivity slowdown in the economy. The finding of Aschaure and that of the following works in the field have drawn a considerable attention among economists and policy makers worldwide to the role of public infrastructure in economic growth.

Sturm et al (1998), Romp and Haan (2007), and Torrisi (2010) survey vest amount of works in the field and identified different theoretical approaches that have been widely considered to measure the impact of public infrastructure investment on the economic growth such as the one considered by Aschaure "the production function approach", cost-function approach, Vector Autoegressions VAR model, endogenous

growth model, and simultaneity equations models SEM.[122] With few exceptions, most of the surveyed works suggest a positive and significant impact of public capital on the economic growth at the local and the international levels. However, the magnitude of the effect differs across the studies and for most of those considered Aschuare's approach the elasticity appears to be smaller than that found by Aschuare, (Romp and Haan, 2007). [123]

After four decades of economic planning with a relatively heavy infrastructure investment, Saudi Arabia may represent, as Loony and Frederiksen (1985) suggest, an interesting case study to examine the impact of public infrastructure on economic development. In this chapter we will try to examine such impact in Saudi Arabia using the widely common approach of Aschuare "the production function approach" in the context of VAR model and cointegration analysis, similar to that of the previous chapter. The chapter is organized as follow: the following section discusses the infrastructure development in Saudi Arabia, section 3 reviews the literature, section 4 presents the empirical methodology and data sources, section 5 reports the empirical findings and section 6 concludes.

[122] Gramlich (1994) and the World Development Report (1994) may provide earlier surveys of the literature.
[123] Fernald (1999), Haan et al (2008), among others, suggest that one feature of the public investment in some area, highway for example, is the fact of a very low marginal rate of return on additional investment is expected once the basic part of the networks are established.

4.2 INFRASTRUCTURE DEVELOPMENT IN SAUDI ARABIA

Some features and conditions that characterise Saudi Arabia's economy are combined together to create the need for a catalyst role for the government in the process of economic development (Edens and Snavely, 1970; El Mallakh, 1982; Looney, 1990). Saudi Arabia has vast dry land area covers over 2.2 million square kilometres of what is called Arabian Peninsula, stretches from the west coast of Persian Gulf to the east coast of the red sea – over 1300 km –, and from south borders with Yemen and Oman to north borders with Iraq and Jordan – over 1700 km –.[124] A country with immense uninhabitable desert land with no perennial rivers or lakes and sporadic and infrequent rainfall; only 0.2 percent of total land was used for cultivation by early 1970s and at least 25 percent of total population were still nomadic. The urban population was small and scattered in numbers of towns in different regions around the country and hardly connected with each other, which may reflect the small market size of the country.[125] Furthermore, economic activities in those towns were mostly engaged in bazaar or "suq-type" commercial activity (Edens and Snavely, 1970).

Although oil revenue, since its exportation in late 1930s, has always been the major source for the government to practice the dominant role in all economic activities, it was not until the late 1960s and early 1970s, where oil revenue increases dramatically, the government had the financial capability to take its role to influence

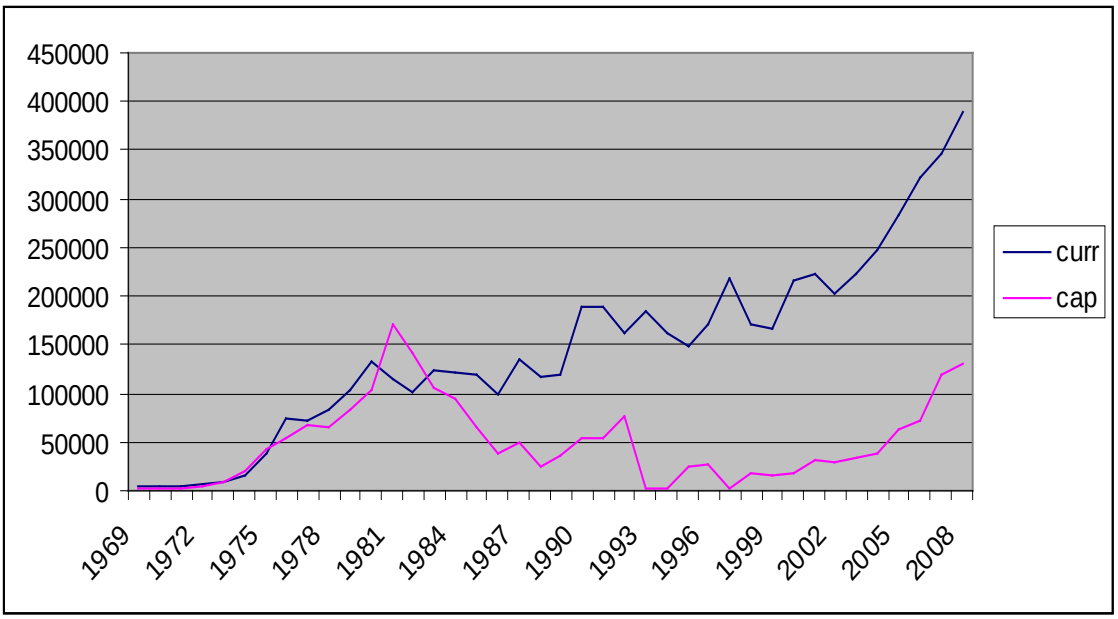
[124] Saudi Arabia is the largest country in Arab World and is among the largest 25 countries in the world (Aldagheiri, 2010).
[125] The population of the two major cities in the country Riyadh and Jeddah was less than 20,000 inhabitants each prior to Wold War II, and up to the mid of 1950s Saudi Arabia had no paved roads (Costa and Noble, 1986).

the rate and the quality of economic development.[126] In 1970 the government introduced a series of ongoing five-year economic plans with a generous welfare system and heavy public investment programmes in different sectors as the principal aim is to alleviate the socio-economic level of the country and to lead the process of economic development. Figure 4-1 shows that public capital investment increases dramatically with impressive figures since early 1970s, though it declines sharply since late 1980s and through the 1990s due to the drop in oil prices during these periods as well as the cost of second gulf war, it picks up again with the start of the seventh economic plan early this century as the oil prices tends to rise since, and the demand for infrastructure services tends to increase as the county's population keeps growing. On the other hand, current government expenditure appears to grow with time – which may indicate the dominant role of government as the main employer for Saudi nationals (Fasano and Wang, 2001) –.[127]

With such heavy capital expenditures Saudi Arabia has been able to acquire a ready made economic infrastructure that took Western Europe and United States over 100 years to build (Al-Hegelan and Palmer, 1985). In the first two economic plans, for instance, approximately $250bn was spent in various elements; with an impressive figure of investment per capita of almost $35,000 (Costa and Noble, 1986). Public investments were made in many sectors, but the development of public infrastructure, especially transports and communications, has received a great attention.

[126] Saudi's oil revenues rise from $56mn in 1950 to over $300mn in 1960 and over $1bn by 1970, the revenue generated from oil price shocks during the 1970s alone went well beyond an impressive figure of $200bn(SAMA annual report, different issues).
[127] Looney (1997) argues that the wages bill accounts for almost 50 percent of the state budget in Saudi Arabia.

Figure4-1: Current and Capital Government Expenditures (Million Saudi Riyal)



Source: SAMA Annual Report (2010).

In such vast country like Saudi Arabia transportation infrastructure in particular is important to enhance the regional productivity and increase the exchange of goods and services within the county and with rest of the world. Thus, transports infrastructure has received unprecedented form of development especially in the first three economic plans. For example, 22 airports were either constructed or improved including three international airports in Riyadh (central region), Jeddah (western region), and Dammam (eastern region), Four major sea ports were built including the huge one in Dammam, and over 29,000km of paved roads that linked all regions, cities, and middle-sized urban towns were built and connected with over 54,000 km of earthen-surface agricultural road that served over 7000 villages, (Costa and Noble, 1986; SAMA annual report, 2010).[128] Railways network in Saudi Arabia, on the other hand, has been neglected with only upgrading the existing railway between Riyadh

[128] This huge infrastructure development went along with heavy investments in other sectors such as education, health, and defence as well as the constructions of two major industrial cities that accommodate industries with comparative advantage such as oil refinery and petrochemicals industries; one is in Jubail on the eastern coast and another one is in Yanbu on western coast.

and the east region and the construction of a dry port at Riyadh in 1981, railway infrastructure is the least developed transport system in the kingdom. Such shortage has been noticed and compensated with relatively heavy investment projects of about 3200 km of railways that connect different regions; some of which is under construction and others will be constructed in the coming years, (Aldagheiri 2010, and SAMA annual report 2010). Now there are nine major sea ports and 12 other small and medium modern one in the country, 3 international airports and 21 other local and regional airports, and over 54,000km of paved road connected with about 132,000 km of agricultural roads.

Telecommunications infrastructure also have been favoured during the first economic plans, with Intelsat network opened in the first economic plan the country was opened to the international communications with the extension of telephone networks to all cites and towns around the country, as well as to some villages; by 1985, for example, there was over 900,000 telephone lines. However, the telecommunications services went under huge pressure since late 1980s and through the 1990s; for example, about 250,000 applicants were in waiting for new lines in 1992 and the number kept rising Benna (1995).[129] As of now, Saudi Arabia has very well established telecommunication services; there are over 4 million telephone lines and seven standard earth stations link up with the Intelsat Satellite system. Mobile communication services also have witnessed a great development in the last decade in terms of penetration, quality, and prices especially after the market was opened for competition; the number of mobile phones increases from around 5 million mobiles in

[129] Benna further suggests that most of infrastructure and industrial development in the country are concentrated in central east-west axis of the country from east port of Dammam through Riyadh in the central region to the west port of Jeddah on the red sea; for example, around 75 percent of the working telephone line in 1994 had been in the east, Riyadh (central region), and Jeddah (western regions).

2002 to over 44 million lines in 2009, internet services have been growing too with rapid rate; internet subscribers went up from around 1 million in 2001 to 10 million subscribers in 2009 (SAMA annual report, 2010).

Fresh water shortage is well noticeable phenomenon in Saudi Arabia where most of the country is desert land including Al-Rub al Khali which accounts alone for one third of the country's land area. The government has acted in many ways to secure the shortage of fresh water since the start of first economic plan. During the 1970s the government put on a major effort to allocate and map aquifers around the country, and many dams were built around the country with thousands of miles of irrigation canals that distribute the surface floods water to the fertile land (Beaumont, 1977).[130] To remedy the shortage of water and to meet with the increasing demand for water by urban and industrial uses, Saudi Arabia engages in the largest desalination programme in the world history (McHale, 1980). Number of desalination plants was constructed on the east and on the west coasts of the country with water pipe supply extended to many cities and towns around the country. Saudi Arabia is the biggest producer of desalinated water in the world; there are now 29 desalination plants in the country producing about 3 millions cubic meters a day (SAMA annual report, 2010). On the other hand, the development of the sewage system in the country has been rather slow. Although the construction of sewage networks in the major cities was completed in the second and the third economic plans (Beaumont, 1977; and Costa and Noble, 1986), the expansion of the existing networks and the construction of sewage network system in other small urban cities as well as the management of sewage effluents waste have been slow.

[130] By 2009 Saudi Arabia has 302 dams with a total storage capacity of 907.8 million cubic meters, (SAMA annual report, 2010).

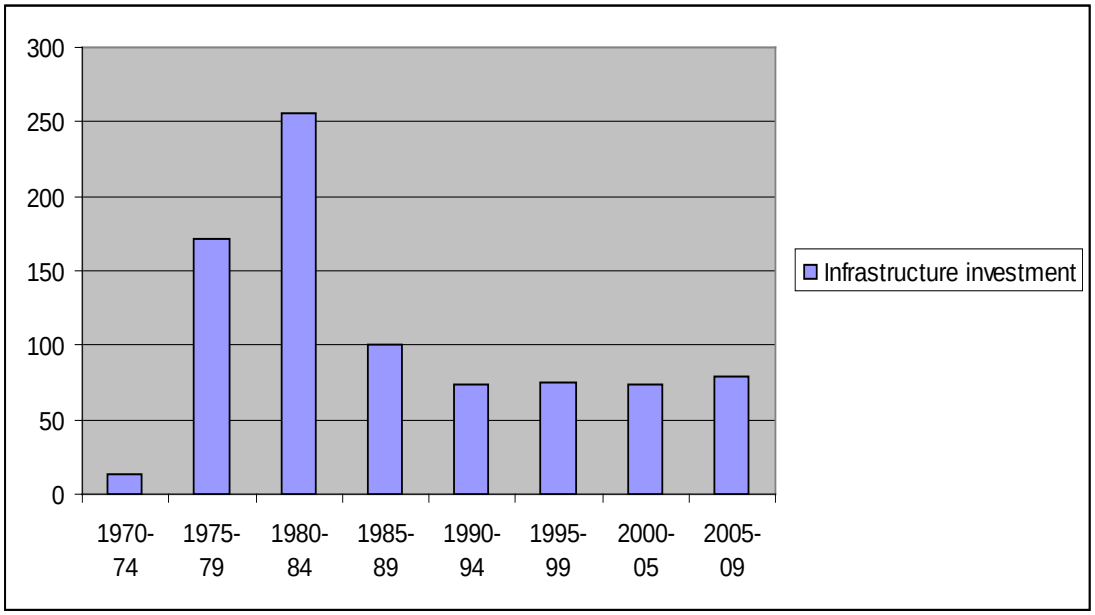
Saudi Arabia has also invested heavily on electricity generation and distributions networks; electricity power reaches almost all parts of the country by the mid 1980s with generating capacity of over 13,900 Mega Watt (MW) in 1985 and over 1.7 million subscribers. However, there has been a dramatic increase in the demand for electricity services from the industrial sector and from the growing urban population since late 1980s accompanied with slow growth rate of electricity capacity since 1990. The electricity service went under a big pressure to meet the increasing demand, The Ministry of Water and Electricity's calls for $117bn investment to increase the generation capacity from 17,000 MW in 1995 to about 67,000 MW by 2020 (Moussa, 2010). [131] Massive investments have been carried out and some still going on to increase electricity generation capacity and to expand the distributions networks. Saudi Arabia now generates over 38,000 MW a year with 8,750 miles of transmission lines, 52,000 miles of distribution lines and over 53,000 miles of service connections (SAMA annual report, 2010).[132] Furthermore, an ambitious project has already begun with the other GCC countries to link all the national power grids of the GCC region.

Figure 4-1 reports the volume of infrastructures investment in Saudi Arabia in the last 8 economic plans (1970 – 2009). Infrastructure investment increases dramatically in the first three economic plans (1970-1984) which may reflect the low level of infrastructure in the country prior to the 1970s. As the infrastructure investment peaked in the mid 1980s, it starts receding during the late 1980s and through the 1990s as the oil prices fell down and most of infrastructures were established. However, as the previous discussion suggests, Figure 4.2 shows that the infrastructure

[131] Saud Arabia has one of the highest per capita electricity consumption in the world around 5000 kwh/month, (Moussa, 2010).
[132] See also the report by Saudi embassy in U.S.A (2010).

investment has been increasing since the start of this century as the government engages in different infrastructure projects to meet with the increase demand for infrastructure services. For example, the current economic plan (2010-2014) approximates $385 bn covering various sectors such as transports, energy and utility, health and education, industrial and tourism development (Connor, 2010).

Figure 4-2: Infrastructure Investment in Saudi Arabia (Billion Saudi Riyal)



Source: Al-Shammari (2009) and SAMA annual report different issues.

4.3 LITERATURE REVIEW

The role of public capital in economic development has always been recognised as an important factor for the development process. The large amount of public capital expenditure that most European and developing countries had witnessed in the 1960s and 1970s was as results of widespread conventional wisdom that was based upon both, the argument formulated by Hirschmann that social overhead capital, as he describes infrastructure,[133] is the base for productive economic activities, and on the extensive government intervention that was generally needed after World War II (Diamond, 1990). A great attention, however, has been paid to the role of public capital in the economic performance after the finding of (Aschauer, 1989). Aschauer investigates the impact of public capital accumulation on the productivity movements of the United States' private economy. He argues and presents some empirical evidence that suggests the shortfall in infrastructure investments during the 1970s and 1980s in the Unite States could be crucial in explaining the slowdown in productivity growth in the country.

Aschauer presents public capital as a free input, public good, provided by the government to all private firms. Using production function approach in the form of Cobb-Douglas that includes public capitals as explanatory variable, along with private capital and labour over the period 1949- 1985, the results reflect a strong positive impact of public capital on productivity of the private sector. The estimated elasticity of total public capital was 0.39 and significant, whilst the elasticity of core

[133] The first time the term "infrastructure" come to the current use was in the 1950s when the U.S. military applied it to their underlying structures (Cain, 1997).

infrastructure alone was 0.24 and highly significant compare to other forms of public capital.[134]

Aschauer's finding, as he suggests, offers tentative answers for two important questions in the macroeconomic literature. First, policy makers can be in a better position to judge the degree to which public expenditure policies stimulate production, raise interest rates, and induce excess demand pressures, if the degree to which public expenditures can be productive is estimated.[135] Second, economists and policy makers may need to consider the long-run effect of public expenditure on the productivity movements.

There have been substantial waves of empirical works in the role of public capital "infrastructure" on economic performance at the local and at the international levels since Aschauer's findings. Gramlich (1994), Sturm et al (1998), among others, suggest that Aschauer's findings and that of the following works may have in fact provide some explanations for the slowdown in the productivity during the 1970s-1980s in the US and most of OCED countries as the infrastructure expenditure has declined during the same periods,[136] and thereby represents a potential factor of the slowdown in productivity growth. Furthermore, Sturm et al (1998) suggest that the findings of Aschaure and that of the following works in the role of public investment in the growth of output have been well-received policy implications by policy makers;

[134] Aschauer argues that although there are several proposed explanations for the cause of the productivity growth slowdown of private economy in US, such as decline in the R & D outlay, the oil price shocks in the 1970s, the composition of the work force, the findings of his work, however, emphases the importance of considering the role of public investment in explaining productivity slowdown.

[135] For example, a higher marginal productivity of public expenditure may imply that a short-term surge of public spending may bring multiple expansions of output.

[136] Sturm et al (1998), Romp and Haan (2007), among others, argue that many European countries cut back public investment during the 1970s and 1980s, in order to raise the social security transfers as well as to finance the increase in the payments of the debt interest.

infrastructure investment formed a major factor of President Bill Clinton's economic plans.[137]

In line with Hartley's (2006) argument of the absence of a formal economic model of the impact of defence expenditure on e conomic development, Holtz- Eakin and Lovely (1996) have suggested the same thing for productivity effects of infrastructure.[138] Gramlich (1994), Sturm et al (1998), Romp and Haan (2007), and Torrisi (2010) survey vast amount of works in the field and distinguish four approaches that have been widely considered to measure the impact of public capital on economic performance. The first one and the most popular one is the one considered by Aschauer and is commonly labelled as the production function approach, where the public capital variable enters the production function as a common structural input to all firms' production process. The second approach, albeit similar, is so-called the cost-function approach in which the cost function of private firms is augmented with public capital stocks, as well-established public infrastructures may lower the cost of operations and increase profitability of private firms.[139]

The third approach introduces A Vector Autoegressions VAR model as an alternative approach to mitigate some econometric problems of the first approach such as causality and simultaneity bias – as we have considered it in the previous chapter - .

[137] Canning (1998), however, suggests that due to the large involvement of government in infrastructure provisions, the patterns of infrastructure stocks perhaps can be better understood through the political economy arguments rather than through the economic efficiency.
[138] A very little attention has been paid to the theoretical issue of the casual relationship between public capital and economic growth **(**Haan et al 2008).
[139] Sturm et al (1998) called this approach "the behaviour approach" since the profit function of the private firms can be estimated too with public capital in consideration, as firms may consider public capital as they optimize.

The fourth approach is dominated by cross-section studies and employs growth model based on the endogenous growth view. Finally, there have been some attempts of employing more structural models, simultaneity equations models, to measure the role of public capital in economic growth, as we reviewed some here. The review of the empirical literature here will try to group the reviewed studies according to the above classifications, as a summary table for each classification is provided.

Following Aschauer's approach, Munnell (1990) investigates the impact of public capital on private output at the state and the regional level in the United States over the period 1970 – 1986. Using the production function approach, the results suggest that public capital has positive and statistically significant impact on private sector output for all regions (Northeast, North Central, South, and West) as well as for the whole sample. Moreover, even when public capital was disaggregated into Highway and streets, water and sewer system, and other structures and equipments, the estimated coefficients of each component was significant and in line with expectations. He concludes that infrastructure has a lot to offer to the private economy and as the results seem to indicate, the states that invested more in infrastructure tend to have greater output.

Canning and Bennathan (2000) also measure the effect of public capital on economic growth for 62 countries over the period of 1960 – 1990, using the production function approach and two proxies of infrastructure stock – electricity generating capacity and paved road - . The results suggest a positive and significant impact of both infrastructure proxies on economic output. However, when the sample was split into two sub-samples (low-income and high-income) as to control for the possibility that

the elasticity may vary across countries, the coefficient of infrastructure proxies in low-income countries are very small and insignificant, but they remain large and statistically significant for high-income countries. The study suggests that this could imply that infrastructure in poorer countries may not have greater effectiveness than other types of public capital, whilst in rich countries it may have a greater impact compare to other forms of public capital.[140]

The production function approach, nonetheless, has been criticised on different grounds as of the econometric problems that associated with the estimation of a single equation such simultaneity bias and the direction of causation, as well as the misspecification of the relationship between the two variables. To overcome some of the drawbacks of the production function approach, some studies use the cost function of private firms and suggest that the impact of public capital could be analysed in terms of cost saving.[141]

Berndt and Hansson (1992) investigate the impact of public infrastructure on the cost of private sector in Sweden over the period 1960-1988, using cost function approach in the form of generalized Leontief cost function. The results suggest that increase in

[140] Double counting problem is encounter here with the interpretation of the coefficients of infrastructure stock proxies since they are already included in total capital stock variable. Canning and Bennathan suggest that the coefficients of infrastructure proxies can be thought of as the effect of increasing the stock of the particular infrastructure proxy, whilst holding capital stock constant, that is; it is the effect of diverting the resource from other forms of capital to allocate it to the concern infrastructure proxy.

[141] A cost function of private sector can be specified by assuming that firms aim to produce a given level of output at minimum private cost. Since Input prices (p_i) are exogenously determined to the private firms the firms can choose the quantity of the input factors (q_i). This can be modelled as:

$$C(p_t^i, q_t^i, A_t, G_t) = \min \sum p_t^i q_t^i \text{, Subject to } Q = f(q_t^i, A_t, G_t)$$

When firms optimize they will consider the environment where they operate, environmental variables such as the level of technological knowledge (A) as well as the level of public infrastructure capital (G). Thus the infrastructure capital enters the cost function as free input. The dual function that satisfies the optimization problem above is usually approximated by second – order Taylor approximation such as the translog or generalized Leontief function (Berndt and Hansson, 1992; Sturm et al, 1998; and Torrisi, 2010).

pubic infrastructure significantly reduce the costs of private sector. They also suggest that further work is needed to assess the social and private benefits of not only the public infrastructure but also those of other public expenditure such as those of health, education, and social services. Bosc´a et al (2000) use the cost function approach in the generalized Leontief cost function form to analyze the impact of public infrastructure on cost of private sector of 17 Spanish regions over the period 1980 – 1993. The results of the study indicate that the stock of public infrastructure has a significant contribution in reducing the cost and stimulating the productivity of private sector in almost every region in the country. They also indicate that the government may need to continue its investment efforts as there seems to be shortage of public investment, and the results suggest that public capital is growth promoting in the long – run.

Cohen and Paul (2004) also measure the effects of public infrastructure on the cost of the private sector using cost function approach in the form of generalized Leontief cost function on manufacturing data for 48 US states over the period 1982 – 1996. Using a constructed proxy for public highways as the proxy for public infrastructure, the results reflect significant impact of public highways in reducing the cost of manufacturing sector. The results also indicate that the infrastructure in neighbouring state raises the value of own-state infrastructure investment and directly affect the manufacturing firm's cost. The interstate effect of public infrastructure, however, varies across the regions especially between the east and the west; the largest was in the west while the smallest effect was in the east and south, whereas the Pacific states benefit the least.

Table 4.1 literature survey (some studies used Production Function and Cost Function Approaches to Measure the Impart of Infrastructure on Economic Development)

Author	*Sample*	*Remarks*	*Public capital variable*	*Main Conclusion*
Production Function Approach				
Aschauer (1989)	U.S.A 1949-1985	Time – series estimates	Public capital stock and core infrastructure	Public capital and core infrastructure have significant positive effects on the productivity of the private economic.
Munnell (1990)	4 U.S regions 1970-1986	Time series and Pooled panel estimates	Public capital stock	Positive and significant impact of public capital on private sector output for all regions as well as for the whole sample.
Canning and Bennathan (2000)	62 countries 1960-1990	Cross – section estimates	Electricity generating capacity and paved road	Positive impact of both public variables on economic growth for the whole sample, but insignificant impact for low income countries while positive and significant for high income countries.
Cost Function Approach				
Berndt and Hansson (1992)	Sweden , 1960-1988	Time – series estimates	Infrastructure capital	Public infrastructure significantly reduces the cost of private economy.
Bosc´a et al (2000)	17 Spanish regions 1980-1993	Pooled penal estimates	Stock of public Infrastructure	the stock of public infrastructure has a significant contribution in reducing the cost and stimulating the productivity of private sector in almost every region in the country
Cohen and Paul (2004)	48 US states, 1982-1996	Pooled panel estimates	Public highways stock	Public highway reduces the cost of manufacturing sector across the states.

Sturm et al (1998) and Romp and Haan (2007) suggest, however, that the flexible form of the cost function usually produce estimates that suffer from multicollinearity problem since the function consists of many cross-products of the inputs. Moreover, they notice that the properties of the time series are not considered in most studies that used production function approach, and hardly mentioned in those employ cost function approach. They, however, conclude that most of the surveyed studies suggest that pubic capital raises the productivity and reduce the cost of private economy.

Various studies in the field have employed Vector Autoegressions VAR models to mitigate some of the econometrics problems that are associated with first two approaches. VAR model as we saw in previous chapter does not have prior assumptions about the causality between the variables under investigation; in VAR models all variables are endogenous and jointly determined. Thus, the direction of causation between public capital and economic growth can be investigated. Batina (1998), for example, uses VAR approach to estimate the production function of private sector in the US where public capital variable is included as to assess the impact of public capital on private output over the period of 1948-1993. The study employs several alternative proxies for private capital and labour to assess the sensitivity of the results to the alternative proxies. The results indicate that public capital appears to have a strong positive long lasting impact on the private sector output, and vice versa. The study finds strong evidence for multiple cointegration vectors, ranging from two to four vectors in many cases depending in which combination proxies are used. The main results, however, are fairly robust to the combination of proxies employed. Impulse response analysis also reveals that an innovation to public capital can have positive long lasting effect on private output,

labour, and capital. And an innovation to output, labour, and private capital can also affect the public capital. However, when public capital was disaggregated into different types – highways and streets, and water and sewer system – the impact of public capital was much smaller than that of the data in aggregate form.

Kamps (2004b) also investigate the impact of public capital in economic growth for 22 OECD countries over the period 1960-2001 using VAR approach and similar variables to those considered in production function approach.[142] The results of cointegration and VECM suggest that there is at least one cointegration relationship in each country and a significant long – run relationship between pubic capital and output. Moreover, the impulse responses analysis shows that, for the majority of countries, an innovation to public capital have a significant positive effect on output, and vice versa. It further suggests that the public capital and private capital for most countries are long – run complements, whilst the response of employment to a shock in public capital is statically insignificant. On the other hand, Ghali (1998) investigates the impact of public capital on economic growth in Tunisia over the period from 1963 to 1993 using VAR approach. The results suggest that the public capital carries a long-run negative effect on the output and on private capital. Furthermore, the causality appears to run from income to public capital and not vice versa. Ghali relates that to the inadequacy of infrastructure stocks allocation and highly subsidized inefficient state owned enterprises that often prevent the possibility for private investment.

[142] Kamps (2004b) and Romp and Haan (2007) provide extensive surveys on the studies that have used VAR approach to analyse the impact of public capital in economic performance, they note, however, that most of the studies are usually consisted of four variables – output, employment, private capital, and public capital -.

Other group of studies, on the other hand, have employed cross – section and panel data to measure the impact of public capital on economic performance. Most of these studies employ growth model that primarily based upon the endogenous growth theory, In which the growth process is not exogenously determined, as it is the case in the view of exogenous growth theory, but is rather an endogenous process that influenced by economic agents' behaviour. So in endogenous growth model capital formation plays the key role in explaining the different performances, where other types of capital namely human capital and knowledge capital are considered along with fiscal capital.[143] For example, Easterly and Rebelo (1993) investigate the impact of some public policy variables such as taxation, and public investment on the economic growth rate using cross-section data for 100 countries over the period 1970 – 1988. Using the share of investment in transport and telecommunication as proxy for infrastructure, the results suggest that economic growth is positively and robustly correlated with infrastructure variable. They study argues that the relatively large and significant coefficient of transport and telecommunication variable indicates that infrastructure investment may in fact raises economic growth not only by r aising private investment but also by increasing the social return to private investment.

Devarajan et al (1996), on the other hand, investigate the effects of pubic expenditures on economic growth for 43 de veloping countries over the period 1970 – 1990. In contrast to the expectations, the standard candidates for productive expenditures such as telecommunication and transport, health, and education appear to have insignificant

[143] The general forms of the estimated models in various studies that investigate the impact of public capital on economic growth can be expressed as follow:

$$\Delta(Y/L)_t = \alpha + \beta\,(Y/L)_0 + \gamma\,(I^G/Y)_t + Z$$

Where, $\Delta(Y/L)_t$ is the average growth rate of GDP per capita, $(Y/L)_0$ is the initial level of GDP per capital, $(I^G/Y)_t$ is the average rate of public investment, and Z is a set of conditional variables such as private investment, human capital proxy…etc, see Sturm et al (1998), and Torrisi (2010) for further details.

impact on t he economic growth, whilst the current expenditures are positively correlated with economic growth. Devarajan et al suggest that such results perhaps can be possible and not very surprising where productive expenditures can be unproductive if there are excessive amounts of them or they have been misallocated as it can be the case in many developing countries. The study concludes that the widespread belief that an increase in public capital in developing countries promotes economic growth may have been exaggerated; some components of current expenditure such as o peration and maintenance may carry significant effect on economic growth than public capital can do.

Milbourne et al (2003) also employ the endogenous growth model that consists of public capital to assess the impact of public investment on economic growth for 74 countries over the period 1960-1985. The cross-section estimates suggest that public investment carries a si gnificant and positive effect on economic growth with quite reasonable coefficient that is comparable with private capital coefficient. However, these results hold only for OLS estimates, but not for estimates produced by instrumental variable IV technique, where the impact of public capital was statistically insignificant.[144]

[144] The cross- section studies are mostly based on the regression of single equation growth model, where the previous econometric problems such as simultaneity bias, causation, and multicollinearity may exist in the estimation. A more structural model perhaps can provide a viable way when data allowed.

Table 4.2 Literature Survey (Some Studies Used VAR and Cross-Section Approaches to Measure the Impart of Infrastructure on Economic Development)

Author	*Sample*	*remarks*	*Public capital variable*	*Main Conclusion*
VAR Approach				
Batina (1998)	U.S.A 1948-1993	Time – series estimates	Public capital stock	public capital carries a strong positive long lasting impact on the private sector output, and vice versa
Kamps (2004b)	22 OECD countries, 1960-2001	Time-series estimates	Public capital stock	Positive and significant impact of public capital on private sector output for most countries in the sample.
Ghali (1998)	Tunisia, 1963-1993	Time-series estimates	Public investment	Public investment has a significant negative impact on economic growth.
Cross-Section Studies				
Easterly and Rebelo (1993)	100 countries, 1970-1988	Cross – section estimates	The share of investment in transport and telecommunication	Economic growth is positively and robustly correlated with infrastructure variable
Devarajan et al (1996)	43 Developing countries, 1970-1990	Pooled Penal estimates	Public capital components (telecommunication and transport, health, education…etc)	Public capital expenditures have negative and significant impact on economic growth, whilst current public expenditures have positive effects on the economic growth.
Milbourne et al (2003)	74 countries, 1960-1985	Cross – section estimates	public investment	Public investment has positive and significant impact on economic growth according to OLS estimates but insignificant impact according to IV estimates.

Other group of studies employs more structural models, a system of simultaneous equations, to measure the effect of pubic capital on the economic performance. A system of simultaneous equations model will overcome some econometrics' problems that are associated with the estimation of a single equation, such as simultaneity bias and multicollinarity as it can be the case in some of the other approaches discussed above. Duffy-Deno and Eberts (1989) for instance, measure the impact of public capital on the regional economic growth, measured by GDP per capita, for 28 United States metropolitan areas over the period 1980-1984 using system that consists of two equations, income equation and public investment equation. The 2SLS estimated results suggest a positive and statistically significant effect of public infrastructure on personal income and vice versa. Duffy-Deno and Eberts suggest two channels for public infrastructure effects: one through the actual constructions of public investment, and the other one is through the contribution of public infrastructure as unpaid input in the production process and as consumption good for households. They conclude that public infrastructure has long – run consequences for promoting a region's productivity and its competitive advantage. Therefore, well maintained public infrastructure should be an important component of any policy aims to enhance regional development.

Roller and Waverman (2001) employ a system of simultaneous equations to investigate the impact of telecommunication infrastructure on economic growth for 21 OECD countries over the period 1970 – 1990. The system consists of four equations: production function equation, demand for telecommunication equation, supply of telecommunication equation, and the production function of telecommunication equation. Using the penetration rate (number of mainline per capita) and controlling

for country-specific by fixed effect technique, the GMM estimates of the system suggest a significant and positive effect of telecommunication on economic growth and vice versa. Furthermore, the results suggest that countries with higher level of telecommunication infrastructure may well experience a larger impact on output compare to those with relatively lower level telecommunication infrastructure.

Moreover, Sridhar and Sridhar (2007) analyse the causal relationship between telecommunication infrastructure and economic performance for a sample of 63 developing countries over the period 1990 – 2001 using a system of four equations similar to that of Roller and Waverman (2001).[145] According to Sridhar and Sridhar the World Bank reports that the investment in telecommunications infrastructure by private sector in developing countries between 1993 and 2003 was about 230$bn. And therefore it is important to study the relationship between telecommunication infrastructure development and the economic performance in those countries as to determine if the developing countries have benefited from this recent development in this emerging area. The study use main landline penetration and mobile phone penetration as proxies for telecommunication infrastructure and allowing for country fixed-effect, the 3SLS estimates indicate that total telecommunication infrastructure carries a positive and significant effect on the economic growth. They also estimate the system for both the main landline penetration variable and the mobile phone; the results suggest that the impact of mobile phone variable on growth is greater than that of the main landline telephone. They related that to the fact that the cost of

[145] Roller and Waverman (2001) argue that the direction of causation between economic growth and telecommunication is clearly two-way, increase in telecommunication stimulates economic growth by fostering the exchange of good and services, lowering the cost of information...etc, and in return increase in economic activities raises the demand for telecommunication services. Thus, unless telecom infrastructure investment is modelled, the measured effect of telecom infrastructure on economic growth will be bias.

infrastructure for landline telephones is greater than that of mobile phones, and therefore developing countries have bypassed investment in fixed landlines to wireless and cellular mobile system as a way to catch up with developed countries since penetration rates of telephones are very low in many developing countries. They conclude that the policy makers in developing countries need to promote investment in telecommunication by improving regulations and by c reating more competitive climate to attract more foreign direct investment into telecommunication industry.

Table 4.3 literature survey (Some Studies Used SEM to Measure the Impart of Infrastructure on Economic Development)

Author	*Sample*	*Remarks*	*Public capital variable*	*Main Conclusion*
Duffy-Deno and Eberts	28 U.S metropolitan areas, 1980-1984	Two equations, income equation and public investment equation, pooled panel, 2SLS estimates'.	Local infrastructure investment.	Positive and significant effect of public infrastructure on personal income, and vice versa.
Roller and Waverman (2001)	21 OECD countries, 1970-1990	Four equations: production function equation, demand for telecommunication equation, supply of infrastructure equation, and the production function of telecommunication equation, pooled panel, GMM estimates'.	Main landline penetration	A significant and positive effect of telecommunication variable on economic growth and vice versa.
Sridhar and Sridhar (2007)	63 Developing countries, 1990-2001	Four equations: production function equation, demand for telecommunication equation, supply of infrastructure equation, and the production function of telecommunication equation, pooled panel, 3SLS estimates'.	Main landline penetration and mobile phone penetration	Both variables have significant and positive effect on economic growth and vice versa. But the impact of mobile phone variable is greater than that of main landline.

4.4 EMPIRICAL METHODOLOGY

Diamond (1990) suggests that the wide range of infrastructure forms indicate that the relationship between infrastructure and economic growth is not only very complex but also is very real. As direct or indirect input into production, the quality and the quantity of infrastructure provisions affect the productivity and the cost of private economy. Vast amount of works on the role of infrastructure in economic growth, as we reviewed some in the previous section, have shown a positive and significant correlation at local, regional, and international levels between the two variables. However, the mechanism through which infrastructure affect growth is not fully established. A concern of whether infrastructure provisions cause economic growth or growth causes infrastructure investments, is not settled yet, as we reviewed different approaches that have been proposed in the literature to measure the casual relationship between the two variables.

The World Bank report (1994) argues that there are evidences to suggest that infrastructure stocks composition do change significantly as income rises and the economy matures from low-income stage into middle-income then into high-income stages, especially for certain infrastructure - access to safe water, paved roads, telecommunication, and power - . Basic infrastructure such as supply of safe water and transport is more important in low-income countries, but as economies grow and mature to middle-income stage more transport infrastructure is provided, the share of agriculture in the economy declines, and the demand for power and telecommunication increases. And as the economies move to high-income level the demand and the stocks of telecommunication and power become even greater.

Therefore, a more structure model as Sturm et al (1998) and Roller and Waverman (2001), among others, suggest perhaps is more appropriate one to measure the relationship between the economic growth and the infrastructure investment to control for simultaneity bias and to identify the casual relationship. Yet, Saudi Arabia, as most of MENA countries, suffers the lack of the quality and the availability of some economic and social indicators to construct a model similar to that suggest by Roller and Waverman (2001) or even an wishful one.

Gramlich (1994) argue that public capital is recognised by most economists as an important factor in the production of total output. Therefore, the production function approach in the context of VAR and cointegration analysis may provide a viable way to measure the relationship between the two variables. VAR, as we discussed in the second chapter, is a reliable framework that has widely been used in the economics literature; an advantage of VAR model is that each variable in the system is a function of the lagged values of all endogenous variables in the system and thus simultaneity bias is not an issue and OLS yields consistent estimates.

Following the main stream that considers VAR approach (e.g. Kamps 2004b) the econometric model is as follow:

$$\text{Ln GDP} = \alpha_0 + \alpha_3 \ln \text{KG} + \ln \text{KP} + \alpha_2 \ln \text{L} + \varepsilon$$

Where GDP is the level of real GDP, KG is public capital stock, KP is private capital stock, L is labour force, and ε is the error term. In order to develop the dynamics of the model as well as to avoid the simultaneity bias the study employs the Vector Autoregressive (VAR) framework to estimate the previous equation. Similar to our

analysis in the previous chapter, the impulse responses and variance decompositions analyses as well as that of the cointegration and ECM are carried out here. All variables are measured in the real terms of 2000 prices, and they are all in the natural logarithm form.

4.5 DATA AND DATA SOURCES

Real GDP is used as proxy for total output, public capital expenditure is used as proxy for public capital stock KG, [146] and Credit to private sector is used as indicator for private capital stock KP. Labour force is considered as indicator for employment.

Data for GDP, public capital expenditure, and credit to private sector are obtained from the Saudi Arabian Monetary Agency SAMA annual report (2010). Data for labour force from 1980 to 2008 is obtained from the World Development Indicators (WDI) (2010). To estimate the data for labour force during the period from 1970 to 1979 we used data for the number of government's employees to derive the labour force data from 1970 to 1979. We find that the percentages of government's employees in the labour force range from 9 percent to 11 percent throughout the time from 1980 to 2008. Hence, we consider 10 percent as an average rate and drive the labour force during the 1970s using data for the number of government's employees which is available from SAMA annual report from 1970.[147] The data for all variables range from 1970 to 2008.

[146] Disaggregated data on public capital expenditure, such as transports and telecommunications, health and social development…etc, are available only from 1981, which offers limited number of observations for the estimation. Thus, we consider total public capital expenditure which is available from 1970.

[147] Simply if X is the number of government's employees, and Y is the labour force. Then if X is 10 percent of Y then: Y= (1/0.10) X.

4.6 EMPIRICAL INVESTIGATION

4.6.1 UNIT ROOT TESTS

The two alternative unit root tests, the Augmented Ducky-Fuller (ADF) test and Philips-Perron (PP) test, have been carried out to assess the degree of integration for each variable considered. The results of both tests suggest that our variables (real GDP, real public capital expenditure KG, real credit to private sector KP, and labour force L) are all first difference stationary I (1); the null hypothesis of a unit root in the level form of all four variables cannot be rejected at 5% level, but it was significantly rejected at 1% level for all first difference form of the variables by both unit root test as in Table 4.4.

Table 4.4: Unit Root Tests

H0: The variable has a unit root

Variables	Order of integration	ADF	K	P-P	L
LGDP	I (0)	-2.501	1	-2.785	0
LRKG	I (0)	-2.861	0	-2.698	2
LRKP	I (0)	-2.607	1	-1.777	5
LL	I (0)	-1.628	0	-1.574	3
ΔLGDP	I (1)	-5.493**	0	-5.492**	2
ΔLRKG	I (1)	-7.093**	1	-7.835**	5
ΔLRKP	I (1)	-4.664**	0	-4.591**	8
ΔLL	I (1)	-3.911**	0	-3.906**	3

Note: k is the degree of augmentation in ADF tests determined automatically based on (SIC). L is the bandwidth determined automatically based on (Newly-West Bandwidth).
Two asterisks ** indicate the significance at 1%.

Following the same steps as in the previous chapter we estimate VAR and extract VAR's impulse responses and variance decompositions. Cointegration test of Johansen (1988) and the estimation of the Vector Error Correction Model (ECM) is

then conducted to detect the presence of long – run relationship among the variables. The empirical analysis is as follow:

4.6.2 VAR ESTIMATION, IMPULSE RESPONSES, AND VARIANCE DCOMPOSITIONS

The appropriate lag length for VAR is tested, and the results suggest that the system is stable with 3 lags; the roots of the companion matrix are all less than one in absolute value as in Table B.1 in Appendix B. Further properties of the VAR system can also be found there. All residual except those from the equation for credit to private sector are normally distributed, also there is no autocorrelation. Hence, the dynamic of the VARs system is examined using both the impulse responses and variance decompositions methods.

4.6.2.1 IMPULSE RESPONSES

In the correlation matrix of the residuals there are evidences of high correlation between some variables (e.g. 0.41 between GDP and L) which may imply that the use of Cholesky decomposition might not produce unique impulse responses. However, we notice that the impulse responses provided by Cholesky are not too dissimilar in time-profile and magnitude to those produced by Generalized responses as in figure 4.3, which may suggests that the order of the variables into VAR does matter but only slightly. Both the impulse response functions of Cholesky decomposition and those of Generalized Responses of Pesaran and Shin (1998) are depicted here with two standard error bands above an below the function as in Figure 4.3. We provide here

two sets of impulse responses: the first six subplots to the left in figure 4.3 is the impulse responses of GDP, KP, and L to a one standard deviation shock to public capital KG, and the second 6 subplots to right in the figure is the impulse responses of KG to a shock in each one of the other three variables (GDP, KP, and L) in the VAR system.

The plotted Generalized responses in Figure 4.3 show that GDP shifts upward after a one-off innovations to public capital KG, and then decreases gradually for 10 periods before the impact becomes negative and continues to be to the end of the period. The responses of the other two production factors (KP, and L) may represent whether an increase in the third production factor in our model "public capital" is substitutable or complementary to the other production factors (KP and L). Private capital KP shifts downward after a shock to the public capital KG, but constantly increases for 4 years and gradually deceases for 10 ye ars before the impact reverts to negative impact which continues to the end of the period. The responses of Labour L to a one standard deviation shock to public capital KG are similar to some extent to that of private capital; a downward shifts at the start with negative impact for 3 ye ars then a constantly increase until it become positive after 4 years and continue to increase for another 10 years before it start receding to the end of the period.

The positive increase in the total output GDP at the start after a shock to public capital KG may indicates the role of public capital in stimulating economic activities, but the gradual decrease of the impact and the negative impact thereafter perhaps is a sign of low rate of return on pu blic investment – the ratio of pubic capital to GDP in Saudi Arabia is relatively high ranging from 60 to 91 percent in the last four decades - , or

may refer to the low level of efficiency at which these public projects have been constructed and operated.[148] On the other hand, an increase in the level of public capital appears to be complementary to private capital KP, in the medium run, but it can be substitutable in the short run and to some extent in the long-run.[149] Interestingly, labour force and public capital seem to be complements in the long-run which may indicate the public capital enhances economic activities and, hence, the demand for labour. However, the negative impact that public capital has at the start on both private capital and labour force, and at the end of the period in case of KP, perhaps is as result of crowding out effect.

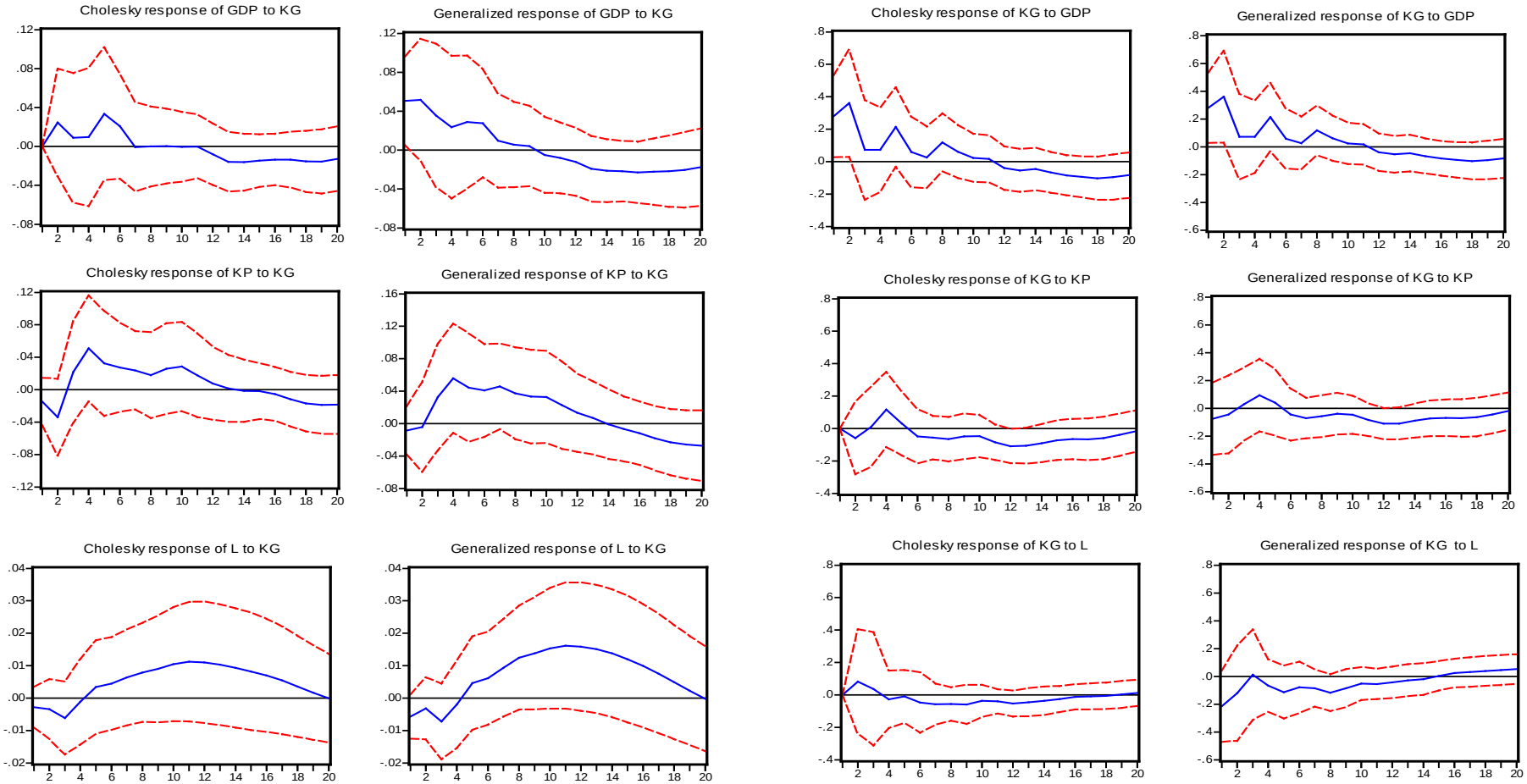
The second 6 subplots to the left in Figure 4.3 depict the response of public capital to shocks to the other variables in the model. After one-off innovations to GDP public capital KG shifts upwards at the start then increases for one year before it starts decreasing in cyclical pattern until it becomes negative after 12 years and continues to be negative until the end of the period. On the other hand, public capital seems to response negatively to an increase in the private capital as it can be seen from the subplot in figure 3-3. An increase in labour force also appears to carry negative impact on the public capital for the first 15 years before it becomes a positive effect that continues to the end of the period. So, it appears, to some extent, as it is from the previous plots; public capital and labour force may be substitutable in the short-run but they might be complement in the long-run, whilst public capital and private

[148] Kamps (2004b) relates the negative output response to a shock in public capital that he finds for Japan to the high rate of public capital to total output where the ratio may have been beyond the optimal level – the highest amongst OECD countries the ratio of public capital to GDP in Japan ranges between 95 and 117 percent from 1980 to 2000 (Kamps, 2004a) – so that additional public capital may have negative impact.

[149] Note that the responses of private capital may help in explaining the pattern of the output responses, as public capital may crowd out private capital.

capital may be complement in the short-run but they can be substitutable in the long-run.

Figure 4.3: Impulse Responses



4.6.2.2 VARIANCE DECOMPOSITIONS

Variance decompositions, as we mentioned in the previous chapter, provide another method to analyse the dynamic of the VAR system. They break down the variation of the dependent variables into the component shocks to the VAR system and measure the relative importance of each random innovation in affecting the variables in the VAR system.

Table 4.5: Table of Variance Decompositions: One Standard Deviation Innovation to The variable in the Top Raw, impact on the variables in the left hand column.

	GDP	KG	KP	L
After 1 period				
GDP	100	12.778	2.716	17.403
KG	0	87.221	2.707	1.778
KP	0	0	94.576	1.453
L	0	0	0	79.363
After 2 period				
GDP	86.131	24.914	24.384	10.899
KG	1.968	73.86	5.422	2.794
KP	11.42	0.416	65.911	11.813
L	0.481	0.808	4.282	74.493
After 5 period				
GDP	76.778	27.188	24.779	6.684
KG	4.27	70.023	14.523	4.082
KP	13.793	1.864	57.173	45.528
L	5.158	0.923	3.522	43.705
After 10 period				
GDP	72.471	27.376	36.426	23.398
KG	4.681	67.349	15.9	9.873
KP	16.779	3.121	44.203	44.762
L	6.069	2.152	3.468	21.965
After 20 period				
GDP	67.724	28.634	34.994	34.482
KG	6.993	61.086	15.227	15.727
KP	19.366	7.627	44.642	33.643
L	5.9158	2.652	5.135	16.147

Table 4.5 reports the variance decompositions for all variables in the system. The second column in the table shows that after an innovation the contribution of public capital KG variation in the variations of GDP is slowly increases from around 2% after 2 periods to around 4% after 5 periods but marginally increases thereafter amounting for about 7% after 20 periods have elapsed. Similarly, the contribution of the variation in labour force in the variations of GDP is slowly increases throughout the periods where it peaks at 6% after 10 periods and marginally declines thereafter. On the other hand, the variations in GDP appear to be influenced constantly throughout the periods by the variations of private capital settling at around 20% after 20 periods. Column 2 shows that only the variation of GDP has significant contributions to the variations in public capital where it increases from about 12% after first period to 27% after 5 periods and settles at about 28% after 20 periods have elapsed. The contributions of the variations in the other two variables, private capital and labour force, to the variations in public capital are very small until 20 periods have passed. The last two columns show the variation in GDP has a substantial influence throughout in the variations of private capital and that of labour force amount for about 36% and 23% respectively after 10 periods. The variation of public capital KG gradually contributes in the variations of the private capital, settling at around 15% after 10 years. It also influences the variations of labour force (column 5) where it amounts for about 15% after 20 periods have elapsed.

Such information along with those drawn from the impulse responses leads us on to try to identify possible long – run relationships between the variables in the VAR system.

4.6.2.3 VECM AND COINTEGRATION RELATIONSHIP:

Possible long – run relationships between the variables in the system would require the presence of cointegration relationships between particular variables, and then the estimation of vector error correction model (ECM). Similar to our analysis in the previous chapter, we consider Johansen cointegration technique which consists of two alternative likelihood ratio tests, the Trace statistic test and the Maximum Eigenvalue test. In detecting the presence of cointegration, the choice here is between Model 3 and Model 4 of Johansen (1995). The results statistics of both tests "Trace statistic" and "Maximum Eigenvalue test" for both Models "Model 3" and "Model 4" are based on the maximum likelihood estimates of VAR of order 3, and they are reported in Appendix B.

We note that under both models there are two cointegration vectors (2CVs), according to both likelihood ratio tests, and they are significant at 5% level as in Appendix B. This means that we can use Johnsen's Likelihood Ratio test χ^2 to test for the presence of trend (Model 4) versus the restricted model of no trend (Model 3) in the CVs. The test has degrees of freedom equal to the rank of the matrix (r), that is, the number of CVs. The test statistic was calculated and the outcome was; $\chi^2(2) = 12.091$, which is grater that the 5% critical value of 5.99. Thus, we accept the restriction implied by Model 4 that a trend should be included in the CVs.

Based on our model, the production function, we were able to identify two cointegartion relationships as they are reported in Table 4.6 and graphed in Figure

4.4.[150] The LR test for binding restrictions with probability of (0.448), which is greater than (0.05), implies that the restrictions do hold and hence the βs coefficients can be unique. The first coitegration vector is normalised on private capital and represent the long – run relationship between private investment and total output as suggested by economic theory. Income could be the main determinant of the demand for credit by private sector in Saudi Arabia, whilst the level of public capital and that of labour have no significant impact of the private investment.[151]

The second cointegration vector is normalised on GDP and may be regarded as the long – run relationships between the level of output and the levels of public capital KG, private capital KP, and labour force L. Converting it into equation indicates that in the long-run the level of GDP is positively affected by the level of public capital, private capital, and the level of employment. Private capital carries a positive and highly significant impact on the level of output which may confirm the prediction of the economic theory and the general view that private investment is an important factor in the production of total output. An elasticity of 0.42 implies that a 1 percent increase in private capital would boost total output by 0.42 percent, where the estimated effect is highly significant. The coefficient of labour is restricted to 1 to identify the cointegration vector and, hence, is significant, but the coefficient of public capital, though with positive sign, is very small and is not significant. Effectively, there is along – run relationship between output and two production factors (privat capital KP and employment L).

[150] Both cointegration vectors are level stationary I(0) at 5% level of significance with intercept according to KPSS unit root test with LM stat for the first CV1 is (0.173), and (0.217) for the second CV2 which for both below the 5% critical value of (0.463).
[151] Looney (1990) argue that Saudi Arabia has open economy and, hence, the crowding out effect of public investment on private investment may be less effective since private investors have access to the international market.

Table 4.6: Identified Cointegration Equations

Cointegration Restrictions:
B(1,3)=1,B(2,1)=1,B(1,1)=-1
B(2,4)=-1
B(1,2)=0,B(1,4)=0,
A(2,1)=0,A(2,2)=0,A(3,2)=0
Convergence achieved after 78 iterations.
Restrictions identify all cointegrating vectors
LR test for binding restrictions (rank = 2):

Chi-square(5)	4.738985
Probability	0.448558

Cointegrating Eq:	CointEq1	CointEq2
GDP(-1)	-1.000000	1.000000
KG(-1)	0.000000	-0.012323 (0.02530) [-0.48712]
KP(-1)	1.000000	-0.420679 (0.07936) [-5.30109]
L (-1)	0.000000	-1.000000
@TREND(70)	-0.069221 (0.00493) [-14.0396]	0.045374 (0.01061) [4.27708]
C	3.301356	-7.778266

Note: the notations for the coefficients β and α are as follow: $\beta_{i\,j}$ is the coefficient of j^{th} variable in cointegration vector i. and $\alpha_{i\,j}$ is the adjustment coefficient in the VEC equation i with respect to the error correction term from cointegration vector j. ( ) =standard error: [ ] = t-stats

Why public capital appears to have insignificant effect on the development of total output? Is it because of the relatively high level of capital expenditure in Saudi Arabia, and, hence, a low rate of return on additional investment "over-investment" as Kamps (2004b) finds for Japan, and Harb (2009) for some GCC countries)? Or, perhaps, is due to the misallocation phenomenon of public investment in the MENA (Ghali, 1998; and Makdisi et al, 2003; Agenor et al, 2005; among others), and/or to the disparity in the level of development among the regions in Saudi Arabia (Benna, 1995)?

Joharji and Starr (2010), as they try to explain the low rate of return on public investment that they found for Saudi Arabia, call for a reform of budgetary classifications system in order to obtain more detailed and classified data to pinpoint the components of public capital that drag down public capital productivity. They in fact find the current government expenditure is way more productive than public capital expenditure, and as Devarajan et al (1996) suggest, they argue that allocating public spending to maintenance and improvement of the existing infrastructure could be much more growth promoting than engaging in further investment. Agenor et al (2005), on the other hand, suggest that an improvement in the constructions and the operations of the public infrastructures would require redirecting the role of the public sector as a catalyst, rather than a provider, of most of the infrastructure services, which will allow for the engagement of private sector in the infrastructure investment. Such engagement of private sector may provide commercial disciplines to the delivery of the services and thereby improving the quality and the quantity of the services as well as the level of efficiency.

The misallocation of public investment, where public investment projects are badly conceived or managed that they operate at uneconomically high cost, is well noticed phenomenon in most countries in the MENA region and, to some extent, most of developing world as suggested by some researchers (Ghali, 1998; Magdisi et al, 2000; Agenor et al, 2005; among others). In a rentier state such as Saudi Arabia with relatively unlimited supply of capital the situation could be worst. As main recipient of the oil rent, the government has built a big bureaucracy to plan, execute, regulate, and to maintain the development process (Al-Hegelan and palmer, 1985). The

devastating impact that a rain storm had on the second major city in Saudi Arabia "Jeddah" in November 2009, perhaps can be a reflection of the poor infrastructure development despite the massive public investment that have been devoted to public infrastructure development in the city. An impact of such magnitude that shocked both the government and the public; over 100 people lost their life's and many roads and districts flooded with many houses and businesses are destroyed with billions of riyals worth of damage cost. The government has acted immediately by forming a committee to investigate and to assess the reasons of such impact to happen with the permission to interrogate any government official regardless of his position.

In other hand, Looney (1990) argues that there is a general agreement among economists that conflicting results and/or undesirable situations is expected if the public infrastructure investment, labour market planning, and educational planning are unconnected. Saudi Arabia has acquired a huge public investment that is way beyond the quantity and the quality of the human capital formation in the country, and has, to large extent, relied on expatriate labour to construct and to operate the public infrastructure projects (Al-Hegelan and palmer, 1985; among others). Moreover, the transfer of technologies and skills that are required for the constructions and the operations of these investment projects have been rather slow. Therefore, the argument of conflicting results or undesirable situations, as Looney suggests, perhaps can be evident in Saudi Arabia: despite the heavy public investment in different sectors the problem of a relatively high rate of unemployment among the Saudi nationals has been a major concern for Saudi government since early 1990s and up to now.

To check whether these two identified cointegration vector can be informative, in essence that their predicted values for their dependent variables did no converge too far from their actual values. We employ the series of KP and GDP given by first and second vectors to forecast their long-run values across the extended data set against their actual values as they graphed in Figure 4.4. The graph shows that the long-run values of KP and GDP appear to wander around their actual values and seem to have similar trend of those of the actual values, especially those of KP. Such results may imply that the long-run relationship anticipated by the second CV2 may hold, and thus the public capital expenditure may have insignificant impact of the level of output, whilst private capital and employment appear to have significant contributions to the level of GDP.

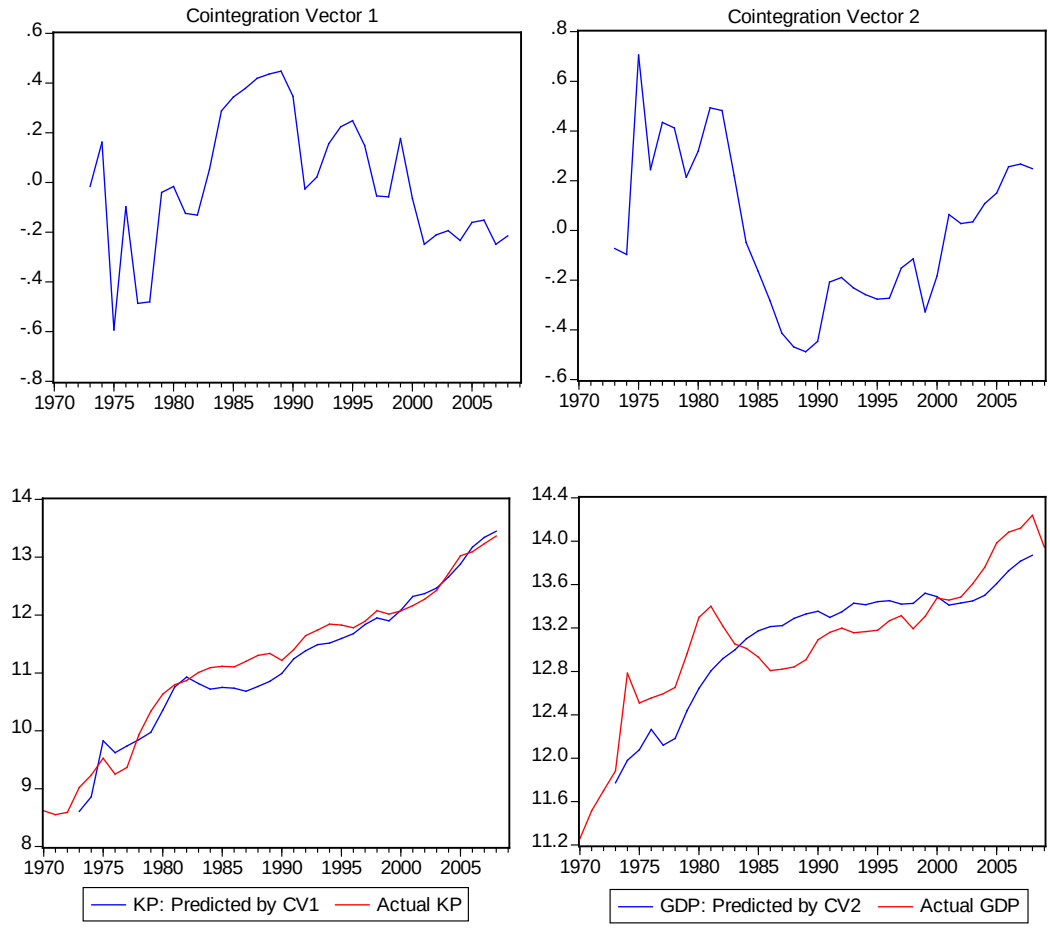
The results from the dynamic specification of VEC in Table 4.7 show that in the short-run public capital expenditure has positive but insignificant impact on the level of GDP, the lagged dynamic effect of public capital on GDP equation are all positive but insignificant (not different from zero). On the other hand, both private capital KP and the level of employment carry short – run positive impacts on GDP; first dynamic lag in case of private capital KP and through the second dynamic lag in case of employment L. We also notice that the retained adjustment coefficients (the α s) are all statistically significantly different from zero. Moreover, results suggest that the public capital variable KG is the "weakly exogenous" variable in the system: that is, it is not influenced by the disequilibrium in the 2 long-run relationships. The changes in public capital KG appear to kick starts changes in the GDP, KP and L: essentially, since our variables are measured in logs, an increase/decrease in the growth of KG generates movements in the rates of growth of the other variables.

Table 4.7: ECM Estimation

Error Correction:	DGDP	DKG	DKP	DL
CointEq1	-0.861449	0.000000	-0.375903	0.179515
	(0.35379)	(0.00000)	(0.07596)	(0.04975)
	[-2.43494]	[NA]	[-4.94855]	[3.60829]
CointEq2	-0.906183	0.000000	0.000000	0.190596
	(0.29728)	(0.00000)	(0.00000)	(0.04198)
	[-3.04822]	[NA]	[NA]	[4.53992]
D(GDP(-1))	-0.253108	1.034496	0.307345	0.063487
	(0.19203)	(1.02348)	(0.11001)	(0.02565)
	[-1.31806]	[1.01076]	[2.79383]	[2.47552]
D(GDP(-2)	-0.198070	0.728534	-0.420505	-0.028106
	(0.17084)	(0.91055)	(0.09787)	(0.02282)
	[-1.15938]	[0.80010]	[-4.29658]	[-1.23184]
D(KG(-1))	0.038925	-0.415213	-0.033980	0.000113
	(0.03027)	(0.16132)	(0.01734)	(0.00404)
	[1.28606]	[-2.57391]	[-1.95975]	[0.02791]
D(KG(-2))	0.030456	-0.683474	0.005578	-0.005022
	(0.03332)	(0.17758)	(0.01909)	(0.00445)
	[0.91411]	[-3.84892]	[0.29222]	[-1.12864]
D(KP(-1))	1.159809	0.051582	0.494476	-0.033011
	(0.24051)	(1.28187)	(0.13778)	(0.03212)
	[4.82229]	[0.04024]	[3.58887]	[-1.02771]
D(KP(-2))	0.310188	-0.133164	-0.523633	-0.072508
	(0.23869)	(1.27218)	(0.13674)	(0.03188)
	[1.29954]	[-0.10467]	[-3.82944]	[-2.27457]
D(L(-1))	0.638410	5.684262	2.042567	0.048436
	(1.21265)	(6.46316)	(0.69469)	(0.16195)
	[0.52646]	[0.87949]	[2.94027]	[0.29908]
D(L(-2))	2.792980	6.031524	0.081424	-0.082316
	(1.03921)	(5.53877)	(0.59533)	(0.13879)
	[2.68760]	[1.08897]	[0.13677]	[-0.59310]
C	-0.269825	-0.603291	0.038857	0.061152
	(0.10292)	(0.54853)	(0.05896)	(0.01374)
	[-2.62176]	[-1.09983]	[0.65907]	[4.44907]

Note: ( ) =standard error: [ ] = t-stats

Figure 4.4: Cointegration Relationships, and Actual Values of the Variables Against the Values Predicted by Their Cointegration Vectors



4.7 CONCLUSION

The role of public infrastructure in the development process has been thought of by many economists and policy makers as an important factor for economic growth. This chapter reviews large body of literature in the role of public capital investments' and surveys different approaches that been considered to assess the casual relationship between the economic development and public capital. Most of the surveyed studies, with few exceptions, suggest that pubic capital raises the productivity and reduces the cost of production. Among various approaches and estimating methods, the production function approach of Aschaeur (1989) in the context of VAR model and cointegration analysis is selected to examine the impact of public capital expenditures on the economic development in Saudi Arabia throughout the period from 1970 to 2008.

The vast amount of windfalls from oil revenues since early 1970s has allowed Saudi Arabia to invest heavily in the development of public infrastructure, giving the fact the country had very little of public capital infrastructure prior to the 1970s. However, The main finding of the empirical results of the VAR/ECM estimations suggest that despite the relatively heavy public investment that Saudi Arabia has acquired in the last four decades, it appears such heavy public investment has insignificant – albeit positive – impact on the level of economic development in the country. Such results as Devarajn et al (1996) suggest perhaps can be possible and not very surprising where productive expenditures can be unproductive if there are excessive amounts of them or they have been misallocated as it can be the case in many developing countries. Saudi Arabia, as mentioned earlier, has a relatively high rate of public

capital to GDP – 60 percent to 91 percent in the last for decades – with a big bureaucracy involved in planning and executing public project, low rate of return on public investment as well as the misallocation of public investment may have higher probability.

Saudi Arabia may need a m ore careful and pragmatic economic planning that considers the characters of Saudi economy such as the level of human capital formation, the small market size of the country, and the nature of the economy "rentier economy". for example, despite the fact that Saudi Arabia is a relatively very wide country and hence the railway transport and the constructions of dry ports in all regions should be on t he priority to increase the regional productivity within the country and to increase the exchanges of goods and services, however, the railway transports system is the least developed transport system in the country.

Saudi Arabia has become increasingly concern over misallocations and mismanagement of public investment and the rapid deterioration of public facilities. Thus, allocating public spending to where there is need for, and to the maintenance and the improvement of the existing infrastructure could be much more growth promoting than engaging in further investment as it has been suggested by Agenor et al (2005), and Joharji and Starr (2010), among others. Furthermore, encouraging the participation of private sector in the investment and the operation of public infrastructure can be crucial to alleviate the delivery and the quality of public infrastructure services.

CHAPTER 5

CONCLUSION

5.1 CONCLUSION AND POLICY IMPLICATIONS

This chapter summarises the findings of the earlier chapters and provides the general conclusion of the thesis. The aims of this thesis have been to assess the role of the state in economic development for the member countries of the GCC. The fact that GCC countries are rentier economies and the state, as the recipient of natural resource wealth, plays the key role in all economic activity raises the importance of investigating the impact of government actions on the development process of the economy. The directions in which the government allocates its expenditure dictate the distribution of income and the allocations of resources to foster growth and development. The analysis concentrates on *three* aspects of the role of the state that might have special importance to the development process in those countries.

First, we examine an indirect role of the state in economic development by exploring the role of the financial development in affecting the development of other sectors in the economy. In such developing countries with a substantial concurrent flow of windfall from natural resource exportations, financial institutions can play a major role in the development of other sectors in the economy by channelling the wealth to the other promising sectors and, thereby, alleviate the developmental problems of other sectors. In addition, financial system can contribute significantly to total output since these countries have abundance of financial assets that may give them a comparative advantage in the financial and banking industries. The government has

played an important role in trying to develop financial institutions and foster financial development. However, for small rich developing countries that sit on the world's largest proven oil and natural gas reserves, security of the field and the trade of the oil is a major concern for these countries. GCC region is one, if not the first, of the highly defence spending regions in the developing world, and correspondingly has higher level of arms imports. Thus, the impact of such heavy defence expenditure in economic development is analysed as it may be regarded as a direct role of the state. Moreover, the oil wealth has allowed some of these countries to engage in relatively large programmes of investments in public infrastructure since early 1970s, as the aim is to alleviate the socio-economic level of the country and to lead the process of economic development. Infrastructure has widely been thought of as an essential base for productive economic activities. Thus, the final analytical chapter assesses the role that public capital investment may have had on the development of economic activity in Saudi Arabia over the period 1970-2008 as another direct role of the state in the development process.

Chapter 2 reviews the development of financial sector in the GCC region in the last four decades. The chapter assesses the financial deepening in the region as well as the development of capital market and the monetary policy in these countries. Review of literature shows that there are two opposite hypothesis regarding the casual relationship between economic development and the state of financial development. Supply-leading hypothesis where more developed financial sector promotes the development process by e.g. mobilizing savings, facilitating the exchange of goods and services, and allowing investor to diversify risks. Demand –following hypothesis, on the other hand, suggests that the financial development grows in respond to the

economic growth and it may not be the one who can lead the development. It is rather the growth of the real side of the economy what promotes the development of financial sector.

The aim of chapter 2 is to identify the casual relationship between the financial development and the economic growth in the GCC countries. Has the financial system promoted the economic development in the region, or it is merely a consequence of the development process as a whole. This may have an important implication for the policy makers in the region where these countries may have a comparative advantage in financial industry as the region have abundant of financial capital. Four proxies of financial development are selected to represent the level of financial development (e.g. M3/GDP, credit to private sector as a share of GDP), and three alternative causality tests – Granger–causality tests, Sims–causality, and G-M-D causality tests – are considered to assess the causal relationship and the direction of causation between financial development and economic growth in each country in the GCC in the last few decades. The results suggest that there is a long – run relationship between the level of economic development and the state of financial development in 4 countries in the sample (Bahrain, Qatar, Saudi Arabia, and UAE). The results further suggest that for those countries that have been engaging for quite sometimes (e.g. Bahrain, UAE, and to lesser extent Kuwait) in improving the level of financial system; the financial system seems to facilitate the economic growth. For Oman, some evidence suggest that the financial sector perhaps is growing in respond to the development of the real side of the economy, whilst the financial development and economic development appear to be mutually correlated in case of Saudi Arabia. Qatar, in the other hand, has mixed results; different forms of causation are reported for each

indicator according to Granger – causality tests. However, the low frequency of the data may cast doubt over Qatar's results.

Chapter 3 investigates the role that security outlays may have on the development process in GCC countries. This chapter gives an overview of the region security and the historical events that have challenged the security and the stability of the region, and consequently have led to higher defence expenditure that characterises the GCC countries. The chapter also survey the theoretical models that have been considered in the literature to measure the effect of defence spending on economic development. Various model and technique have been applied in the literature of defence-growth nexus, five groups of different models are reviewed which include Benoit's work, demand side models, supply side models, Deger type models (system of equation model), and Solow models. Among those models, the classic production function approach in the form of Cobb-Douglas is considered to measure the effect of defence expenditure and economic growth. The empirical analysis is carried out in the context of time series and VAR model for 4 countries in the GCC region (Bahrain, Oman, Saudi Arabia, and UAE) over different periods in the last four decades.

The emerging results suggest that there appears to be a long-run relationship between the level of defence expenditure and the level of economic development in all countries considered. However, the effect of defence expenditure on the economic growth appears to convey Benoit's argument of the positive impact of defence expenditure on economic growth for the members of the GCC with relatively small economy and low level of defence burden (Bahrain and Oman). On the other hand, Saudi Arabia and UAE with their high defence burdens, the effect is significantly

negative; higher defence expenditure in both countries appears to retard the economic growth in the long-run.

Chapter 4 analyses the impact of public capital on the development process in one member of the GCC, Saudi Arabia. The chapter reviews the public capital expenditure and the development of public infrastructure in Saudi Arabia in the last four decades 1970-2008. The theoretical models that have been applied in the literature to assess the casual relationship between the public capital and economic development are reviewed and grouped into five groups: the production function approach, cost-function approach, Vector Autoegressions VAR model, endogenous growth model, and simultaneity equations models SEM. The widely common approach of Aschaure "the production function approach" is employed in the context of time series analysis and VAR model.

The finding suggests that public capital may enhance economic activity in the short-run, but it has insignificant impact in the long-run. Despite the low level of public capital that Saudi Arabia had up to the 1960s, the rate of return on the heavy public investment, which the government has been launching since early 1970s, may have been well below the expectations. This finding convey the findings of other works that have assesses the role of public capital in Saudi Arabia and some other countries in the MENA region (e.g. Ghali, 1998; Magdisi et al, 2000; Agenor et al, 2005; Joharji and Starr, 2010). Perhaps, the inefficient allocations of public investments as proposed by some researches as well as the high rate of public investment in Saudi Arabia may explain the low rate of return on public investment.

The main findings and contributions of this thesis as well as some policy implications of the thesis could be summarised as follow:

1. Financial sector can a growth promoting sector for some GCC countries.

The results suggest the existence of long – run relationship between economic growth and financial development for all GCC countries except for Kuwait. For Bahrain and UAE, and to lesser extent Kuwait, the results also suggest that the financial system can be a leading sector in the process of economic development, where the supply – leading hypothesis appears to fit the relationship between economic growth and financial development in the last few decades. In Oman economic development appears to stimulate the financial development, whilst the bi-directional causality may fit the relationship between economic development and the level of financial development in case of Saudi Arabia. Qatar has mixed results.

Financial sector can be a promising sector for all GCC countries, given the fact of limited domestic investment opportunities outside that of energy related sectors. The region can act as a financial centre for MENA region and to large extent other neighbouring developing regions such as East Africa, Indian subcontinent, and the new independent states in central Asia. Thus, GCC countries may need to consider the financial sector as promising sector that can contribute significantly to their economic development. The fact that the capital assets of the Hong Kong and Shanghai Banking Corporation (HSBS) is greater than that of the top 50 banks in the GCC region is totally disappointing. Merger between Banks in the region should be promoted; as the banker (2004) suggests the GCC Banks' will be unable to survive the competition –

with such small fragmented banking sector – with well established international banks when markets do eventually open up.

The central banks may need to take the lead in the process of promoting financial sector development by reviewing their regulation procedures that may hinder or slow the development of financial system; hard to acquire a commercial bank license is a common feature in the region which has lower the level of competition and led to high level of concentration in the banking industry. The lack of mortgage schemes in the financial system in some GCC countries has hindered the development of hosing and real estate sectors. Lack or weak regulations that governor the insurance activities has also led to a small and fragile insurance industry; central bank of Saudi Arabia, for example, has just recently released the complete rules and regulations for insurance activities. Furthermore, there is a need in all GCC members to enhance prudential regulations and supervision, upgrade the standards of transparency and provision of financial information, and reduce government participation in financial institutions and allow for foreign participation. More and more attention needs to be devoted to alleviate the standards as well as the strength and the soundness of the financial institutions in the GCC so they can be able to take their position in the international market.

The government, in principle, will have a major developmental role in actively promoting and prudentially regulating the financial sectors of the economy. Given that the central banks of these countries are not 'independent' as in the European or US sense, they still rely heavily on the directions provided by finance ministries. Thus, the regulatory and promotional aspects of finance lie heavily in the hands of government. Further research on the institutional aspects of government involvement

in the governance and development of financial institutions, markets and structure would be fruitful.

2. Higher defence expenditure retards economic growth and development in some GCC countries.

For GCC countries with high defence expenditure (Saudi Arabia, and UAE), the empirical results indicates that defence expenditure appears to negatively affect economic development in the long-run. On the other hand, the countries with lower and modest defence spending (Bahrain and Oman), defence expenditure seems to carry positive externalities to the economy. However, the security of the region perhaps is beyond the security of these countries alone, oil is a strategic good and any disturbance in its supply can hit the security of most counties in the world, especial those with high level of oil consumption such as U.S, which may explain the permanent presence of American force in the region.

History shows that these countries have always received substantial external help from foreign powers to halt the internal and the external threats; e.g. Oman against the rebellions in the 1960s, Kuwait against Iraq in the 1961 and 1990, and Saudi Arabia against the extremist rebels in 1979, as well as the permanent presence of British and then American troops in most of the GCC states up to now. It seems to be impossible for the small GCC states to carry their security on their own; they are so small countries in terms of land area and population size. So moving to a union stage perhaps is the best way to ensure the security of all GCC members. GCC countries should understand that their security cannot be separable and is always to be together. The call from the king of Saudi Arabia in the GCC annual summit in December 2011

to move from cooperation stage to the union stage perhaps is a reflection of the necessity for these countries to merge into more formal political and economic system such as federation system or confederation one. In such political and economic system the GCC countries can perhaps build a strong regional power that is capable of carrying its security on its won. Moreover, the heavy defence expenditures of those countries can be better allocated in such political system and technological and skill transfers can be increased as these countries may engage in heavy defence industries.

The role of the state is paramount in the analysis of defence and development, particularly since defence is the quintessential public good. This thesis looked at military expenditure and growth in a macroeconomic framework for the GCC. Further research would emphasise the micro aspects of the interconnections. Most important would be a potential study on defence industrial co-operation which could identify the areas where a co-operative defence structure would be the most beneficial. This would also reduce arms import which many analysts believe have the most direct growth retardation effects.

3. **The return on the higher public capital in Saudi Arabia may have been well below the expectations.**

The empirical results of the fourth chapter suggest that although public capital outlays may carry positive effect in the economy in the short – run, it has insignificant impact on the economic development in the long – run. Misallocation and inefficient use of the public investment may have been the cause of the low rate of return on public capital as it is the case in most countries in the MENA region according to different

resources (e.g. Ghali, 1998; Magdisi et al, 2003). Thus, more allocation to the maintenance and the improvement of the existing public infrastructure could be much more growth promoting than engaging in further investment. Furthermore, encouraging the participation of private sector in the investment and the operation of public infrastructure can be crucial to alleviate the delivery and the quality of public infrastructure services.

Economic development, labour market, and education system in all GCC countries seem to be unconnected; despite the heavy public investment in Saudi Arabia or in other GCC countries since the 1970s, the problem of high level of unemployment among the GCC nationals has been a real concern to the governments for over two decades.[152] The very low percent of national labour in the private sector is a common feature in all GCC countries; Saudi Arabia, for example, as it is trying to tackle the problem of growing unemployment among the national labour sets 5 percent as the minimum national labour that each private company has to employ. Furthermore, although the governments in the region have always been the biggest employer of the national labour, the governments' employment capacity in these countries could not keep up with the growing populations since late 1980s.

Policy makers in GCC countries, therefore, need to consider some economic features of their economies in the economic planning such as the dominant role of natural resource sector in the economy, small market size (low level of population), and the comparative advantage that they may have in some energy related industries as well as in banking and financial industries. In essence, the more emphasise perhaps should

[152] Kuwaitization, Omanization, and Saudization are the alternative terms that reflect the high levels of unemployment among national labour in the region.

be put on the development of the sectors with comparative advantage (e.g. petrochemical industries, oil refinery, aluminium, airline transports, banking industries, insurance and reinsurance activities) should go ha nd in hand with development of the education system and educational institutions in the related fields, as well as increasing the foreign participations in such industries to alleviate the level of efficiency and to allow for technological and skills transfers. If data was available on human capital formation, further research would use a similar econometric model to analyse the impact of human capital (education, skills, technology) on economic growth.

Finally, this thesis may have some weight but it is far from perfect and has its limitations. The lack of data for most GCC countries as well as the short span of the time series for some economic and social indicators has limited the choices of empirical methodologies and dictated the empirical analysis. Some limitations of the work as well as some suggestions to guide further empirical and econometric research are reviewed below.

In chapter two the low frequency of the data for most countries in our sample may cast doubt over the reliability of the results. So, considering more financial indicators and see w hether the main conclusion for each country does hold, would be useful. Furthermore, i t would be perhaps more appropriate to include more countries with similar characters such as those of OPEC and apply panel techniques to get over the short span of the data problem and to assess if there is a general pattern for the causal relationship between economic development and the level of financial system development in rentier economies.

The main limitation in chapter three is data availability. If aggregate military expenditure could be broken down into its components, such as personnel and procurement, then we could investigate which aspect of defence is relatively more productive or harmful to economic growth. Moreover, it might be interesting to investigate whether the heavy defence expenditure (demand for arm) that characterises some GCC countries is as results of an arm race going on between Iran and GCC countries with their American ally over the control of the strategic region of the Persian Gulf, as the political tension between Iran and GCC member has been escalated since the beginning of this century. An empirical arms race model for the region would be an interesting future research project, given the usual problems of data.

Chapter four has also its own limitations. The total public capital expenditure for Saudi Arabia, which includes different forms of capital expenditures (e.g. education, infrastructure, health), is used as proxy for the infrastructure investment; this may mask the actual impact of the infrastructure investment. In addition, the estimated power of the model can perhaps become better if a human capital proxy is included in the model along with existing variables (public and private capital, as well as the level of labour force), which would require the construction of human capital proxy based upon the economic and social data available about Saudi Arabia. Adding other countries to the sample, and estimating their own time series analysis would also be fruitful. Construction of more appropriate human capital proxy may give better estimated results by the model. However, GCC countries as most MENA countries do

not have data for long periods for human capital indicators such as education expenditure, enrolment ratio, and average year of schooling.

The thesis generally has added to knowledge of the role of the state in economic development, with special focus on the GCC rentier states, by a pplying some appropriate data analysis technique to assess the impact of government intervention on economic development. It also provides some economic overview over one of the fast growing developing economies, the rentier states of the GCC. Traditional results that emerge from empirical studies are usually based upon the estimation of a single equation using basic econometrics techniques. We have utilised more advanced econometrics to estimate and analyze the impact of the government on development in major direct and indirect channels. T he empirical results of this thesis are noteworthy and add contributions to the overall literature of the role of the state in economic development.

APPENDIX A1: Bahrain

Bahrain: The VAR Estimates and the Diagnostic Tests

Table A1.1: ***Vector Autoregression Estimates (Bahrain)***

	GDP	K	D	L
GDP(-1)	0.489569	0.256584	0.755735	-0.006452
	(0.18200)	(0.44573)	(0.55221)	(0.00887)
	[2.69000]	[0.57564]	[1.36855]	[-0.72759]
k(-1)	0.009363	0.644726	-0.055928	0.001839
	(0.05180)	(0.12686)	(0.15716)	(0.00252)
	[0.18077]	[5.08227]	[-0.35586]	[0.72852]
D(-1)	0.109817	0.136512	0.580818	-0.002975
	(0.05053)	(0.12375)	(0.15332)	(0.00246)
	[2.17331]	[1.10309]	[3.78834]	[-1.20845]
L(-1)	-2.440289	-4.731532	0.809407	0.959615
	(0.63073)	(1.54474)	(1.91376)	(0.03073)
	[-3.86899]	[-3.06299]	[0.42294]	[31.2242]
C	-0.146192	-6.372923	-2.115660	0.039447
	(0.78846)	(1.93106)	(2.39236)	(0.03842)
	[-0.18541]	[-3.30023]	[-0.88434]	[1.02676]
TREND	0.095744	0.141276	-0.040433	0.000777
	(0.02358)	(0.05775)	(0.07154)	(0.00115)
	[4.06055]	[2.44642]	[-0.56516]	[0.67660]
R-squared	0.981799	0.856389	0.905320	0.999917
Adj. R-squared	0.978008	0.826470	0.885595	0.999899
Sum sq. resids	0.079989	0.479794	0.736407	0.000190
S.E. equation	0.057731	0.141391	0.175167	0.002813
F-statistic	258.9270	28.62352	45.89713	57664.49
Log likelihood	46.33784	19.46580	13.03938	136.9840
Akaike AIC	-2.689189	-0.897720	-0.469292	-8.732264
Schwarz SC	-2.408950	-0.617480	-0.189053	-8.452025
Mean dependent	7.611689	6.138816	4.500700	-0.721377
S.D. dependent	0.389289	0.339417	0.517882	0.280498

Determinant resid covariance (dof adj.)	8.30E-12
Determinant resid covariance	3.40E-12
Log likelihood	225.8296
Akaike information criterion	-13.45530
Schwarz criterion	-12.33435

Note: ( ) =standard error: [ ] = t-stats

Diagnostic Tests:

1) **The roots of the companion matrix:**

Table A1.2

Root	Modulus
0.988543	0.988543
0.763707	0.763707
0.676189	0.676189
0.24629	0.24629

2) **Residuals' tests:**

Table A1.3

Equation	Normal distribution test			
	J-B statistic		Kurtosis	
Y	7.126	(0.028)	4.326	(0.138)
K	2.815	(0.244)	1.499	(0.093)
D	0.346	(0.841)	2.507	(0.581)
L	2.967	(0.226)	1.851	(0.199)
Vector	13.256 (0.103)			
Vector tests				
	AR(4)		***Hetero***	
LM (χ2 (16))	17.52 (0.353)			
χ (100)			108.20 (0.270)	

3) **Cointegration test:**

Table A1.4

Johansen Maximum Likelihood cointegration test

	Model 3		***Model 4***	
No. of CV	***Max- Eigen statistic***	***Trace Statistic***	***Max- Eigen statistic***	***Trace statistic***
None	85.795*	119.6362*	87.123*	138.588*
at most 1	28.514*	33.840*	32.466*	51.465*

* Significant at %5 level of significance.

APPENDIX A2: OMAN

The VAR Estimates and the Diagnostic Tests

Table A2.1: ***Vector Autoregression Estimates***

	GDP	K	D	L
GDP(-1)	0.489569	0.256584	0.755735	-0.006452
	(0.18200)	(0.44573)	(0.55221)	(0.00887)
	[2.69000]	[0.57564]	[1.36855]	[-0.72759]
K(-1)	0.009363	0.644726	-0.055928	0.001839
	(0.05180)	(0.12686)	(0.15716)	(0.00252)
	[0.18077]	[5.08227]	[-0.35586]	[0.72852]
D(-1)	0.109817	0.136512	0.580818	-0.002975
	(0.05053)	(0.12375)	(0.15332)	(0.00246)
	[2.17331]	[1.10309]	[3.78834]	[-1.20845]
L(-1)	-2.440289	-4.731532	0.809407	0.959615
	(0.63073)	(1.54474)	(1.91376)	(0.03073)
	[-3.86899]	[-3.06299]	[0.42294]	[31.2242]
C	-0.146192	-6.372923	-2.115660	0.039447
	(0.78846)	(1.93106)	(2.39236)	(0.03842)
	[-0.18541]	[-3.30023]	[-0.88434]	[1.02676]
TREND	0.095744	0.141276	-0.040433	0.000777
	(0.02358)	(0.05775)	(0.07154)	(0.00115)
	[4.06055]	[2.44642]	[-0.56516]	[0.67660]
R-squared	0.981799	0.856389	0.905320	0.999917
Adj. R-squared	0.978008	0.826470	0.885595	0.999899
Sum sq. resids	0.079989	0.479794	0.736407	0.000190
S.E. equation	0.057731	0.141391	0.175167	0.002813
F-statistic	258.9270	28.62352	45.89713	57664.49
Log likelihood	46.33784	19.46580	13.03938	136.9840
Akaike AIC	-2.689189	-0.897720	-0.469292	-8.732264
Schwarz SC	-2.408950	-0.617480	-0.189053	-8.452025
Mean dependent	7.611689	6.138816	4.500700	-0.721377
S.D. dependent	0.389289	0.339417	0.517882	0.280498

Determinant resid covariance (dof adj.)	8.30E-12
Determinant resid covariance	3.40E-12
Log likelihood	225.8296
Akaike information criterion	-13.45530
Schwarz criterion	-12.33435

Note: ( ) =standard error: [ ] = t-stats

Diagnostic Tests:

1) **The roots of the companion matrix:**

Table A2.2

Root	Modulus
0.905703 - 0.030989i	0.906233
0.905703 + 0.030989i	0.906233
0.345108	0.345108
0.225238	0.225238

2) **Residuals' tests:**

Table A2.3

Equation	**Normal distribution test**	
	J-B statistic	**Kurtosis**
Y	1.570 (0.456)	1.985 (0.241)
K	1.894 (0.387)	1.818 (0.172)
D	3.990 (0.136)	1.275 (0.046)
L	2.970 (0.226)	1.519 (0.087)
Vector	10.425 (0.236)	
Vector tests		
	AR(3)	***Hetero***
LM (χ2 (16))	15.46 (0.492)	
χ (100)		123.124 (.058)

3) **Cointegration test:**

Table A2.4: Johansen Maximum Likelihood cointegration test

	Model 3		***Model 4***	
No. of CV	***Max- Eigen statistic***	***Trace statistic***	***Max- Eigen statistic***	***Trace statistic***
None	96.46*	126.77*	106.82*	153.08*
at most 1	23.079*	30.310*	24.425*	46.259*

* Significant at %5 level of significance.

APPENDIX A3: SAUDI ARABIA

The VAR Estimates and the Diagnostic Tests

Table A3.1: ***Vector Autoregression Estimates***

	GDP	K	D	L
GDP(-1)	0.824620	0.586559	0.095932	0.000577
	(0.24164)	(0.18054)	(0.18303)	(0.00071)
	[3.41267]	[3.24889]	[0.52413]	[0.81786]
GDP(-2)	-0.584135	-0.357895	0.014634	0.000326
	(0.29156)	(0.21784)	(0.22085)	(0.00085)
	[-2.00347]	[-1.64289]	[0.06626]	[0.38309]
GDP(-3)	-0.122399	0.122959	0.090762	-0.000682
	(0.28812)	(0.21527)	(0.21824)	(0.00084)
	[-0.42482]	[0.57118]	[0.41588]	[-0.81123]
GDP(-4)	0.054279	0.102809	-0.047015	0.000921
	(0.25121)	(0.18770)	(0.19029)	(0.00073)
	[0.21607]	[0.54774]	[-0.24707]	[1.25577]
K(-1)	0.868286	0.810676	1.074753	-0.000714
	(0.32703)	(0.24435)	(0.24772)	(0.00095)
	[2.65507]	[3.31775]	[4.33865]	[-0.74789]
K(-2)	-0.566059	-0.265778	-0.278996	0.000864
	(0.38085)	(0.28456)	(0.28848)	(0.00111)
	[-1.48631]	[-0.93401]	[-0.96711]	[0.77750]
K(-3)	-0.415622	0.179422	0.025040	-0.000893
	(0.38456)	(0.28733)	(0.29129)	(0.00112)
	[-1.08079]	[0.62445]	[0.08596]	[-0.79505]
K(-4)	-0.330394	-0.380777	0.342019	-0.000598
	(0.32919)	(0.24596)	(0.24935)	(0.00096)
	[-1.00366]	[-1.54813]	[1.37163]	[-0.62267]
D(-1)	0.304080	0.117231	-0.186323	0.000344
	(0.21986)	(0.16427)	(0.16654)	(0.00064)
	[1.38306]	[0.71364]	[-1.11880]	[0.53619]
D(-2)	0.242372	0.078020	-0.120210	0.000722
	(0.20856)	(0.15583)	(0.15798)	(0.00061)
	[1.16212]	[0.50068]	[-0.76093]	[1.18617]
D(-3)	0.189403	-0.019582	-0.187121	0.001077
	(0.18669)	(0.13949)	(0.14141)	(0.00055)
	[1.01453]	[-0.14039]	[-1.32322]	[1.97606]
D(-4)	0.387453	0.143961	0.142538	0.000419

	(0.19239)	(0.14375)	(0.14573)	(0.00056)
	[2.01387]	[1.00147]	[0.97808]	[0.74520]
L(-1)	26.35571	-26.68264	-124.9475	3.102338
	(57.8412)	(43.2169)	(43.8131)	(0.16886)
	[0.45566]	[-0.61741]	[-2.85183]	[18.3726]
L(-2)	-36.74112	84.16112	358.8278	-3.686227
	(160.519)	(119.934)	(121.589)	(0.46861)
	[-0.22889]	[0.70173]	[2.95116]	[-7.86636]
L(-3)	-16.67210	-91.99827	-333.5840	1.929087
	(160.410)	(119.852)	(121.506)	(0.46829)
	[-0.10393]	[-0.76760]	[-2.74541]	[4.11945]
L(-4)	25.27195	33.87344	100.8979	-0.354504
	(57.2658)	(42.7869)	(43.3772)	(0.16718)
	[0.44131]	[0.79168]	[2.32606]	[-2.12053]
C	3.198777	-2.800654	2.798175	0.007902
	(2.11745)	(1.58209)	(1.60391)	(0.00618)
	[1.51067]	[-1.77023]	[1.74459]	[1.27834]
TREND	0.078927	0.017362	-0.051631	0.000126
	(0.02702)	(0.02019)	(0.02047)	(7.9E-05)
	[2.92085]	[0.85996]	[-2.52249]	[1.60356]
R-squared	0.984758	0.993003	0.993325	1.000000
Adj. R-squared	0.973962	0.988047	0.988597	0.999999
Sum sq. resids	0.454403	0.253672	0.260720	3.87E-06
S.E. equation	0.137599	0.102809	0.104227	0.000402
F-statistic	91.21393	200.3578	210.0858	3861529.
Log likelihood	35.45984	47.70158	47.12612	280.5888
Akaike AIC	-0.831421	-1.414361	-1.386958	-12.50423
Schwarz SC	-0.086706	-0.669645	-0.642243	-11.75951
Mean dependent	5.939178	-0.307614	3.788133	2.548352
S.D. dependent	0.852733	0.940354	0.976038	0.508287

Determinant resid covariance (dof adj.)	1.55E-13
Determinant resid covariance	1.65E-14
Log likelihood	428.0207
Akaike information criterion	-16.95337
Schwarz criterion	-13.97451

Note: ( ) =standard error: [ ] = t-stats

Diagnostic Tests

1- The roots of the companion matrix:

Table A3.2

Root	Modulus
0.947695 - 0.136455i	0.957468
0.947695 + 0.136455i	0.957468
0.803646 - 0.473712i	0.932871
0.803646 + 0.473712i	0.932871
0.482181 - 0.687432i	0.839678
0.482181 + 0.687432i	0.839678
0.835091	0.835090
0.714863 - 0.419788i	0.829006
0.714863 + 0.419788i	0.829006
-0.470159 - 0.677586i	0.824726
-0.470159 + 0.677586i	0.824726
-0.722562	0.722561
0.135002 - 0.612043i	0.626755
0.135002 + 0.612043i	0.626755
-0.393837 - 0.261753i	0.472887
-0.393837 + 0.261753i	0.472887

2- Residuals' tests:

Table A3.3

Equation	**Normal distribution test**			
	J-B statistic		**Kurtosis**	
Y	6.886	(0.032)	1.026	(0.009)
K	6.222	(0.044)	1.135	(0.013)
D	3.406	(0.182)	2.806	(0.798)
L	4.768	(0.092)	1.358	(0.087)
Vector	21.284 (0.006)			
Vector tests				
	AR(3)		***Hetero***	
LM (χ2 (16))	21.89 (0.147)			
χ (320)			338.60 (0.227)	

3- Cointegration test:

Table A3.4
Johansen Maximum Likelihood cointegration test

	Model 3		*Model 4*	
No. of CV	***Max- Eigen statistic***	***Trace statistic***	***Max- Eigen statistic***	***Trace statistic***
None	45.043*	76.949*	45.296*	101.448*
at most 1	5.133*	5.133*	33.784*	56.151*

* Significant at %5 level of significance.

APPENDIX A4: UNITED ARAB EMIRATES (UAE)

The VAR Estimates and the Diagnostic Tests

Table A4.1: Vector Autoregression Estimates

	GDP	K	D	L
GDP(-1)	0.624531	0.148421	0.570555	-0.009749
	(0.20320)	(0.09812)	(0.28025)	(0.00333)
	[3.07349]	[1.51266]	[2.03588]	[-2.92454]
GDP(-2)	-0.342576	0.072609	0.074462	0.001110
	(0.25598)	(0.12361)	(0.35304)	(0.00420)
	[-1.33828]	[0.58742]	[0.21091]	[0.26430]
K(-1)	0.273293	0.169159	-0.451639	0.006858
	(0.28851)	(0.13931)	(0.39791)	(0.00473)
	[0.94724]	[1.21422]	[-1.13502]	[1.44886]
K(-2)	0.071265	0.201452	0.013872	-0.003476
	(0.18054)	(0.08718)	(0.24899)	(0.00296)
	[0.39474]	[2.31087]	[0.05571]	[-1.17363]
D(-1)	0.344342	0.160489	0.469391	-0.008463
	(0.14097)	(0.06807)	(0.19443)	(0.00231)
	[2.44264]	[2.35768]	[2.41425]	[-3.65950]
D(-2)	0.013400	0.231207	-0.160539	0.000247
	(0.16936)	(0.08178)	(0.23357)	(0.00278)
	[0.07913]	[2.82729]	[-0.68732]	[0.08890]
L(-1)	-3.844665	2.223160	20.33924	1.705871
	(5.17913)	(2.50085)	(7.14296)	(0.08497)
	[-0.74234]	[0.88896]	[2.84745]	[20.0773]
L(-2)	1.720324	-4.423261	-15.36336	-0.727599
	(4.37440)	(2.11227)	(6.03310)	(0.07176)
	[0.39327]	[-2.09408]	[-2.54651]	[-10.1389]
C	4.108670	-1.902264	-1.383009	0.119204
	(1.85300)	(0.89476)	(2.55562)	(0.03040)
	[2.21731]	[-2.12601]	[-0.54116]	[3.92132]
TREND	0.118905	0.125866	-0.239745	0.001526
	(0.05893)	(0.02845)	(0.08127)	(0.00097)
	[2.01785]	[4.42350]	[-2.94997]	[1.57884]
R-squared	0.895084	0.975494	0.963771	0.999994
Adj. R-squared	0.850120	0.964991	0.948244	0.999991
Sum sq. resids	0.215512	0.050250	0.409935	5.80E-05
S.E. equation	0.101304	0.048917	0.139717	0.001662

F-statistic	19.90672	92.88094	62.07104	390573.1
Log likelihood	33.02814	55.59637	23.06194	160.4429
Akaike AIC	-1.485686	-2.941701	-0.842706	-9.705991
Schwarz SC	-1.023110	-2.479125	-0.380129	-9.243415
Mean dependent	12.16523	6.223500	4.439029	0.574351
S.D. dependent	0.261671	0.261438	0.614138	0.568883

Determinant resid covariance (dof adj.)	5.76E-13
Determinant resid covariance	1.21E-13
Log likelihood	285.0356
Akaike information criterion	-15.80875
Schwarz criterion	-13.95844

Note: ( ) =standard error: [ ] = t-stats

Diagnostic Tests

1- The roots of the companion matrix:

Table A4.2

Root	Modulus
0.789979 - 0.353192i	0.865339
0.789979 + 0.353192i	0.865339
0.839896	0.839896
0.142289 - 0.561936i	0.579671
0.142289 + 0.561936i	0.579671
-0.473484	0.473484
0.369001 - 0.120001i	0.388024
0.369001 + 0.120001i	0.388024

2-Residuals' tests:

Table A4.3

Equation	**Normal distribution test**			
	J-B statistic		**Kurtosis**	
Y	5.033	(0.080)	1.027	(0.024)
K	5.717	(0.057)	0.896	(0.016)
D	2.333	(0.311)	1.735	(0.150)
L	5.219	(0.073)	0.991	(0.022)
Vector	18.304 (0.019)			
Vector tests				
	AR(3)		***Hetero***	
LM (χ2 (16))	11.577 (0.772)			
χ (180)			166.05 (0764)	

3- Cointegration test:

Table A4.4

Johansen Maximum Likelihood cointegration test

	Model 3		*Model 4*	
No. of CV	***Max- Eigen statistic***	***Trace statistic***	***Max- Eigen statistic***	***Trace statistic***
None	79.7580*	131.570*	86.275*	165.323*
at most 1	35.2717*	51.812*	48.463*	79.047*
at most 2	12.750*	16.540*	19.295*	30.583*

* Significant at %5 level of significance.

APPENDIX B:

The VAR Estimates and the Diagnostic Tests

Table B1: Vector Autoregression Estimates

	GDP	KG	KP	L
GDP(-1)	0.363277	2.130050	0.582292	0.035956
	(0.23300)	(1.29100)	(0.14758)	(0.03436)
	[1.55911]	[1.64992]	[3.94558]	[1.04638]
GDP(-2)	-0.039564	-0.536198	-0.740408	-0.095907
	(0.22318)	(1.23659)	(0.14136)	(0.03291)
	[-0.17727]	[-0.43361]	[-5.23769]	[-2.91385]
GDP(-3)	0.169045	-0.409847	0.384574	0.022389
	(0.16812)	(0.93151)	(0.10649)	(0.02479)
	[1.00550]	[-0.43998]	[3.61151]	[0.90300]
KG(-1)	0.045141	0.387675	-0.018682	-0.000382
	(0.03387)	(0.18766)	(0.02145)	(0.00500)
	[1.33276]	[2.06579]	[-0.87085]	[-0.07651]
KG(-2)	0.007986	-0.325158	0.048306	-0.003269
	(0.03700)	(0.20503)	(0.02344)	(0.00546)
	[0.21581]	[-1.58589]	[2.06099]	[-0.59902]
KG(-3)	-0.039299	0.443070	0.010693	0.007098
	(0.03867)	(0.21426)	(0.02449)	(0.00570)
	[-1.01627]	[2.06792]	[0.43658]	[1.24460]
KP(-1)	0.698069	-0.804140	1.041922	0.079516
	(0.24578)	(1.36180)	(0.15567)	(0.03625)
	[2.84022]	[-0.59050]	[6.69297]	[2.19375]
KP(-2)	-0.454927	-0.637105	-0.890421	-0.004936
	(0.31957)	(1.77067)	(0.20241)	(0.04713)
	[-1.42354]	[-0.35981]	[-4.39899]	[-0.10474]
KP(-3)	-0.235242	1.111756	0.480106	0.066758
	(0.23605)	(1.30790)	(0.14951)	(0.03481)
	[-0.99656]	[0.85003]	[3.21112]	[1.91766]
L(-1)	-0.653707	4.418918	1.770406	0.706277
	(1.55903)	(8.63817)	(0.98747)	(0.22992)
	[-0.41930]	[0.51156]	[1.79286]	[3.07184]
L(-2)	1.459576	-0.038240	-2.102387	-0.178061
	(1.61625)	(8.95521)	(1.02372)	(0.23836)
	[0.90306]	[-0.00427]	[-2.05368]	[-0.74703]

L(-3)	-1.085151	-6.190887	0.306157	0.211822
	(1.17280)	(6.49815)	(0.74284)	(0.17296)
	[-0.92527]	[-0.95272]	[0.41214]	[1.22469]
C	6.016547	-6.151853	0.183580	-0.617107
	(1.72271)	(9.54503)	(1.09114)	(0.25406)
	[3.49250]	[-0.64451]	[0.16825]	[-2.42901]
T	0.035223	0.081119	0.032520	-0.003581
	(0.01508)	(0.08355)	(0.00955)	(0.00222)
	[2.33578]	[0.97086]	[3.40472]	[-1.61009]
R-squared	0.946521	0.642871	0.996200	0.998919
Adj. R-squared	0.914919	0.431840	0.993954	0.998280
Sum sq. resids	0.441920	13.56675	0.177290	0.009611
S.E. equation	0.141730	0.785284	0.089770	0.020902
F-statistic	29.95179	3.046332	443.6294	1564.028
Log likelihood	28.12082	-33.51564	44.56098	97.02814
Akaike AIC	-0.784490	2.639758	-1.697832	-4.612674
Schwarz SC	-0.168677	3.255571	-1.082019	-3.996861
Mean dependent	13.17988	10.64835	11.35965	1.455782
S.D. dependent	0.485898	1.041816	1.154531	0.504052

Determinant resid covariance (dof adj.)	2.86E-08
Determinant resid covariance	3.98E-09
Log likelihood	143.8193
Akaike information criterion	-4.878849
Schwarz criterion	-2.415597

Note: ( ) =standard error: [ ] = t-stats

Diagnostic Tests

2- The roots of the companion matrix:

Table B2

Root	Modulus
0.948459 - 0.194209i	0.968138
0.948459 + 0.194209i	0.968138
0.382743 - 0.784767i	0.873127
0.382743 + 0.784767i	0.873127
-0.412004 - 0.593529i	0.722513
-0.412004 + 0.593529i	0.722513
-0.323246 - 0.584334i	0.667783
-0.323246 + 0.584334i	0.667783
0.646533	0.646533
0.474982	0.474982
0.092867 - 0.412375i	0.422703
0.092867 + 0.412375i	0.422703

2-Residuals' tests:

Table B3

Equation	**Normal distribution test**			
	J-B statistic		**Kurtosis**	
GDP	4.304	(0.116)	4.016	(0.045)
KG	4.167	(0.124)	2.156	(0.142)
KP	6.514	(0.038)	6.494	(0.011)
L	2.331	(0.311)	2.321	(0.917)
Vector	17.318	(0.027)		

Vector tests				
	AR(4)		**Hetero**	
LM (χ2 (16))	14.231	(0.581)		
χ (260)			303.636	(0.0325)

3- Cointegration test:

Table B4

Johansen Maximum Likelihood cointegration test

	Model 3		**Model 4**	
NO of CVs	***Maximal eigenvalue statistic***	***Trace statistic***	***Maximal Eigenvalue statistic***	***Trace statistic***
None	65.173*	96.922*	66.289*	121.624*
at most 1	21.78*	31.749*	32.755*	55.334*

* Significant at %5 level of significance.

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