DISSERTATION

THE EFFECT OF HUMAN CAPITAL ON TOTAL FACTOR PRODUCTIVITY GROWTH IN THE ARAB GULF COOPERATION COUNCIL COUNTRIES

Submitted By

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ABSTRACT

THE EFFECT OF HUMAN CAPITAL
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This study is based on the understanding that economic growth in the long run can be achieved not only by increasing accumulation of capital and labor, but also through a sustained growth in total factor productivity (TFP). Therefore, knowledge of factors that explain TFP growth is important in explaining economic growth in the long run. Previous studies emphasize that in general education and health have very important effects on TFP growth, but the effects of these factors have not been widely studied in the AGCC countries. The first step in understanding the problem is to estimate TFP growth by using the Solow Model (1957) and Kalio Model (2012) and the second step is to determine the factors that affect TFP growth by using the Miller and Upadhyay (2000), Khan (2005), and Kalio (2012) models.

The results from this study show that the contribution of the accumulation of capital and labor is higher than the contribution of TFP to economic growth over the period 1990-2014 and that it is still low or negative in these countries compared to developed countries. The most positively impactful variables on TFP growth in the AGCC are trade openness, oil revenues, and government consumption, while education, health, manufacturing, and FDI show little if any effect in most AGCC countries. In contrast, Jordan shows a positive effect of education, FDI, and manufacturing on TFP growth that may make Jordan more productive in the long term than AGCC countries.

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CHAPTER ONE: INTRODUCTION

Over the past thirty years, the Arab Gulf Cooperation Council (AGCC) countries (Saudi Arabia, Kuwait, Bahrain, Qatar, the United Arab Emirates, and Oman) have attempted to transition from economies dependent on natural resources into knowledge-based societies. As a part of that effort, these countries have increased investments in education and health under the assumption that such efforts will increase the contribution made by human capital factors to economic growth. However, the net effect of oil on the economy remains an open debate in AGCC countries. Most economic growth in these countries comes from government spending of revenues acquired from the sale of oil and gas. The AGCC countries are mono-product economies that are based heavily on oil exports, and large investments in petroleum infrastructure alone have not created a diversified productive industrial environment within the region. As such, it is necessary for these countries to increase non-oil related components of GDP in order to create sustainable economic growth.

The oil sector employs a large number of low-skilled foreign workers, which creates limited economic growth in Total Factor Productivity (TFP) to the degree that growth in TFP is related to human capital and labor productivity. TFP is the amount of total productivity, or economic output that is not explained by measured inputs, such as labor and capital. Growth in TFP is strongly correlated with labor productivity (Comin, 2006). Also, long-term growth per capita income is driven by growth in TFP (Comin, 2006; Solow, 1956). Growth in TFP generally drives long-term economic growth and sustainability, and endogenous growth models have linked TFP with technological innovation and human capital inputs (Comin, 2006; Ismail, Sulaiman, &Jajri, 2014; Solow, 1956). As a result, many countries have invested heavily in health and education in an attempt to increase the overall skill level and productivity of the labor force, orthe

amount of human capital (Ismail et al., 2014). The AGCC countries have continued to rely on the public sectors to absorb new workers because the private sector is unable to provide all of the jobs that are needed.

Although the AGCC countries are obviously dependent on oil exports, the increased employment of citizens in the oil sector has been a challenge. For example, in Bahrain and Oman, oil reserves are smaller and thus can be depleted faster, making it more urgent to find non-oil related sources of economic growth in TFP. Qatar, Kuwait, and the UAE depend on the public sector to provide employment with incentives to work in the private sector (Cherif & Hasanov, 2014). However, public sector jobs are also associated with low-skilled labor, which offers little contribution to growth in TFP. The net impact of oil on the economy remains an open debate.

Since oil was discovered in the 1930s, AGCC countries have had an opportunity to develop their economies and increase income per capita. The governments within the AGCC have invested heavily in infrastructure and in petrochemical industries. Exports have provided an important channel for using economic growth to develop services such as finance, trade, and for developing the education and health of their populations.

Non-oil components of GDP include resource related industries, such as petrochemicals and energy incentives to help offset energy costs. In addition, transportation systems, communications, and services like retail stores, restaurants, social services, and construction are non-oil components of GDP. The non-oil share of the total GDP for the group reached 69 percent on average over the period 1992-2011, driven mainly by Bahrain and the UAE at 83 percent and 81 percent respectively.

Unfortunately, high non-oil GDP growth in these countries is not a firm indicator that growth can be sustained over the long-term. These industries are still primarily driven by growth

in the price of oil (Gruss, 2014). In addition to sensitivity to oil price, petrochemical industries are capital intensive and have few linkages to the rest of the economy. These industries also require new technologies, but these new technologies are still being imported rather than developed in the countries.

Because there is not much transfer of new technology to the rest of the economy, employment opportunities are constrained to sectors that are capital intensive and hence limited in their ability to absorb labor. Also, the income that comes from the exports produced by these industries is correlated with oil prices, so income and employment decrease when the price of oil comes down.

AGCC countries depend on service industries, such as tourism, financial services, and transportation for non-oil contributions to the GDP. These industries rely mainly on low-skilled labor. These jobs are not attractive to citizens because these activities are poorly paid and have limited opportunities for advancement; so, it is predominately immigrant workers who are employed in these activities.

In an effort to increase the contribution of human capital and technological change to growth in TFP, spending on education and health is increasing across the Arab Gulf Cooperative Council countries. Their governments have initiated an increased focus on the quality of education. This shift has influenced curriculum development, teacher preparation, the role of formal schooling, and increased opportunities for students to study abroad, creating lifelong learning trends and an educational culture. The assumption underlying this shift is that such an educational investment will lead to endogenous technological progress and resulting accelerated economic growth. Most of the AGCC countries have started bold national experiments to pilot new technologies and teaching methods in their schools (Nour, 2005).

In a similar vein, AGCC governments have made substantial progress in improving health care access and quality, and in addition, they have built new hospitals that can absorb a large number of patients. Their national benefits and expectations have increasingly been focused on human capital by improving workers' abilities through improvement in health and education attainment. The health systems in the GCC countries have improved compared to those of many of their neighbors. AGCC countries have initiated policies and conditions that drive the creation and reform of health care toward establishing and sustaining a knowledge-based society across the AGCC (Wiseman, Alromi, and Alshumrani, 2014).

In the AGCC, governments play an important role in human capital accumulation by providing state funds for formal schooling and health care. A number of studies have explored the relationship between government spending on education and health care and economic growth in the context of endogenous growth models. These models emphasize the potential for public spending on education to directly influence human capital and consequently affect economic growth in the long–run (Jung and Thorbecke, 2003; Blankenau and Simpson, 2004; Narayan, Narayan, and Mishra, 2010).

Public spending within the AGCC has increased dramatically during the past two decades. Saudi Arabia is considered to be the first among the AGCC countries in spending on education. Saudi Arabia spent 5.6% of GDP in 2013 on education compared to 3.5% in 1970. In the AGCC countries, average spending on education reached 3.3% of GDP in 2013 (UNSCO, 2013). Consequently, the spending— especially on education—is expected to enhance labor skills and in turn to support the growth of total factor productivity from the private sector in the economy. The governments within the AGCC have recently built several industrial cities that can absorb many graduates. For example, they have begun building industrial cities that are focused on the oil

industry in order to spur investment and create more quality employment opportunities to employ the large numbers of educated workers, allowing the countries to absorb the many graduate students that come back from abroad (Ministries of Labor and Financial in the AGCC countries, 2015)

Saudi Arabia has begun building six industrial cities. It spent $373 billion to support this venture from 2010 to 2014. As a result, the labor force reached 8 million and economic growth increased from 5.1% in 2011 to 7% in 2012. Expenditures amounted to $236.3 billion in 2012 (Jasser, 2013). In 2007, the government in the UAE built the world's first 'zero-carbon city' in a settlement called Masdar, the development of which is projected to cost around $18 billion. The planning for industrial cities includes establishing modern technology zones and their expansion by providing necessary services and support for entrepreneurs in developing their innovative ideas, as well as a means for the absorption of new college graduates.

1.1 Statement of the problem

The AGCC countries spend a huge amount of money on education and health. However, there is a difference of opinion among economists about the relationship between spending on education and health and economic growth (Jung and Thorbecke, 2003; Blankenau and Simpson, 2004; Narayan, Narayan, and Mishra, 2010). Spending on education and health is generally regarded as productive spending (Wiseman, Alromi, and Alshumrani, 2014). In the context of AGCC, thus, it appears it would be advantageous to study the effect of human capital on output growth through total factor productivity growth (TFP).

Over the last three decades, a plethora of empirical studies have established that individual earnings are associated with more schooling (Barro and Lee, 1996; Barro and Lee, 1997; Bloom, Canning, &Mlaney, 2001). Some empirical studies support the view that efficient and sufficient spending on education and health sectors fosters human capital formation and promotes economic growth (Schultz, 1961; Devarajan, Swaroop, and Zou, 1996; Barro and Lee, 1997; Psacharopoulos and Patrinos, 2004; Akitoby et al. 2004).

According to Solow (1956, 1957), economic growth in the long run can be achieved through a sustained growth in TFP, not only by accumulation of capital and labor. Therefore, knowledge of factors that explain TFP growth is important in explaining economic growth in the long run. While previous studies emphasize that education and health have very important effects on TFP growth, the effects of education and health in the AGCC countries have not been widely studied. Therefore, it is very important to estimate the relationship between inputs into human capital formation (education and health) and total factor productivity growth (TFP). This study uses TFP growth because inputs such as physical capital and labor may not always help to increase GDP growth (Khan, 2005). This paper separates the contribution of the basic inputs (capital stock and labor force) in production that directly influence economic growth from factors that indirectly affect output growth through TFP.

The first step in understanding the problem is to estimate TFP growth by using the Solow Model (1957) and Kalio Model (2012) and to determine the factors that affect TFP growth by using the Miller and Upadhyay (2000), Khan (2005), and Kalio (2012) models. So, the empirical portion of this study is set up in the following way:

1.1.1 By using a growth accounting model, this study will estimate a series of models, using a relatively large dataset, to compute the contribution of:

- Capital stock to economic growth
- Labor to economic growth
- Total factor productivity growth to economic growth

1.1.2 This paper will use the Miller and Upadhyay (2000), Khan (2005), and Kalio (2012) models to estimate the effects of: human capital accumulation (gross enrollment ratio in secondary school and higher life expectancy); the share of manufacturing exports to total goods exports; share of openness of trade to GDP; share of high technology exports to total goods exports; share of foreign direct investment to GDP; share of government spending to GDP; inflation rate; share of oil revenues to GDP; and the immigrant percentage to total population on TFP growth. Human capital in this study will be composed of both indicators for education via enrollments in secondary school and health via higher life expectancy. Indicators are better measures of education and health related to outcomes, versus the use of input measures of education and health expenditure in the case of AGCC countries and Jordan. Total factor productivity (TFP) will be measured by using real GDP growth.

The AGCC countries are selected in this study for the following reasons:

- Oil serves as the main source of foreign exchange needed to finance public sector employment and spending on infrastructure, education, and health. But AGCC countries' development experience displays that previous growth strategy based on factor accumulation is infeasible.
- Long-term economic growth in these countries can only be achieved through a sustained increase in total factor productivity growth. .For example, AGCC countries plan to depend critically on the success of efforts to educate and employ the rapidly expanding youth population.
- Current education reforms will help, but will not solve these issues in the next few years.

- Investment in education will create a large pool of labor that may be difficult to absorb into the private sector, due to mismatches not only of skills, but also of expectations of wages and working conditions.
- The AGCC countries will face questions about how best to manage and counsel students who finished their education abroad, as they face pressures from immigrants that want to protect their jobs from competition. The AGCC countries will attempt to pursue a common policy on managing immigration. But given the significant differences among the countries in terms of population size and natural resource endowments, they all seek to motivate the demand side to absorb skilled laborers.
- There is no previous study that has estimated the effect of human capital on total factor productivity TFP growth and economic growth in the AGCC.
- The data needed for this study are available.

1.2 Purposes of the study:

1. What is the difference among the AGCC countries and Jordan in the effect of TFP growth on economic growth?

This paper will use a growth accounting model to examine the effect of TFP growth on economic growth in each country of the AGCC countries and Jordan in order to see if the mechanism for growth is the accumulation of labor or capital, or both, or if it is due to technological advancement (TFP).And, this paper will study Jordan separately because it is not dependent on oil as resource.

2. What is the expected effect on TFP growth of :human capital accumulation (gross enrollment ratio in secondary school and higher life expectancy); the share of manufacturing exports to total goods exports; share of openness of trade to GDP; share of high technology exports to total goods exports; share of foreign direct investment to GDP; share of government spending

to GDP; inflation rate; share of oil revenues to GDP; and the immigrant percentage to total population for each country?

This paper also is based on a model used by Miller and Upadhyay(2000), Khan (2005), and Kalio (2012) to study the effect of independent variables on TFP growth. Miller and Upadhyay find that human capital has a positive effect on TFP in middle-income countries. However, in low-income countries, the impact moves from negative to positive as the country moves from a low level of openness to a higher level. Miller and Upadhyay find that the effect of the ratio of total exports to GDP on TFP is significant and positive. They also find that inflation has a significant negative effect on TFP growth at the 5-percent level, but Sarel (1996) finds that inflation rate and growth are positively correlated when inflation is below 8 percent. A high technological influence comes from the interaction between FDI and human capital that may influence TFP positively (Kalio, 2012). The size of government plays an important role in investment and educational improvements and governments in AGCC are clearly a driving force in the economy (Rains, 1989). However, Solow (1991) pays attention to the parameter of government consumption, which was negative in growth regressions. For example, Sala-i-Martin, et al. (2004), find that a high share of government spending reduces annual growth by 0.4 percent. The output growth of the manufacturing sector has a positive effect on TFP growth, but this link is unsubstantial, less than 0.5 percent (Yean, 1997; Mahadevan, 2002). This paper also will check other possible factors that may affect TFP growth negatively.

3. What are the consequences and the policy implications of the different effects of human capital and other factors on TFP growth in the AGCC countries?

This paper will check both the positive and negative effects of TFP growth on economic growth for the AGCC countries with or without Jordan. The aim of pooling countries is to identify

and assess the key determinants of productivity performance such as: human capital accumulation (gross enrollment ratio in secondary school and higher life expectancy); the share of manufacturing exports to total goods exports; share of openness of trade to GDP; share of high technology exports to total goods exports; share of foreign direct investment to GDP; share of government spending to GDP; inflation rate; share of oil revenues to GDP; and the immigrant percentage to total population on TFP growth for a panel of 6 countries over the period 1990-2014. I consider these 6 countries because they fall into a similar economic growth group and there is sufficient well-documented data available for them.

1.3 Contributions of this study

This study is different from others. This study is looking for similarities and differences within a relatively homogenous group of countries. This study can contribute to a better understanding of determinants of TFP growth. This study also may aid in developing a uniform policy on education and health within the AGCC group. This paper makes some contributions to the literature on the relationship between education, health, and other factors versus TFP development to achieve sustained growth in this area of the world. The AGCC countries are very important because they have 54 percent of the oil reserves and 40 percent of the gas reserves in the world. In contrast, Jordan's economy is not dependent on oil as a resource, so understanding the difference in TFP growth between the AGCC countries and Jordan is critical because sustained growth in this entire region is necessary to support and help achieve welfare for citizens and stability in the world economy. Finally, I illustrate the use of modern statistical methods that are appropriate for this study.

1.4 Organization of study

This dissertation is structured as follows: Chapter two presents an overview of the AGCC economies, concentrating on analyzing the effect of education and health indicators on economic growth during the period from 1990 to 2014. Chapter three reviews the theoretical literature that describes the contribution of total factor productivity growth to economic growth and the effect of education, health, and other factors on TFP growth. Chapter four focuses on the methodology from empirical literature that is used in estimating the contribution of capital stock, labor force, and TFP growth to economic growth and the relationship between human capital indicators and other factors on TFP growth. Chapter five explains the data used in the estimation process and the sources of the data. Chapter six presents the estimation results of TFP growth and the effect education, health, and other factors in each country of the AGCC and Jordan as well as pooled for all these countries together on TFP growth. It also analyzes the consequences and the policy implications of the results in the AGCC. Chapter seven presents the conclusions and recommendations for future policy development.

CHAPTER TWO: THE ECONOMY OF AGCC COUNTRIES

2.1 Development plans in the AGCC countries

The Arab Gulf Cooperation Council countries have a common vision toward economic development, as set out in national development plans. They plan to reduce their dependency on the oil sector and to create more employment for young and growing populations. For example, Saudi Arabia published the national vision to reduce dependence on oil by 2020 and to remove its reliance on oil by 2030.The absence of such a vision leads to the waste of trillions of money, the spread of monopolies, corruption, poverty, unemployment and delay of development projects. Development plans have a long history in Saudi Arabia, Kuwait, and UAE as a means of setting out development objectives, particularly following the lows in oil prices in 1998-1999. These plans emphasize economic diversification and increasing the abilities of human capital in supporting labor force participation in the AGCC countries. Most plans stress the need to boost productivity and competitiveness, and include promotion of a business environment conducive to economic growth. The AGCC countries' aims include integrating economies with the global knowledge economy by encouraging entrepreneurship, attracting foreign investment, fostering innovation, and ensuring access to finance for small- and middle-sized projects. Other themes these countries support would include improving education and healthcare outcomes, and the desirability of improving the efficiency of the public sector. As a result, in Saudi Arabia, the labor force reached 8 million, and economic growth increased from 5.1% 2011 to 7% in 2012, and expenditures on government programs amounted to $236.3 billion in 2012 (Saudi Arabian Monetary Agency, 2015).

2.2 The economic growth in the AGCC countries

The GDP growth of the AGCC countries has sometimes been higher than that of other advanced economies and other oil exporting countries as a function of the size of the AGCC countries. For example, Figure 2.1 shows the annual GDP growth in the Arab Gulf Cooperative Council countries during the period from 1990 to 2014. Qatar was the highest in economic growth among AGCC countries at 8.8 percent per year while Oman was the lowest among countries at 3.5 percent per year. However, the current growth method in the AGCC countries relies largely on oil revenues and producing oil-related products and non-tradable goods while importing most of the tradable goods it consumes (Cherif and Hasanov, 2014). Some studies show that export sophistication is one of the major determinants of total factor productivity growth that guarantees sustained growth (Hausmann, Hwang, and Rodrik, 2007). The AGCC countries have heavy industrialization strategies in energy and chemicals sectors like aluminum that help to diversify production, especially for Saudi Arabia and Bahrain.

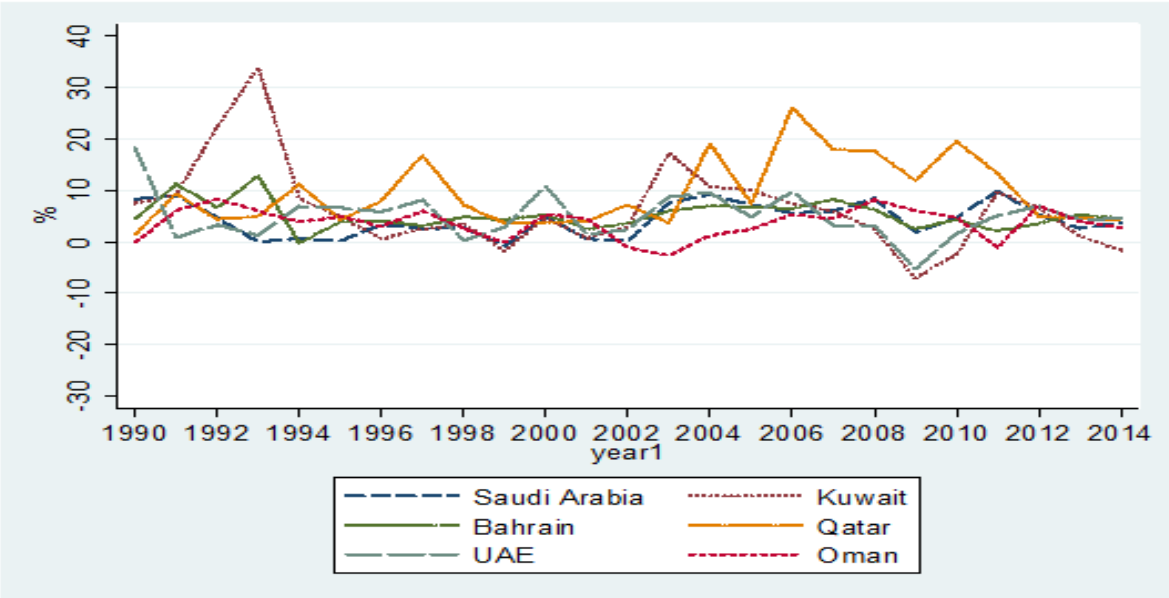

Figure 2.1 Annual growth rate of real GDP in the AGCC countries in period 1990-2014

2.3 Infrastructure development in the AGCC countries

Spending on infrastructures has been rising across the AGCC countries and there has been a growing focus on the quality of education and health. The growth of physical capital increased in the AGCC countries during the period from 1990 to 2014. Figure 2.2 shows that Qatar was the highest in growth of physical capital. It grew on average 19 percent while Saudi Arabia was the lowest at7 percent per year. In addition, the AGCC countries have heavily invested in transportation. They have started building rail networks between them which will run from Kuwait, through Saudi Arabia, Bahrain, Qatar, UAE, and Oman, and which will transport goods and passengers. This project will be worth around $128 billion in 2020 (Gray, 2016)[1].

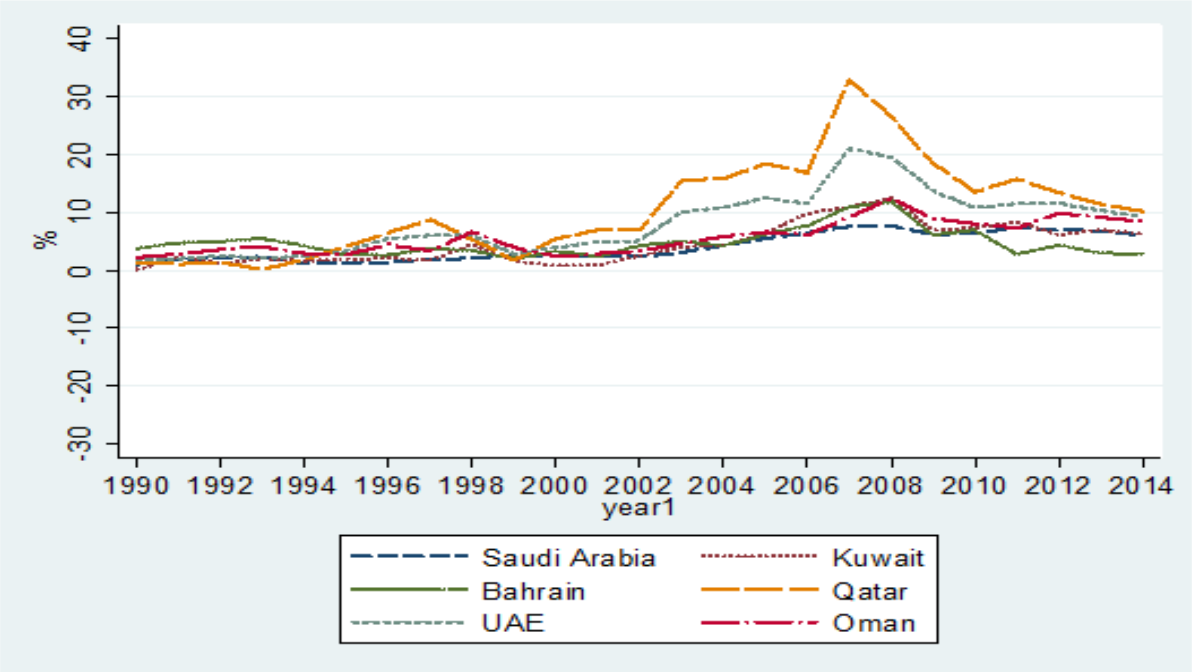

Figure 2.2 Annual growth of physical capital in the AGCC countries in period 1990-2014

[1] See more at: http://www.tamimi.com/en/magazine/law-update/section-14/december-january-3/gulf-cooperation-council-countries-continue-to-offer-favourable-environments-for-foreign-investment.html#sthash.DhzpC2mX.dpuf

2.4 Population and migrations in the AGCC countries

Population growth in the GCC is heavily driven by immigration trends that make growth in GDP per worker in Bahrain, Oman, and Saudi Arabia disappointing. The AGCC countries have one of the fastest growing populations in the world and also the migrants' ratio reached 51 percent on average over the period 1990-2014[2]. This rapid total population growth will put pressure on public services, housing, and infrastructure. Increasing numbers of migrants will also create a large pool of labor that may be difficult to absorb into the private sector due to competition from foreign labor, which has low skills and accepts low wages. A large proportion of the national population has relatively low incomes and poor job prospects. The total population of the six countries grew by an average of 4.2 percent per year during the period 1990- 2014, driven largely by the flow of immigrant labor attracted by job opportunities during the economic boom. Figure 2.3 shows the path of growth of immigrants in the AGCC countries during 1990-2014. Among the AGCC countries, the UAE and Qatar represent the largest percentages in the growth of immigrants at79percent and 72 percent per year, respectively.

The biggest challenge for the AGCC countries is that the population is expected to grow from an estimated 39.6 million in 2008 to 53.4 million in 2020 (Unit, 2009). This increase in population requires investment in infrastructure and education, and, in addition, water, transportation, and housing. These processes will put pressure on the budgets of governments that depend on revenues from oil. So, the majority of spending goes to health, education, subsidies, and wages for people who work in the public sector. Moreover, demand for infrastructure and services will grow in line with population growth. Consequently, oil revenues do not directly support production sectors in these countries but is spent on public services. However, if education

[2] Source: I computed from my data.

and health improve, then the growth of total factor productivity will also increase, and this development in economic factors will be less dependent on oil. For example, reforms in the UAE were successful in reducing the dependence on oil, thereby, the share of oil to GDP decreased by more than 20 percent during 1992-2014 (Cherif and Hasanov, 2014).

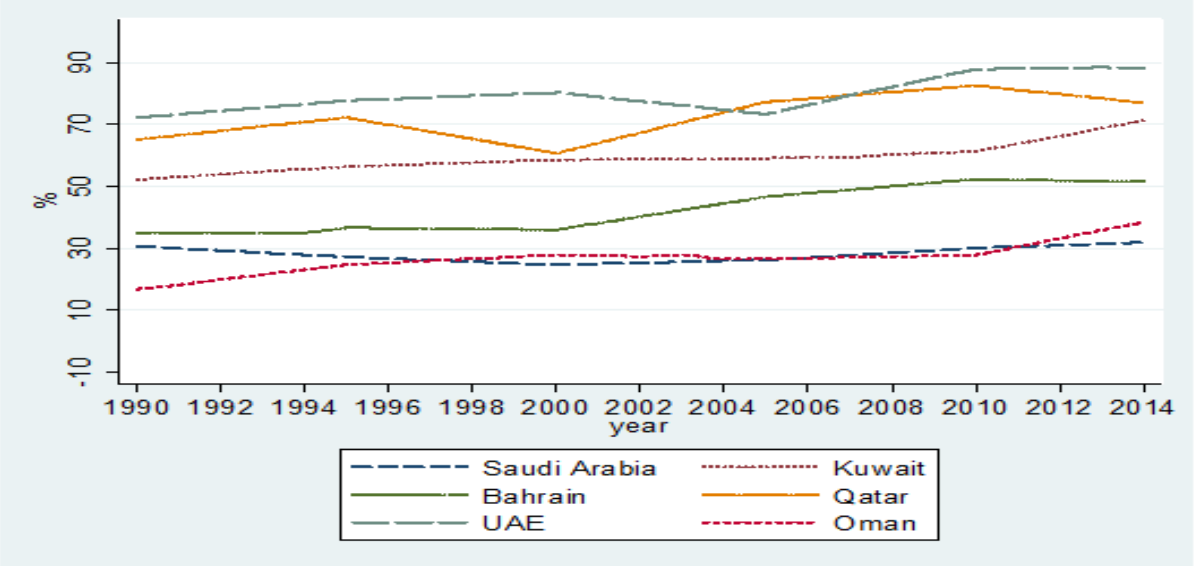

Figure 2.3 Annual immigrants growth in the AGCC countries in period 1990-2014

2.5 Economic growth and growth of GDP per capita

The negative link between GDP per capita growth and output growth is noticed in the case of AGCC countries. Figure 2.4 shows the economic growth in the period 1990-2014. The economic growth grew at an acceptable rate; Qatar was the highest one at 9 percent and Kuwait grew by 6 percent on average in this period. While figure 2.5 confirms that the growth of real GDP per capita was disappointing in the AGCC countries during the period from 1990-2014[3]. For

[3]This is annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP per capita is gross domestic product divided by midyear population. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources (source: The World Bank).

example, Saudi Arabia was the best among AGCC countries at 1.50 percent growth per year and Qatar grew by 1.07 percent per year. GDP per capita in UAE and Kuwait shrank by -1.60 and -0.11 percent on average, respectively.

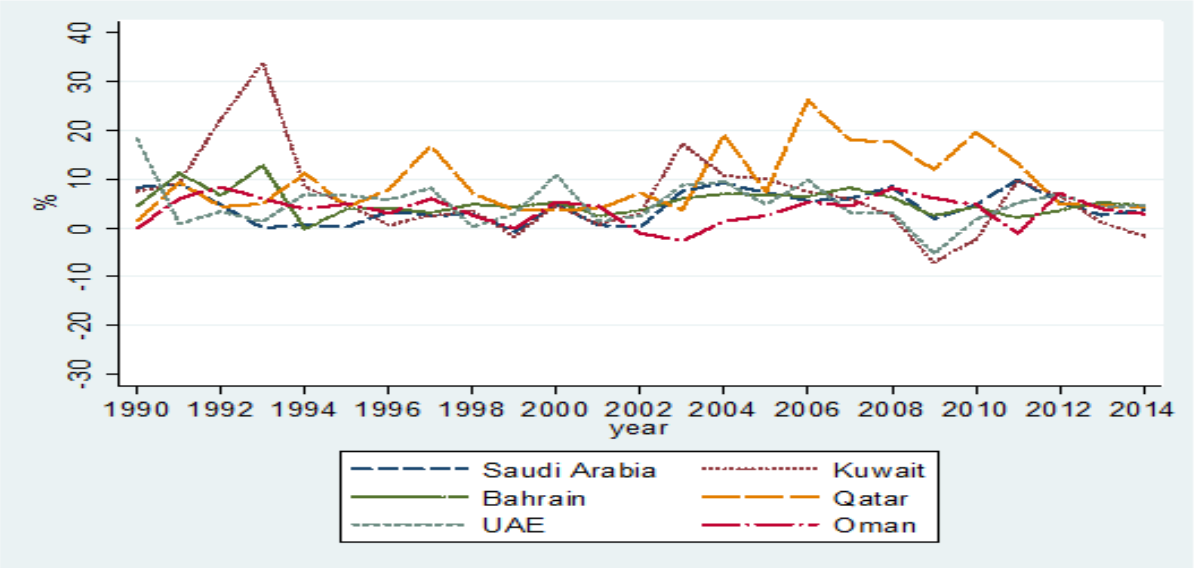

Figure 2.4 growth of GDP in AGCC countries during 1990-2014

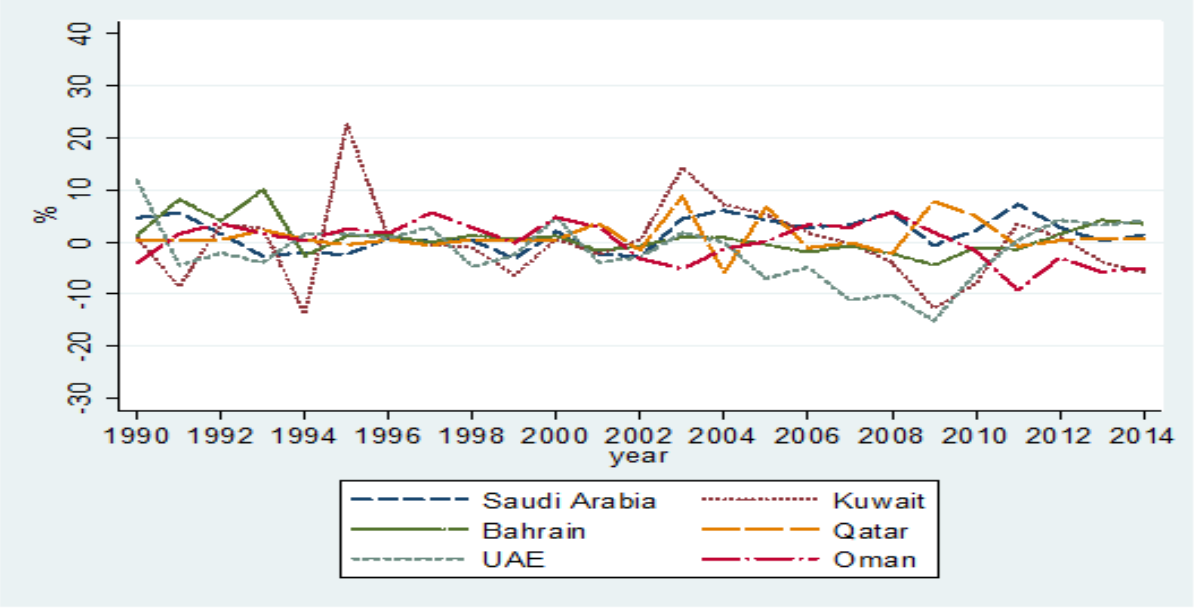

Figure 2.5 Per capita GDP growth in AGCC countries during 1990-2014

2.5 Human capital development in the GCC countries

A large part of government spending continues to be allocated to education and healthcare. Across the Gulf countries with growing populations and local unemployment, governments have looked to address these problems by improving the educational environment. In 2014, Saudi Arabia allocated 25% of the GDP expenditure towards education and human resource development, while the UAE has allocated 21% of its budget for education. Qatar has doubled spending on education in the last five years (World Bank, 2015). Healthcare is also very important and it is expected that spending increases will continue in the AGCC countries in future. However, the challenge is to determine whether increases in spending will meet development objectives and improve productivity through strengthening education systems and improving human capital.

Table 2.1: Average annual human development index in the AGCC countries income per capita

Country/Year	1980-1990	1990-2000	2000-2010	2010-2012
Bahrain	1.02	0.92	0.16	0.15
Kuwait	0.25	0.92	0.06	0.1
Oman	1.01	0.85	0.15	0.17
Qatar	0.18	0.76	0.32	0.33
Saudi Arabia	1.29	0.93	0.18	0.74
UAE	0.27	0.93	0.25	0.30

Source: World Bank

Table 2.1 shows the average annual human capital development index in the AGCC countries. Concerning growth in human capital in the periods from 1980/1990 and 1990/2000, Saudi Arabia had the highest growth among the AGCC countries while Qatar had the lowest. Kuwait was the lowest in the period 2000-2012. In general, the Arab Gulf countries had positive growth in the period from 1980 to 2012. The AGCC governments are eager to reduce the extent to which they depend on foreign workers and to improve employment opportunities. So, education reforms are likely to go wider and deeper than has been the case in recent years. Also, the private

sector is likely to be encouraged to sponsor formal training courses for young workers in the AGCC countries.

Although all AGCC countries are heavily dependent on oil exports, their challenge to diversify varies depending on the specificities of each country. For example, in Oman and Bahrain, oil reserves could be depleted sooner than in the other countries in the AGCC, making it more urgent to find other sources of exports revenue. In the remaining countries, Saudi Arabia has oil reserves for the long run. The increased employment of citizens in the private sector is considered a challenge in Saudi Arabia while in Kuwait, Qatar, and UAE, the foreign workers are in the public sector with incentives to work in the private sector and incentives in skill development (Cherif and Hasanov, 2014).

CHAPTER THREE: LITERATURE REVIEW

3.1 Literature on total factor productivity

Much empirical and theoretical research has been carried out on the relation between economic growth and total factor productivity growth in developed countries. Some of these studies have also attempted to explain the Asian economic miracle of high economic growth rates seen in the last several decades. These papers use a simple, direct accounting method to estimate the contribution of total factor productivity (TFP) to economic growth in each country of the AGCCC countries based on Solow (1956 and 1957). These studies seek to answer the following question:

3.1.1 Research question:

What is the difference among the AGCC countries and Jordan in the effect of TFP growth on economic growth?

Solow (1957**)** uses his model ($\frac{\dot{A}}{A} = \frac{\dot{Y}}{Y} - w_k \frac{\dot{K}}{K} - w_l \frac{\dot{L}}{L}$) to examine the contributions of inputs and total factor productivity for the period 1909-1949 of U.S.A. He finds that labor productivity doubles and capital's share is constant over this period. He emphasizes that increases in capital per worker account for only 1/8 of the increase in labor productivity. He attributes the reason to the effects instead of technical change. Solow shows that 88 percent of economic growth is explained by TFP and the remaining by inputs factors. In the same context, Abramovitz (1956) finds in his study of the USA from 1869-1978 and 1914-1953 that only 10 percent of economic growth might be attributed to basic inputs growth and 90 percent to TFP growth.

Kalio (2012) also uses a growth accounting model to show that the contribution of capital and labor are more important than TFP growth in Kenya. Capital stock and labor contribute 71 and 25 percent respectively to economic growth, while TFP contributes only 3.6 percent. He

emphasizes that the slowing in TFP growth comes from focusing on the policies for investment improvement, both in private and public capital. Capital formation is very important Kenya's economy, but should still be added to policies that foster productivity of the work force and improve employment. He found that TFP is affected by institutions, terms of trade, and openness of trade.

Van der Eng (2013) uses a simple direct accounting method to examine the contribution of TFP growth to economic growth for Indonesia during the period 1970-2007. He uses capital stock, education-adjusted employment, and factor income share to find TFP growth. Capital stock growth and education-augmented employment growth explained 70 and 34 percent of GDP growth, respectively, while TFP growth was on average -0.2 percent and explained only -4 percent of economic growth. Van clarifies that this result reflects that the Indonesian economy did not experience the effect of technological change.

Nachega and Fontaine (2006) use the standard Cobb-Douglas aggregate production function in capital, labor, and TFP (A_0) (Yt $= A_0 e^{bt} K_t^{\alpha} L_t^{1-\alpha}$) to investigate the sources of economic growth and TFP growth during the period 1964-2003 for Niger. They show that the highest GDP growth matched with the rapid physical capital growth during the period 1979-1982, and TFP growth was negative. The higher growth rate of capital per worker was related to investment in the uranium sector. Output declined continuously during the period 1983-1993, because of the drop in total factor productivity. So, the income per capita declined by 0.3 percent per year due to change of both TFP by -70.6 percent per year, and physical capital per capita by -29.4 percent per year.

Using a growth accounting model, Saha (2013) estimates the aggregate TFP growth in India during the period 1961-2008. This study shows that life expectancy at birth is one of the most extensively and commonly used indicator in health analysis and it is one of the important mechanisms, which are used in constructing Human Development Index. Saha also examines the effect of health on TFP growth and he observes that an average TFP growth grows by 1.49 percent during the study period. This study finds that improvement of health state affects TFP growth positively and significantly. This study suggests that government should increase the investment in health, which would help in enhancement of the total factor productivity of the economy.

3.1.2 What hypotheses are proposed in these studies?:

1. The contribution of TFP growth is low or negative in the developing countries while it is high and positive in the developed countries.

2. To increase the positive contribution of TFP, a country should adopt policies that improve labor efficiency by developing skills through job training and improved education and health, and thereby should be able to utilize the benefits of technological changes more efficiently.

3. The decrease in output growth in developing countries seems to come from decreasing TFP growth those countries.

4. The investment improvement in both private and public capital is not enough to increase TFP growth but should be complemented with policies that encourage employment and foster improvements in labor productivity.

5. These studies also show that the problem with education is not only in gross enrollment ratio but the quality of the education system and the fact that it is unconnected to the needs of the labor market.

6. These studies find that improvement of health condition affects TFP growth positively and significantly.

3.1.3 Hypothesis

TFP growth accounts for a smaller share of economic growth than accumulation of capital and labor for each of the AGCC countries and Jordan.

3.2 Literature on education, health, and other determinants of TFP

Since estimating the relation between spending on education and health and economic growth is very difficult using direct methods, in this chapter, this study reviews the most important literature that focuses on estimating the indirect relationship between education and health outcomes and economic growth. I analyze implications, consequences, and determinants of the effect of people obtaining more schooling and improving their life expectancy and other determinants of TFP that affect economic growth. A well-educated worker helps a society to improve its ability to acquire as well as use new knowledge. Much research points out that the level of education has an important effect on total factor productivity (TFP) because educated people are required to carry out technology innovation (Romer, 1990). Also, health has an important effect on household income and wealth. It influences total factor productivity indirectly by increasing labor productivity, savings, and investments. Healthy workers are more productive. For example, foreign investors are attracted to invest in healthy environments. Moreover, a longer life expectancy is likely to increase the attractiveness of human capital investment. However, when the workers are exposed to diseases, than the environment will not be as attractive for investors and it has a negative effect on economic growth. These studies seek to answer the following question:

3.2.1 Research question

What is the expected effect on TFP growth for each of the AGCC countries and Jordan of: human capital accumulation (gross enrollment ratio in secondary school and higher life expectancy); the share of manufacturing exports to total goods exports; share of openness of trade to GDP; share of high technology exports to total goods exports; share of foreign direct investment to GDP; share of government spending to GDP; inflation rate; share of oil revenues to GDP; and the immigrant percentage to total population?

Ismail, Sulaiman, and Jajri (2014) use DEA[4] method to measure TFP growth for Malaysia. They estimate the contribution of technology to total factor productivity growth in the period from 1971-2007. They find that even though TFP growth has a significant contribution to the output growth of Malaysia (7.5 percent), its contribution is still lower than the contribution of physical capital and labor. They find the contribution of technological change to TFP is higher than the contribution of technical efficiency change. This result also shows that the main factor contributing to TFP growth is manufacturing output growth followed by the percentage of foreign-owned companies and the ratio of trade to GDP that are very much related to the development and transfer of technology in Malaysia. However, they do find that tertiary education is not a significant determinant of TFP growth.

Miller and Upadhyay (2000) examine the impacts of openness of trade, trade orientation, and human capital on TFP for a pooled cross-section, time series of developing and developed countries. They find that the openness of trade benefits total factor productivity and increases exports to GDP. They find that human capital has a positive contribution on TFP in middle-income

[4]The DEA is a special mathematical linear programing model and test to assess efficiency and productivity. TFP means the product of change in technical efficiency (EFFCH) multiplied with Technological Change(TECHCH) which can be presented as: TFPCH=EFFCH X TECHCH.

countries. However, in low-income countries, the impact shifts from negative to positive as the country shifts from a low level of openness of trade to a higher level. This is because greater openness leads to competition, modern technology, and motivates the demand for high skilled work, and fosters learning by doing.

Yan and Yudong (2003) use a growth accounting exercise to investigate whether economic performance is driven by TFP growth or by factor accumulation in China. They take human capital (the average years of schooling in population aged 15-64 years) into account to study this impact. They construct a measure of human capital stock over two periods, the economic pre-reform period from 1952-1978 and the economic reform period from 1978-199. First, by incorporating a measure of human capital stock in the production function, they find that the accumulation of human capital contributes significantly to economic growth and welfare. The contribution to GDP growth was smaller compared to the economic pre-reform period. Second, by incorporating a measure of human capital stock in the TFP growth, they find also that it contributed positively to output growth by 54.6 percent for the reform period while the contribution of TFP growth was negative for the pre-reform period. This supposes the idea that investing in human capital has great potential in contributing to productivity growth and welfare. The lower growth rate of human capital accumulation for the reform period is a matter that China will need to acknowledge to build an innovation-based knowledge economy.

Khan (2005) uses an empirical growth accounting exercise to decompose the growth rate of aggregate output into the contribution of growth of capital stock and labor and TFP growth in the case of Pakistan. He finds that GDP growth and capital followed identical paths during the period from 1960-1970, however, the slowdown in capital growth implies that it also pulls down economic growth. In the period from 1970-2003, the pattern of economic growth changed; if TFP

growth rose, GDP growth took the same direction and vice versa. Khan finds that domestic investment, FDI, employment, and government consumption have a positive effect on total factor productivity growth. This study also explores that the new areas of investment was private credit followed by the productivity at the firm level.

Knowles, Lorgelly, and Owen (2002) estimate a neoclassical growth model that includes female and male education for across section of countries using long time averages of the data. Over a long time period, they find that closing the gender gap in education plays an important role in raising labor productivity. Their empirical results suggest that female education has a statistically significant positive effect on labor productivity while male education is less clear. In the same context, Caselli, Esquivel, and Lefort (1996) estimate Barro and Lee's calculations again using a generalized method moments (GMM) regression. They use cross sections of five-year periods and find that female schooling has a statistically significant positive effect on output growth while the effect is negative for male schooling.

In the case of human capital derived from employee training, Bartel (1992) investigates the relationships between on-the-job training, wages and job performance by using the personal records of a large manufacturing firm. The main finding in this paper is that learning by doing increases wages and leads to more productivity of companies in the U.S. In the same context, Black and Lynch (1996) add that the quality of the education is an important parameter for productivity in both manufacturing and non-manufacturing sectors for 1600 defined sectors in the U.S.So, Bartel and Black and Lynch find that training has a positive effect on wage growth of labor and leads to an improvement in job performance and total factor productivity of companies in the long run.

On the negative side, Lopez, Thomas, and Wang (1998) emphasize other aspects of education quality not often assessed in the literature: distribution of education and the relation between plans and the output of education. In most countries, unequal distribution of education tends to have a negative effect on per capita income. So, controlling for the distribution of education leads to positive and significant impacts on per capita income. Miller and Upadhyay (2002) do not find evidence that education affects economic growth alone. They add an interaction term between trade and education, especially to account for the observation that the threshold impact of education differs across levels of economic growth. In the case of low-income levels, education is negatively associated with total factor productivity growth but the impact moves from negative to positive as the country moves from a low level to higher level in openness of trade. While for middle and high-income countries the impact of education is a positive effect on TFP growth.

Knowles and Owen (1995) use the study of Mankiw, Romer, and Weil (1992)that include life expectancy in an aggregate production function in an attempt to establish whether health influences income per capita. They find a strong and more robust relationship between income per capita and health capital, than between income per capita and educational human capital.

Bloom, Canning, and Sevilla (2001) study the impact of health on economic growth. This study aims to put health in a well-specified aggregate production function in an attempt to test for the existence of an impact of health on productivity of labor, and to measure its strength. They find that each extra year of life expectancy in the population contributes to an increase of 4% in output. This study suggests that improvements in health may increase output not only by productivity of labor, but also through the aggregation of capital by life-cycle savings.

3.2.2 What hypotheses are proposed in these studies?:

1. The openness to trade improves TFP growth when it increases exports to GDP and lowers the real value of the domestic currency.

2. Human capital has a positive contribution to TFP growth in middle-income countries. But, in low-income, the impact moves from negative to positive as the country moves from a low level to higher level in openness of trade (competition-modern technology, motivate the demand for high skilled, foster learning by doing).

3. Improvements in life expectancy have a strong effect on total factor productivity growth.

4. Domestic investment, foreign direct investment, employment, and government spending have positive effects on TFP growth.

5. Foreign direct investment drives economic growth through increase in productivity levels of workers. It enhances productivity by creating competition between firms and individuals. This competition helps to adopt new procedures of production that improve the quality of labor and capital inputs in the economy.

3.2.3 Hypothesis

Human capital (gross enrollment ratio in secondary school and higher life expectancy) and other factors such as: the share of manufacturing exports to total goods exports, the share of trade openness to GDP, the share of high technology exports to total goods exports, the share of foreign direct investment to GDP, the share of government spending to GDP, inflation rate, the share of oil revenues to GDP, and the immigrant percentage to total population all have positive effects on TFP growth in each country of the AGCC countries and Jordan.

3.3 Literature on the pooled sample of countries

These papers use a panel of data on GDP, capital stock, and labor force to find a time series of TFP in different countries. These papers study the effect of TFP growth on output growth in a group of countries and investigate the effects of determinants of TFP such as human capital, trade openness, high technology exports, foreign direct investment (FDI), manufactured exports goods, and control variables such as inflation. These studies seek to answer the following questions:

3.3.1 Research question

1-What is the effect of TFP growth on economic growth for pooled AGCC countries with or without Jordan?

2- What is the expected effect on the pooled TFP growth of the AGCC countries with or without Jordan of: human capital accumulation (gross enrollment ratio in secondary school and higher life expectancy);the share of manufacturing exports to total goods exports, the share of trade openness to GDP, the share of high technology exports to total goods exports, the share of foreign direct investment to GDP, the share of government spending to GDP, inflation rate, the share of oil revenues to GDP, and the immigrant percentage to total population, and what are the consequences and policy implications of these results?

Gehringer, Martínez, and Danziger (2013)obtain TFP as a residual from the value of the Cobb-Douglas production function. They study the development of TFP and the controls on TFP for 17 European countries from 1995-2007 and estimate aggregated and sectoral TFP. The main results show that total factor productivity differs among sectors and countries and over time. This difference is mainly interpreted to factors common to all countries. The most important factors are trade openness, use of information and communication technologies and human capital. For explanatory variables, an increase in unit wages of 10 percent leads to an increase in TFP of about

2.25 percent. For FDI as percentage of GDP, an increase in FDI of 10 percent increases TFP by 1.22 percent. The use of information and communication technologies has a positive effect and is correlated to TFP by 0.8 percent. However, the proxy for human capital (secondary education) is not statistically significant. They suggest that the main policy implication coming from this is that countries should promote exports and expands the use of information and communication technologies that can support improved efficiency of the work force. This process leads to improvements in human capital efficiency and rewards interest of higher wages that contribute to higher TFP growth.

Griffith, Redding, and Van Reenen (2004)use a panel of industries across 12 OECD countries to study relationship between research and development (R&D) and TFP growth. This paper focuses on R&D and human capital to emphasize whether they have a direct impact upon a country's rate of total factor productivity growth. Griffith, Redding, and Van Reenen find that R&D has played a role in the convergence of TFP levels within industries across these countries. So, an increase in the R&D frontier raises the steady state rate of TFP growth in both the frontier and non-frontier countries. They find evidence that R&D is driven by private return and is statistically and economically important in the U.S. The findings of this paper show that R&D and human capital play an important role in productivity growth, but it only finds a small effect for trade.

Using data from 145 countries during the period from 1980-1999, Baier, Dwyer, and Tamura (2006) study the relative importance of the growth of physical and human capital and TFP growth for developed and developing countries. They show that TFP growth plays an important role in economic growth across all countries, 8 percent for all countries on average. But, they find the contribution of TFP to output growth varies among countries. Growth of TFP for the Western

countries, including the USA, accounts for about 25 percent of economic output growth per worker. For Southern Europe, it is 20 percent and 18 percent for Newly Industrialized Countries (NICs). However, in the Middle East, and Central and Eastern Europe have negative TFP growth on average of GDP growth per worker. Baier, Dwyer, and Tamura indicate that these negative growth rates come from institutional changes and armed conflicts. They emphasize that there is evidence that the growth of output per worker is linked with the accumulation of physical capital, technological changes, and human capital.

Semlali (1999) examines different sources of TFP levels for 88 countries for the period 1960-1994. He estimates the share of physical capital for each region, 0.48 for Africa, 0.44 for East Asia, 0.28 for South Asia, 0.65 for Middle East, 0.72 for Latin America, 0.54 for the Newly Industrialized Countries, and 0.55 for the whole sample. These results are remarkably stable across estimations. For the whole sample, he finds that TFP growth contributed 0.74 percent to an annual average of real GDP growth when the share of capital is 0.2. The contribution of TFP decreased to 0.23, and -0.27 when the share of capital increases to 0.4 and 0.6. So, the two factors that explain TFP across countries are physical capital and human capital. In addition to lower inflation, lower real exchange rate, lower government consumption, higher ratio of reserves to imports, and lower external debt are all linked with higher levels of TFP.

Felipe (1999) shows some studies that used the Solow residual by growth accounting or by econometric estimation of production function. This study discusses important phases of technology in the estimation of total factor productivity growth in East Asian countries. He accomplishes: first, most studies indicate that the notion of technological progress refers to an exogenous factor. Technical progress cannot be taken as the basic point in the examination of the growth of total factor productivity (TFP). An important part of technical progress is embodied in

the capital and labor of production. Second, the growth in TFP comes from the extent of absorption of technical development that is imported from developed countries.

Makdisi, Fattah, and Limam (2005) compare the Middle East and North Africa (MENA) with East Asia and Latin America in the pattern of growth over the period 1960-2000. They find that growth can be the result of the growth of labor and capital or the increase in the efficiency of these inputs. They find also that capital is the main contribution to output growth, more so than labor and TFP in the MENA. Makdisi, Fattah, and Limam point out that the labor force in the private sector remains relatively low in comparison with other regions because of the dominance of the public sector in the economy.In addition, guaranteed employment by the government of university graduates in most of the MENA countries, especially in the AGCC countries, also means that they are not included in the private sector numbers.Among the MENA countries, including the AGCC countries, only Turkey, Egypt, Morocco, and Tunisia had positive TFP growth. They attribute the lower performance of TFP growth to weakness inquality of government institutions and human capital. The other findings of this paper show that capital is less efficient, trade openness is less beneficial to output growth, and the size of government has a harmful impact on output growth in Oman, Saudi Arabia, and Jordan.Also, they find that high inflation and natural resource have a negative effect on TFP growth.

Sala-i-Martinand and Artadi (2003) analyze the economic growth performance in the Arab world over the last forty years. They suggest that the growth of GDP per capita grew between 1963 and 1980 and it stagnated between 1980 and 2000. They state that the slowdown in growth is because of several factors. First, the decline in investment rate leads aggregate growth to decline: countries which invest a substantial fraction of their GDP grows fast and that those which fail to grow are countries that fail to invest. Second, the decline in economic efficiency can be measured

by TFP growth. For example, they show that TFP growth is low and negative in the Arab world, with the exception of Syria and Egypt. Finally, they point out that the decline in TFP growth is the result of weakening in production environment due to excessive public involvement, and low quality of education. This study shows that overall public investment is unproductive and the problem with education is not only in enrollment rates but the quality of education system and the fact that it is unconnected to the needs of labor market. Also, this study points that excessive government intervention makes private investment unproductively expensive.

Hakura (2004) analyzes the weak growth performance in the Middle East and North Africa (MENA) during 1980-2000. He uses an empirical model of long-run growth and finds that the growth performance varies across 16 MENA countries. In AGCC countries, the initial income level, government spending, and institutional quality are the key determinants of growth. He finds that high initial income has a large effect on TFP growth for explaining the growth differential with East Asia; it contributes by 0.8 percent moreto economic growth than in other MENA oil countries, which accounts only for 0.4 percent. Also, he finds that high government consumption in AGCC countries has mainly affected the influence of capital accumulation to the growth differential with East Asia, while poor institutional quality in the other MENA oil countries has mainly affected the influence of TFP growth to the growth differential with East Asia. So, Hakura shows that the impact of high initial income on TFP growth in the AGCC countries is much larger than the impact of poor institutional quality on TFP growth for the other MENA oil countries. Finally, this study suggests that the TFP growth in AGCC countries is higher than the other MENA oil countries.

3.3.2 What hypotheses are proposed in these studies?:

1.These studies show that TFP contribution to GDP growth varies among countries: in Western countries and the USA, it contributes around 25 percent; in Southern Europe it contributes about 20 percent; and in Newly Industrialized Countries (NICs) it contributes about 18 percent. However, in the Middle East and central and East Europe there are negative effects on GDP growth due to institutional changes and armed conflicts.

2. These studies point out that the decline in TFP growth in Arab countries is because of deterioration in production environment due to excessive public involvement, and low quality of education.

3. TFP differs among sectors and countries but it is explained by some common factors: a 10 percent increase in wage increases TFP growth by 2.25 percent, a 10 percent increase in FDI/GDP increases TFP growth by 1.22 percent, and a 10 percent increase in information and communication increases TFP growth by 0.8 percent.

4. These studies show that R&D is statistically and economically important for TFP growth and the growth in TFP comes from the extent of absorption of technical development that is imported from developed countries.

5. These studies emphasize that accumulation of human capital, technological changes, lower inflation, lower government spending, and lower exchange rate have a positive effect on TFP growth.

6. These studies also show that the problem with education is not only in gross enrollment ratio but the quality of the education system and the fact that it is unconnected to the needs of the labor market.

3.3.3 Hypotheses

1. TFP growth has a positive effect on economic growth for pooled AGCC countries with Jordan or without Jordan during 1990-2014.

2. The long-run effect of human capital, the share of manufacturing exports to total goods exports, the share of trade openness to GDP, the share of high technology exports to total goods exports, the share of foreign direct investment to GDP, the share of government spending to GDP, inflation rate, the share of oil revenues to GDP, and the immigrant percentage to total population has a positive effect on the pooled of TFP growth of AGCC countries with Jordan and without Jordan.

3.4 This study

This study is different from previous studies in that it is looking for the differences and similarities between the AGCC countries in total factor productivity growth (TFP) and the contributions of labor and capital to economic growth for a group of homogenous countries and contrasting those results with results for Jordan, a country that is not dependent on oil as a resource. This study can contribute to a better understanding of those factors that may affect technology in these countries. This study also seeks to assess the efficiency of efforts that have been made in these countries to improve human capital (education and health), and to determine whether or not these have had positive effects on TFP growth.

CHAPTER FOUR: METHODOLOGY

Generally, a growth accounting model is used to estimate the contribution of total factor productivity (TFP) growth and factor inputs (capital and labor) to economic growth. This study examines the factors that contribute to TFP growth.

4.1. First Model: growth accounting model

Following Solow (1957) and Kalio (2012), I decompose the sources of economic growth into growth in the level of physical capital, labor, and growth in technology (A). This model is a function of inputs and technology that comes from total factor productivity (TFP). In general, I model the production function as following:

$$\begin{cases} \mathrm{Y(t)} = \mathrm{A(t)F\big(K(t), L(t)\big)} \\ \frac{\mathrm{dA_t}}{\mathrm{dt}} > 0 \; and \; A(\mathrm{t}) = \frac{\mathrm{Y_t}}{\mathrm{F(L(t),K(t))}} \end{cases} \tag{4-1}$$

where Y is output, K is capital, L is labor, and t is time. Taking the derivative with respect to time:

$$\begin{aligned} \frac{\mathrm{dY}}{\mathrm{dt}} &= \frac{\mathrm{dA}}{\mathrm{dt}}\mathrm{F\big(K(t), L(t)\big)} + \mathrm{A(t)}\left[\frac{\mathrm{dF\big(K(t),L(t)\big)}}{\mathrm{dK_t}}\frac{\mathrm{dK_t}}{\mathrm{dt}} + \frac{\mathrm{dF\big(K(t),L(t)\big)}}{\mathrm{dL_t}}\frac{\mathrm{dL_t}}{\mathrm{dt}}\right] \\ &= \frac{\mathrm{dA}}{\mathrm{dt}}\frac{\mathrm{Y}}{\mathrm{A(t)}} + \frac{\mathrm{Y}}{\mathrm{F\big(K(t),L(t)\big)}}\left[\frac{\mathrm{dF\big(K(t),L(t)\big)}}{\mathrm{dK_t}}\frac{\mathrm{dK_t}}{\mathrm{dt}} + \frac{\mathrm{dF\big(K(t),L(t)\big)}}{\mathrm{dL_t}}\frac{\mathrm{dL_t}}{\mathrm{dt}}\right] \end{aligned} \tag{4-2}$$

Dividing through the equation (4-2) by Y and multiplying the capital and labor components on right hand side ($\frac{K}{K}\ and\ \frac{L}{L}$):

$$\frac{\mathrm{dY/dt}}{\mathrm{Y}} = \frac{\mathrm{dA/dt}}{\mathrm{A}} + \frac{\mathrm{dF/dK}}{\mathrm{F/K}}\frac{\mathrm{dK/dt}}{\mathrm{K}} + \frac{\mathrm{dF/dL}}{\mathrm{F/L}}\frac{\mathrm{dL/dt}}{\mathrm{L}} \tag{4-3}$$

$\frac{\mathrm{dY}}{\mathrm{dt}} = \dot{\mathrm{Y}}$, $\frac{\mathrm{dK}}{\mathrm{dt}} = \dot{\mathrm{K}}$, $\frac{\mathrm{dL}}{\mathrm{dt}} = \dot{\mathrm{L}}$, and $\frac{\mathrm{dA}}{\mathrm{dt}} = \dot{\mathrm{A}}$, the dots denote time derivatives, so the corresponding ratios are rates of change.

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + \frac{dF/dK}{F/K}\frac{\dot{K}}{K} + \frac{dF/dL}{F/L}\frac{\dot{L}}{L} \tag{4-4}$$

where $\frac{dF/dK}{F/K} = \delta_k$, and $\frac{dF/dL}{F/L} = \delta_l$are generally the capital and labor income shares.

Rearranging equation (4-4) to represent the shift of the production function TFP or technical progress as following:

$$\frac{\dot{A}}{A} = \frac{\dot{Y}}{Y} - \delta_k \frac{\dot{K}}{K} - \delta_l \frac{\dot{L}}{L} \tag{4-5}$$

This expression indicates that the growth rate of total factor productivity (TFP) can be factored into the growth of capital and labor, both weighted by their output elasticities and the growth of real output.

Now, it is possible to illustrate this process by specifying the production function in capital and labor. The Cobb-Douglas structure implies that share of capital and labor in the economy is following as:

$$Y_{ti} = A_{ti} K_{ti}^{\delta_k} L_{ti}^{\delta_l} \begin{cases} i: \ number\ of\ countries \\ t: time\ series \end{cases} \tag{4-6}$$

whereY_{ti} is output or gross domestic product (GDP) for every country in this study; A_{ti} is TFP for every country; K_{ti} is physical capital for every country; L_{ti} is labor force. Because data do not come in continuous-time form, I apply the rules for deriving proportional changes on equation (4-4) in the discrete-time approximation as:

$$\frac{\Delta Y_{ti}}{Y_{ti}} = \frac{\Delta A_{ti}}{A_{ti}} + \delta_k \frac{\Delta K_{ti}}{K_{ti}} + \delta_l \frac{\Delta L_{ti}}{L_{ti}} \tag{4-7}$$

Having obtained $Y_t, K_{t,}, and\ L_t,$ I then compute the time series for ΔY_t, ΔK_t, and ΔL_t to obtain time series for $\delta_{tk} = \frac{\Delta Y_t / \Delta K_t}{K/Y}, and \delta_{tl} = \frac{\Delta Y_t / \Delta L_t}{L/Y}$ and compute annual averages to obtain δ_k and δ_l. The δ_k andδ_l are consequently used to determine the contribution of capital and labor to output growth. The next step is to account the time series for $\frac{\Delta Y_t}{Y_t}, \frac{\Delta K_t}{K_t}, and\ \frac{\Delta L_t}{L_t}$ which are plugging into equation (4-7) to obtain the time series of $\frac{\Delta A_t}{A_t}$ as following:

$$\frac{\Delta A_t}{A_t} = \frac{\Delta Y_t}{Y_t} - \delta_k \frac{\Delta K_t}{K_t} - \delta_l \frac{\Delta L_t}{L_t} \tag{4.8}$$

This equation means that the percentage change in total factor productivity (TFP) equals the percentage change in output minus the fraction $\delta_k$of the percentage change in capital and minus the fraction δ_l of the percentage change in labor.

These analyses provide an answer to two of the research questions of this study.So, this study seeks to answer the following questions:

- What is the difference among the AGCC countries and Jordan in the effect of TFP growth on economic growth?
- What is the effect of TFP growth on economic growth for pooled AGCC countries?

4.2 Second Model: OLS estimations of TFP growth

Following Miller and Upadhyay (2000), Khan (2005), and Kalio (2012), the total factor productivity (TFP) growth model is composed of various factors that come from in the economic literature. These factors are explicitly included in the explanation of TFP growth. The AGCC countries have characteristics and a technology frontier that distinguishes them from others countries, for example, macroeconomic policy, in terms of the effects of trade openness, political, and legal institutions and type of physical capital. These characteristics may be important for total factor productivity growth. Besides these determinants of TFP, there are some variables that are also important in this model. In general, control variables include inflation, government spending, and oil revenues.

4.3 Overview on some determinants of TFP growth

4.3.1 Human capital

Human resource development and human resource management may affect productivity (Jajri, 2007). For example, the AGCC countries spend a huge amount of money on education and health. If this money is not spent efficiently, growth in the economy will slow. Ugur and Nandini (2011) find that corruption can result in a decline in human capital and a worsening of government finance. In this study, the education and health indicators are used to estimate the impact of human capital variables on total factor productivity (TFP). This study uses gross enrolment ratio in secondary school and life expectancy at birth as outcomes for education and health rather than government expenditures on education and health in developing countries (Eggoh, Houeninvo, and Sossou 2015). Moreover, high quality advanced technology contributes to growth of output as well as reducing dependence on low-skilled labor (Gregory, Romer, and Weil, 1992; Ismail, Sulaiman, and Jajri, 2014). And higher life expectancy is correlated with better health status and lower morbidity (Murray and Chen, 1992).Acaroglu and Ada (2014) explore that the government spending on human capital in Middle East and North Africa (MENA) countries and find it does not have any significant impact on economic growth either in terms of health or education.

4.3.2 Interaction between technology and trade openness

Trade openness plays an important role in determining the effect of technology on total factor productivity. Sachs et al. (1995) confirm that trade openness has a positive effect on economic growth. For Middle East and North Africa MENA, Sala-i-Martin, Doppelhofer, and Miller (2004) find that for each four-year period that a country continues to be open to trade, growth of output is higher by 0.12 percent per year. However, in the same region, Makdisi, Fattah, and Limam(2005)find that the effect of openness of trade on economic growth is less beneficial,

especially in the AGCC countries, whose natural resource abundance is related with high trade ratios.

Trade opennessis represented by theshare of the sum of exports and imports to GDP. Openness is believed to have a favorable effect on output growth through increased productivity in the economy from greater access to advanced technologies that contribute to total factor productivity TFP (Lewis, 1980). For example, the ratio of high technology exports to manufactured exports grew by 3.9,1.7, 1.4, 1.2, 0.6, and 0.01 percent per year for Oman, Kuwait, Bahrain, UAE, Saudi Arabia, and Qatar, respectively, over the period 1990-2014(World Bank, 2015).

4.3.3 Foreign direct investment

Countries that use more productive capital will produce more, especially if the labor force is skilled in using computers.Makdisi, Fattah, and Limam (2005) show that high investment ratios contributed significantly to the proportionally better growth performance of Oman and Tunisia. The specific project financed by the public sector might be very productive if chosen to improve efficiency, however, it becomes quite useless, if the government makes investment decisions with the objective of gaining political or private gains. So, to investigate the stock of capital used in the AGCC countries, available data on the ratio of capital to GDP, which is proxy for capital stocks, were used.

Foreign direct investment (FDI) plays an important role in driving economic growth through the inflow of technology. FDI inflows create potential R&D transfer of knowledge to the native labor force. Thus, it helps to increase productivity levels and improve quality and competition between production firms. FDI brings improvements in the quality of capital and labor inputs in the local economy (Khan, 2005). For example, Bahrain is the fifth most FDI-rich country

in the Middle East and Africa where the FDI grew by 6 percent per year over the period 1990-2011. While Qatar, Saudi Arabia, UAE, Oman, and Kuwait, grew by 2.8, 1.9, 1.8, 1.7, and 0.3 percent per year, respectively, in this period (World Bank, 2015).In 1998, the ratio of stock inflows to GDP reached 20.4, 16.9, 10.4, 5.7, 4.5, and 1.75 percent for Saudi Arabia, Oman, Bahrain, Qatar, UAE, and Kuwait, respectively, (Sadik and Bolbol, 2001).

4.3.4 Government spending and natural resource

The size of government plays an important role in investment and educational improvements in the AGCC countries. The governments in AGCC are clearly a driving force in the economy (Rains, 1989). Governments in AGCC countries finance investment and educational improvements. TFP will improve in the short run but in the long run it can be hurt by rent- seeking activities. Makdisi, Fattah, and Limam (2005) point that resource-rich countries are also related with inefficient consumption and public investment patterns, and provide motive for rent-seeking and other non-productive activities. Barro (1991) shows that the coefficient on government consumption is negative in growth regressions. For example, Sala-i-Martin, Doppelhofer, and Miller (2004) find that the share of government consumption reduces annual growth by 0.4 percent. This study uses the ratio of government consumption to GDP and the ratio of oil revenue to GDP as a good proxy for this effect on growth performance.

4.3.5 Inflation rate

Inflation plays an important role as a control in the model to capture the stability of the economy, which is assumed to be necessary for total factor productivity growth. Moreover, developing countries suffer from the effects of money illusion, which is why inflation should be included as a macroeconomic determinant of TFP. For example, high inflation causes volatility in exports and lowers revenue and has a negative effect on output in the future. Fischer (1993) points

out that high inflation reduces the GDP growth by diminishing investment. Sarel (1996) shows that there is correlation between inflation and economic growth. He finds that the relationship between inflation and economic growth is positive if the inflation is lower than 8 percent and negative if the inflation is higher than 8 percent. Ghosh and Philips (1998) find that increasing inflation from an optimal level of 2.3 percent to 5 percent leads to reduce annual growth of GDP by 0.3 percent.

4.3.6 Population and immigrant percentage

The AGCC countries has one of the fastest growing population in the world and the migrants ratio reached to 37 percent on average over the period 1990-2014. This rapid total population growth will put pressure on public services, housing, and infrastructure. With increasing in the number of migrants, it will also create a large pool of labor that may be difficult to absorb into the private sector, due to competition from foreign labor, which has low skills and accepts low wages. However, what is the effect of the migrants on TFP growth in the host countries? If the migrants have high skills then the benefits are by providing them with the skills they need at lower cost in production. AGCC countries have experience with the migrant labor force during last three decades that began to contribute in building development schemes. Migrants can boost competitiveness is through innovation and this happens when immigrants bring new ideas, work in industries and occupations, or establish new businesses. Migrants may have higher rates of self-employment and may be less risk averse than the locally born population (Peri, G., 2012).

In order to identify the determinants of TFP, I use the equation as following:

$$TFP_i = \gamma_{0i} + \gamma_{1i} manufim_i + \gamma_{2i} govgdp_i + \gamma_{3i} highex_i + \gamma_{4i} edp_i + \gamma_{5i} trad_i + \gamma_{6i} infl_i + \gamma_{7i} fdi_i + \gamma_{8i} life_i + \gamma_{9i} oilrev_i + \gamma_{10i} migrant_i + \mu_i, \quad \text{i = 1 to 7 country} \qquad (4\text{-}9)$$

where TFP is total factor productivity growth, $manufim$ is the share of manufacturing exports to total goods exports,$ovgdp$ is the share of government spending to GDP, $highex$ is the share of high technology exports to total goods exports, edp and $life$ are gross enrollment ratio in secondary school and higher life expectancy at birth (represent investment levels in human capital), $trad$ is the share of trade openness(exports and imports)to GDP, $infl$ is the inflation rate, fdi is the share of foreign direct investment to GDP, $oilrev$ is the share of oil revenues to GDP, $migrant$ is the immigrant percentage to total population, γ_0 is the constant term, and μ is the error term.

This analysis provides an answer to research question of this study. So, this study seeks to answer the following question: What is the expected effect on the pooled TFP growth of the AGCC countries with Jordan or without Jordan of: human capital accumulation (gross enrollment ratio in secondary school and higher life expectancy); the share of manufacturing exports to total goods exports; share of openness of trade to GDP; share of high technology exports to total goods exports; share of foreign direct investment to GDP; share of government spending to GDP; inflation rate; share of oil revenues to GDP; and the immigrant percentage to total population, and what are the consequences and policy implications of these results?

CHAPTER FIVE: DATA

This study estimates a time series for each of the AGCC countries and a pooling of data for six countries observed over the period 1990-2014. The output data (GDP), physical capital, and total labor force are used to account for TFP growth according to the following:

$$\frac{\Delta A_t}{A_t} = \frac{\Delta Y_t}{Y_t} - \delta_k \frac{\Delta K_t}{K_t} - \delta_l \frac{\Delta L_t}{L_t} \quad (5\text{-}1)$$

Growth of all human capital (gross enrolment ration secondary school and higher life expectancy),trade (imports and exports), manufacturing, high technology, foreign direct investment, total government spending, oil revenue, migration ratio, and inflation are used as determinants of TFP in this Model according to:

$$TFP_i = \gamma_{0i} + \gamma_{1i} manufim_i + \gamma_{2i} govgdp_i + \gamma_{3i} highex_i + \gamma_{4i} edp_i + \gamma_{5i} trad_i + \gamma_{6i} infl_i + \gamma_{7i} fdi_i + \gamma_{8i} life_i + \gamma_{9i} oilrev_i + \gamma_{10i} migrant_i + \mu_i \quad (5\text{-}2)$$

5.1. Data sources

Data on GDP, capital stock, and the labor force are from the yearbook published by Department of Statistics in each of the AGCC countries, the World Bank (2015), and the Penn World Tables (Feenstra et al., 2015).

The data on enrolments in secondary school is from the Ministry of Education in each of the AGCC countries, the World Bank, and Penn World Tables. Life expectancy data is from the World Bank. The remaining dataset: trade (exports and imports (percent of GDP)), manufactured exports (percent of goods exports), high technology exports (percent of goods exports), foreign direct investment (percent of GDP), general government final consumption (percent of GDP), oil revenues (percent of GDP), inflation (GDP deflator (annual percent)), and migrants (percent of population)are provided by the World Bank (2015) and Departments of Statistics in each of the AGCC and Jordan (2015).

5.2 Explanation and sources of data

This study uses information on real GDP and real non-oil GDP. Real GDP is used as a useful measure of the total amount of production in the AGCC countries' economies. But for some countries, oil production represents very large share of GDP. So, when the focus is on the private sector, this study should take real non-oil GDP into consideration. This study will use all GDP measure to find the time series of TFP growth. Total GDP is the sum of gross value added by all resident producers in economy plus any product taxes and minus both oil revenues and any subsides not included in the value of productions. Gross fixed capital formation at constant prices includes land improvements, machinery, equipment purchases, and construction that includes roads, railways, schools, hospital, and industrial buildings. Table5.1 and 5.2 shows the definition of variables and sources for the data.

Time series of investment, consumption, and trade are provided in constant national prices. General government final consumption expenditure includes all government current expenditures for purchases of goods and services. FDI refers to direct investment equity flows in the economy and it is the sum of equity capital, reinvestment of earnings, and other capital. Inflation measures the ratio of GDP in current local currency to GDP in constant local currency. Trade is the sum of exports and imports of goods and services measured as a share of GDP. High-technology exports are products with high research and development (R&D) intensity. Finally, secondary school enrollment means the total number of students enrolled in general programs at public and private secondary education institutions.

Table 5.1 AGCC countries and Jordan: definition of variables: 1990-2014

Variables	Definition
GDP	It is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. **It is measured as growth in this study.**
Labor force	It includes people ages 15 and older who meet the International labor Organization definition of the economically active population: all people who supply labor for the production of goods and services during a specified period. It includes both the employed and the unemployed. While national practices vary in the treatment of such groups as the armed forces and seasonal or part-time workers, in general the labor force includes the armed forces, the unemployed, and first-time job seekers, but excludes homemakers and other unpaid caregivers and workers in the informal sector. **It is measured as growth in this study.**
Physical capital	It includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. **It is measured as growth in this study.**
Inflation rate	It means the consumer price index that reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services yearly.
Immigrant percentage	It means the number of people who born in other country than that in which they live and It also includes refugees. The data used to estimate the international migrant stock at a particular time are obtained mainly from population censuses. **It is measured as percentage of total population.**
Education (enrolment rate)	It means the total enrollment in secondary education, regardless of age, **expressed as a percentage of the population of official secondary education age**. This percentage can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition.
Oil revenue share	It is the difference between the value of crude oil production at world prices and total costs of production. **Oil revenue is accounted as percentage of GDP**.
Trade openness share	It is the sum of exports and imports of goods and services. **Trade openness is measured as percentage of GDP**.
Life expectancy at birth	**It means the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth** were to stay the same during its life.
Government spending share	It means the governmental final expenditure that includes all government current expenditures for purchases of goods and services and expenditures on national defense and security. **Government spending is accounted as percentage of GDP**.
High technology share	It means products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery. **High technology is accounted as percentage of GDP.**
Manufacturing share	It means the net output of industrial sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. **Manufacturing is measured as percentage of GDP.**
Foreign direct investment share	It means capital flows from one country to another, granting extensive ownership stakes in domestic companies and assets. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital .**FDI is accounted as percentage of GDP.**

Table 5.2 AGCC countries and Jordan: Descriptive Statistic: 1990-2014

Variables	Source
Real GDP, Capital, Total labor force	World Bank (2015), Penn World Table (Feenstra et al., 2015), Department of Statistics in each of the AGCC (2015).
Non-oil GDP, non-oil K, non-oil L	Non-oil GDP=Total GDP- Oil GDP (oil GDP= oil GDP/DGP) *total GDP) Non-oil capital=total capital-oil capital (oil capital =(oil capital/GDP)*oil GDP) Non-oil L=Total labor –oil labor in energy sector, oil Labor=(oil Labor/total GDP)*total Labor World Bank (2015) and Ministry of Labor in each country of AGCC and Jordan (2015).
Enrolments in secondary school	Ministry of Education in each of the AGCC countries, the World Bank (2015), and Penn World Table (Feenstra et al., 2015).
Life expectancy	World Bank (2015)
Trade openness, manufactured, high technology, foreign direct investment, government spending, oil revenue, migrant percentage, inflation percentage	World Bank (2015) and Ministry of Financial in each country of AGCC and Jordan (2015).

5.3. Data description

5.3.1 Saudi Arabia

Table 5.3 presents the growth of GDP, capital stock, and labor force in the period 1990-2014 in both measures of GDP. GDP growth varied from a minimum growth of -0.7 percent in 1999 to a maximum growth of 10 percent in 2011. Capital stock growth varied from a minimum of 1 percent in 1994to a maximum of 7 percent in 2007. Labor growth shows less fluctuation. This table reveals significant fluctuation in growth rate of capital, labor and output over the period in oil GDP measure. Using standard deviation as a measure of volatility, labor growth continued to have one of the highest measures of volatility by 9 percent.

Figure 5.1, 5.2, and 5.3 show the trend in growth of output, capital and labor over this period in both measures. A quick analysis of the figure show the significant volatility in the oil GDP growth, oil labor growth, and oil capital growth in figure 5.2.

The improvement in GDP growth by 9 percent in 2011 is not only depicted by capital growth, but also by labor and other factors that includes in TFP growth. However, in the non-oil GDP measure, the paths of economic growth and capital are closer. The argument is that factor inputs (capital and labor) cannot always explain the changes in output growth. It looks that TFP growth may play an important role in driving economic growth in addition to the contribution of capital and labor. It is obvious that TFP growth may play an important in explaining economic growth in the measure of total GDP.

Table 5.3 Saudi Arabia: Descriptive Statistic: 1990-2014

Stat.	GDP growth	Capital growth	Labor growth
Total GDP			
Mean	4.358585	4.002052	3.514918
Std.	3.288287	2.40666	1.797694
Max.	9.958933	7.79257	8.270391
Min.	-.7484921	1.03098	-.3014768
Oil GDP			
Mean	2.290907	1.50527	3.666499
Std.	4.160832	4.856134	8.343065
Max.	12.16195	9.4729	21.2117
Min.	-8.01555	-6.72331	-23.48794
Non-oil GDP			
Mean	7.970938	3.745452	3.605023
Std.	2.684462	3.461528	2.509695
Max.	13.18746	10.32376	10.11442
Min.	4.123457	-1.858565	-.6271709

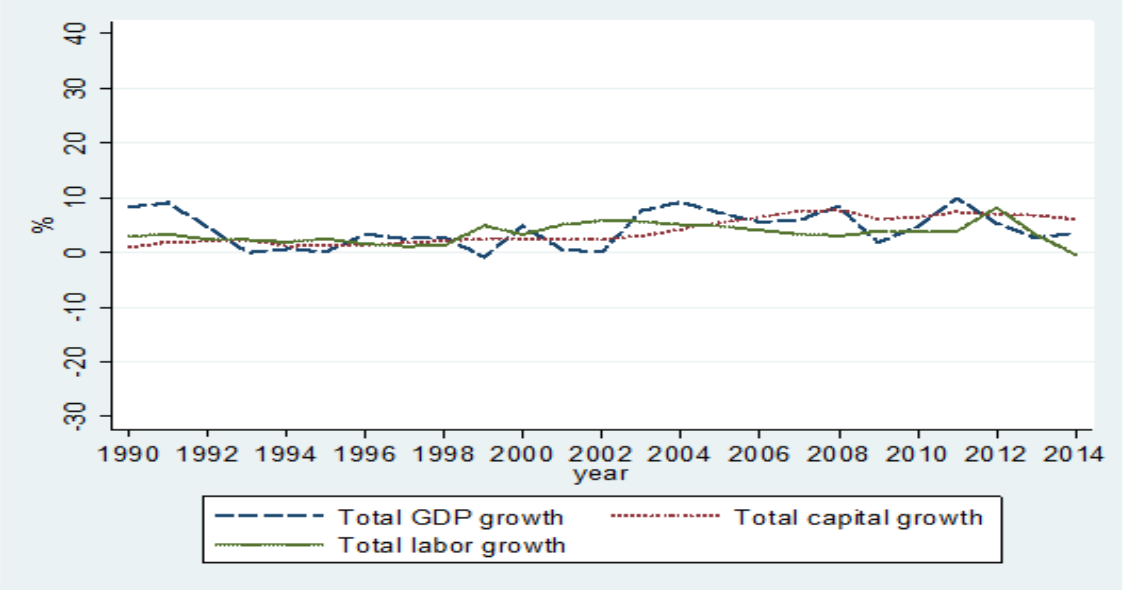

Figure 5.1 Saudi Arabia: total GDP growth, total capital growth, and total labor growth

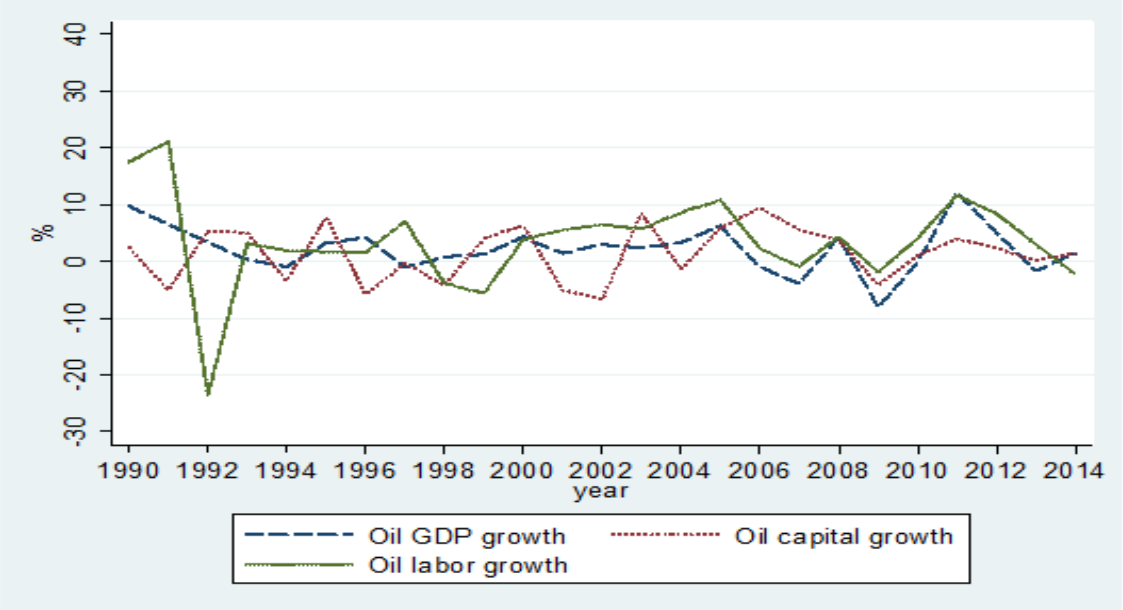

Figure 5.2 Saudi Arabia: Oil GDP growth, oil capital growth, and oil labor growth

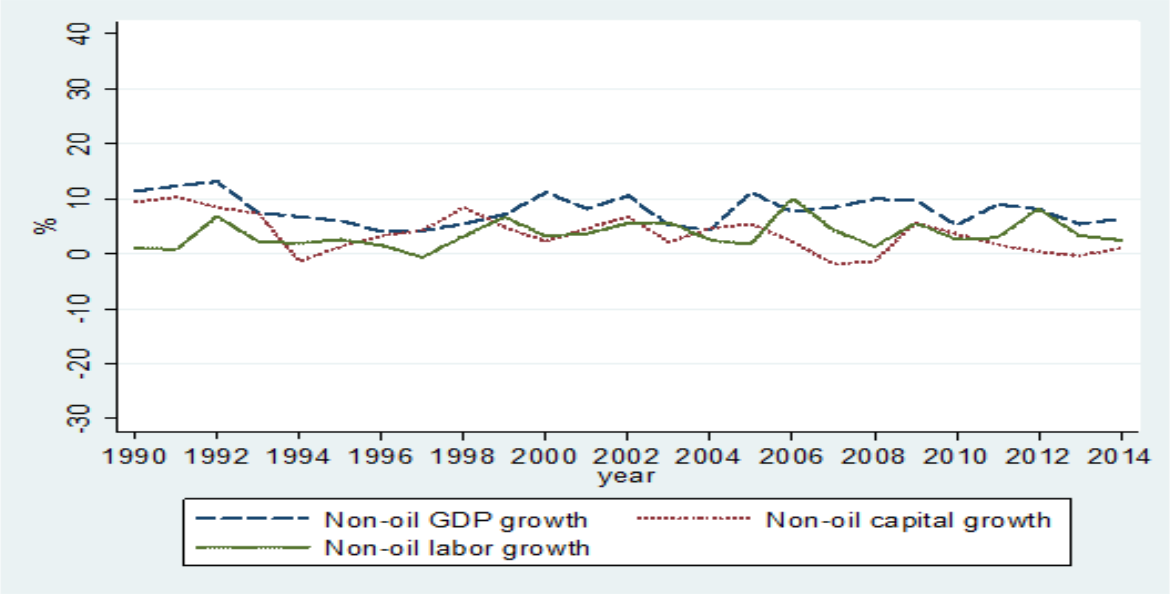

Figure 5.3 Saudi Arabia: Non-oil GDP growth, non-oil capital growth, and non-oil labor growth

5.3.2 Kuwait

Table 5.4 shows the growth of GDP, capital stock, and labor force in both GDP measures for Kuwait in the period 1990-2014. In total GDP measure, GDP growth varied from maximum growth of 33 percent in 1993to minimum growth of -7 percent in 2009 and capital stock growth varied from maximum of 12 in 2008 to minimum of 0.14 percent in 1990.Oil GDP growth, oil capital growth, and oil labor were more fluctuation than non-oil GDP measure. Oil labor force growth and oil capital growth were more fluctuation. This table reveals significant fluctuation in growth rate of oil capital and oil labor, and output over the period. Using standard deviation as a measure of volatility, oil capital growth and oil labor continues to have one of the highest measures of volatility by 4 percent and 3 percent respectively in measures of oil GDP.

Table 5.4 Kuwait: Descriptive Statistic: 1990-2014

Stat.	GDP growth	Capital growth	Labor growth
Total GDP			
Mean	6.414362	4.555	3.811053
Std.	8.499429	3.465138	2.857865
Max.	33.99047	12.5373	7.620104
Min.	-7.076103	.1402535	-1.804606
Oil GDP			
Mean	5.40886	5.502374	3.463537
Std.	7.295696	4.695772	3.663691
Max.	20.61276	15.2652	10.39882
Min.	-9.54015	-1.834457	-1.706427
Non-oil GDP			
Mean	2.76292	4.163449	3.852061
Std.	10.96776	3.436222	2.920086
Max.	13.84963	12.32451	7.670282
Min.	.3218765	.3218765	-1.815516

Figures 5.4, 5.5 and 5.6 show the trend in growth of output, capital and labor over this period. In measure of oil GDP, the change in oil GDP growth in the period 1992- 2005 is depicted along with the growth of oil capital stock and kind of labor force. These changes are not reflected closely in the change in total GDP growth. The argument is that factor inputs (capital and labor) cannot always explain the changes in output growth. It looks that residual (TFP) growth may measure the changes in economic growth that cannot be explained by changes in capital and labor inputs directly. The others factors of determinants of TFP growth may measure the efficiency of labor and capital indirectly.

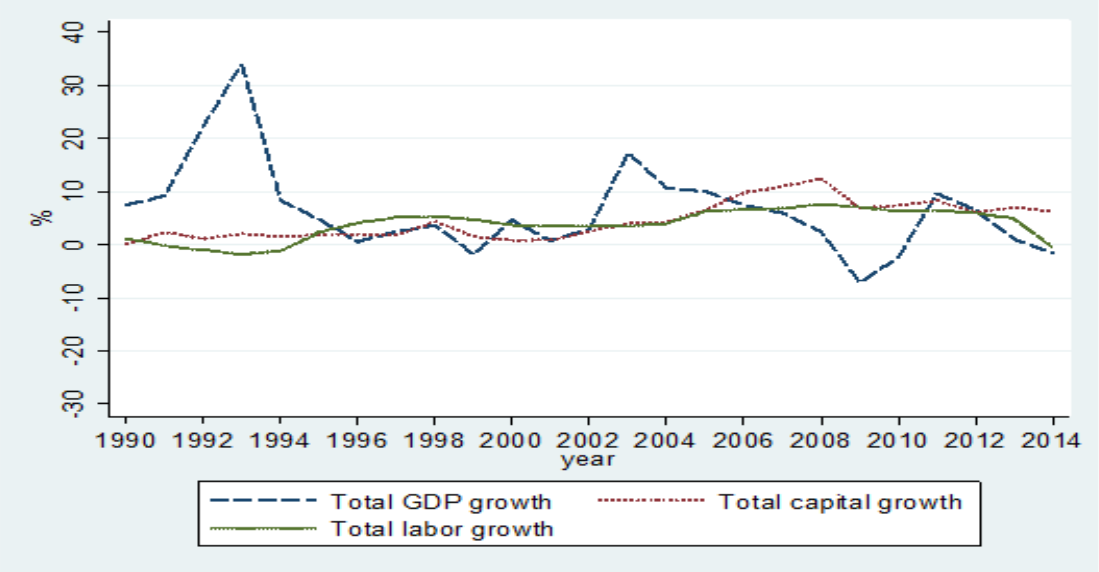

Figure 5.4 Kuwait: Total GDP, total capital, and total labor growth

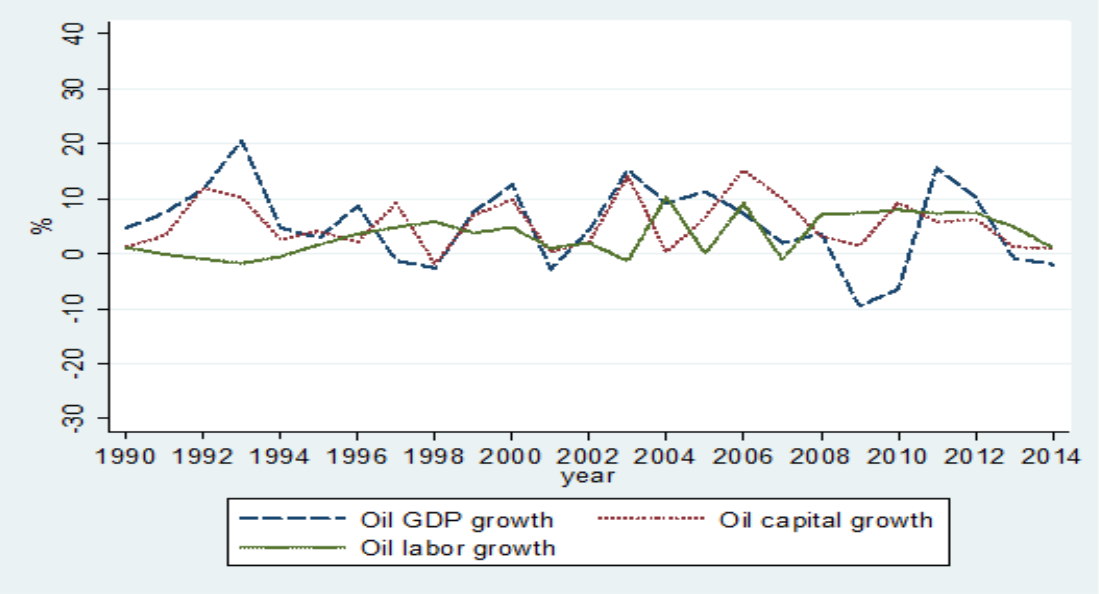

Figure 5.5 Kuwait: Oil real GDP, oil capital, and oil labor growth

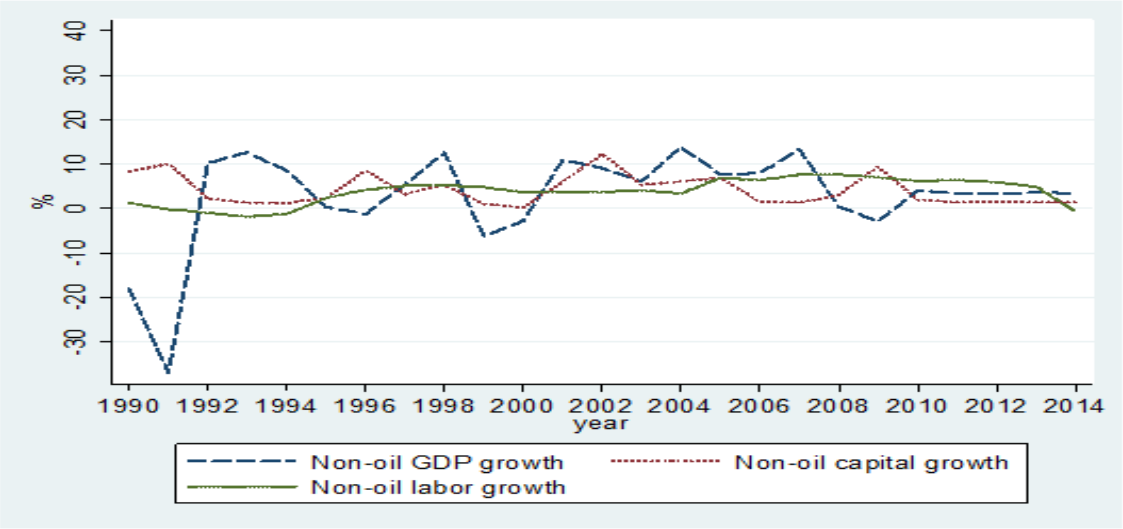

Figure 5.6 Kuwait: Non-oil GDP, non-oil capital, and non-oil labor growth

5.2.3 Bahrain

Table 5.5 reveals significant fluctuations in the growth of capital for total GDP and non-oil GDP measures in the period 1990-2014. Using standard deviation as a measure of volatility, oil GDP growth and non-oil capital have one of the highest measures of volatility by 12 percent and 4.8 percent, respectively. Oil GDP growth rate varied from the lowest growth of -19 percent in 1998 to the highest growth of 43 percent in 2000.

Table 5.5 Bahrain: Descriptive Statistic: 1990-2014

Stat.	GDP growth	Capital growth	Labor growth
Total GDP			
Mean	5.193724	4.807421	5.20304
Std.	2.775974	2.46932	3.866921
Max.	12.87001	11.9236	13.54089
Min.	-.2500015	2.046205	.0386783
Oil GDP			
Mean	2.602862	2.119359	1.956579
Std.	8.706126	2.715042	2.400146
Max.	16.10919	9.654325	9.209803
Min.	-10.19775	-1.432673	-1.094934
Non-oil GDP			
Mean	6.168721	4.180413	5.375454
Std.	4.666723	4.867024	4.063236
Max.	12.97417	16.54379	14.24728
Min.	-2.771471	-2.435678	.0371697

Figures 5.7, 5.8, and 5.9 show the difference in the path of GDP growth, capital stock and labor growth over the period 1990-2014.The fluctuation in oil GDP growth reflects the inefficiency in using inputs to make the growth sustainable and this implies that growth in capital has been largely inefficient. So, It looks that residual (TFP) growth may explain the changes in economic growth that cannot be explained by changes in capital and labor inputs directly in both measures of GDP.

Figure 5.7 Bahrain: total GDP growth, total capital, and total labor growth

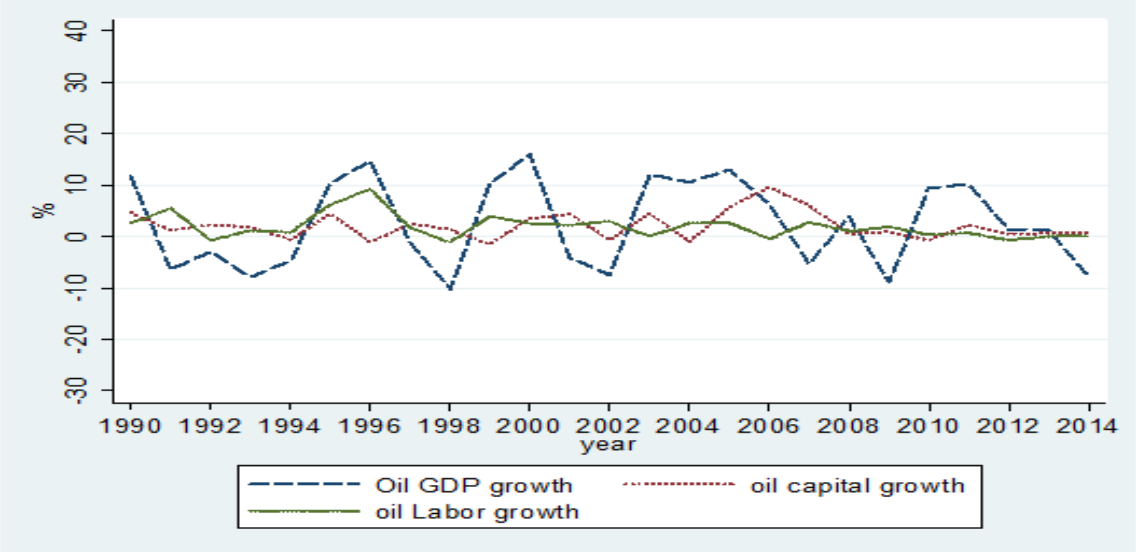

Figure 5.8 Bahrain: Oil GDP growth, oil capital growth, and oil labor growth

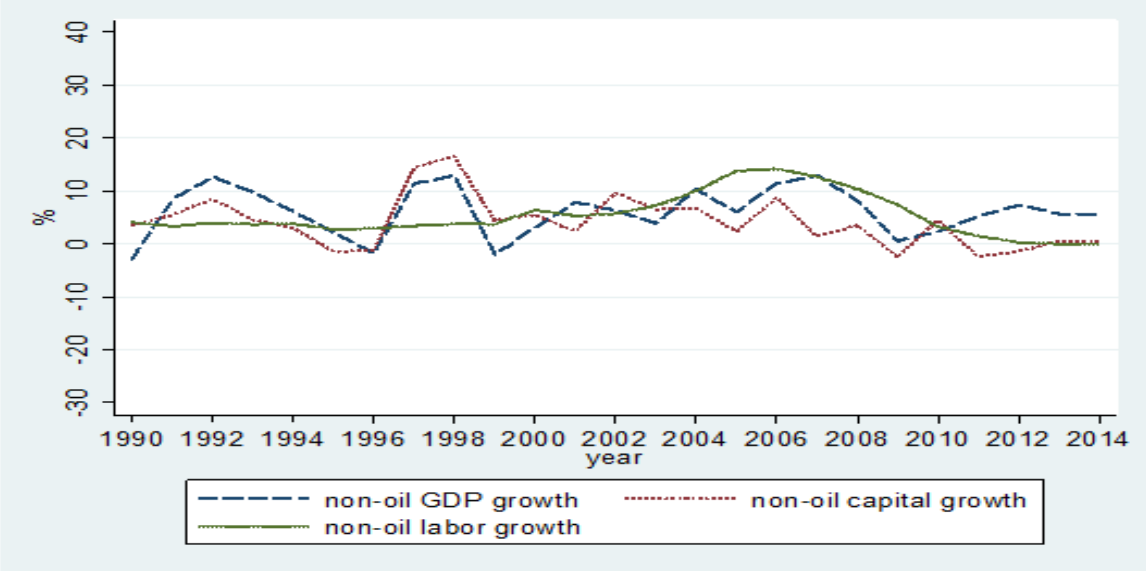

Figure 5.9 Bahrain: Non-oil GDP growth, non-oil capital growth, and non-oil labor growth

5.2.4 Qatar

Table 5.6 reveals significant variation in the growth rate of all variables and for both measures of GDP over the period covered by this study. Using standard deviation as a measure of volatility, non-oil GDP growth and non-oil labor growth continued to have a one of the highest measures of volatility in the period 1990-2014. Non-oil GDP growth varied from the lowest growth of -20 percent in 2000 to the highest growth of 55 percent in 2006. This fluctuation refers to the changes in gas price that discovered in 1990s. Total capital growth continued to have the highest measures of volatility. Its growth varied from the lowest of 0.13 percent in 1993 to the highest growth of 32 percent in 2007. This fluctuation refers to the investment in the infrastructure.

Table 5.6 Qatar: Descriptive Statistic: 1990-2014

Stat.	GDP growth	Capital growth	Labor growth
Total GDP			
Mean	9.489796	10.45168	7.710436
Std.	6.620239	8.381446	8.146098
Max.	26.17025	32.9758	27.34613
Min.	1.418708	.1374765	.815144
Oil GDP			
Mean	9.712219	3.214488	5.642736
Std.	10.68128	3.423419	6.886016
Max.	28.49361	11.43528	24.56958
Min.	-8.876729	-2.725643	-.8008443
Non-oil GDP			
Mean	7.495983	8.711114	7.892919
Std.	12.72727	6.963144	8.46262
Max.	27.64098	20.45198	28.33496
Min.	-15.32912	-7.632213	.7760567

Figures 5.10, 5.11, and 5.12 represent that the path of GDP growth followed the path of capital stock and labor growth, especially in the period 2000-2014. The improvement in GDP growth by 23 percent in 1997 is depicted with growth of 23 percent in capital stock and growth of 1.2 percent in labor. However, the movement of GDP growth and capital and labor are not exactly identical in the remaining of the period 1990-2014. So, output growth is less sensitive to capital growth and labor growth in the period in both measures. It implies that increased or decreased output growth is due to something else instead of capital and labor growth. Consequently, changes in output growth might be due to changes in total factor productivity (TFP) growth.

Figure 5.10 Qatar: Total GDP, total capital, and total labor growth

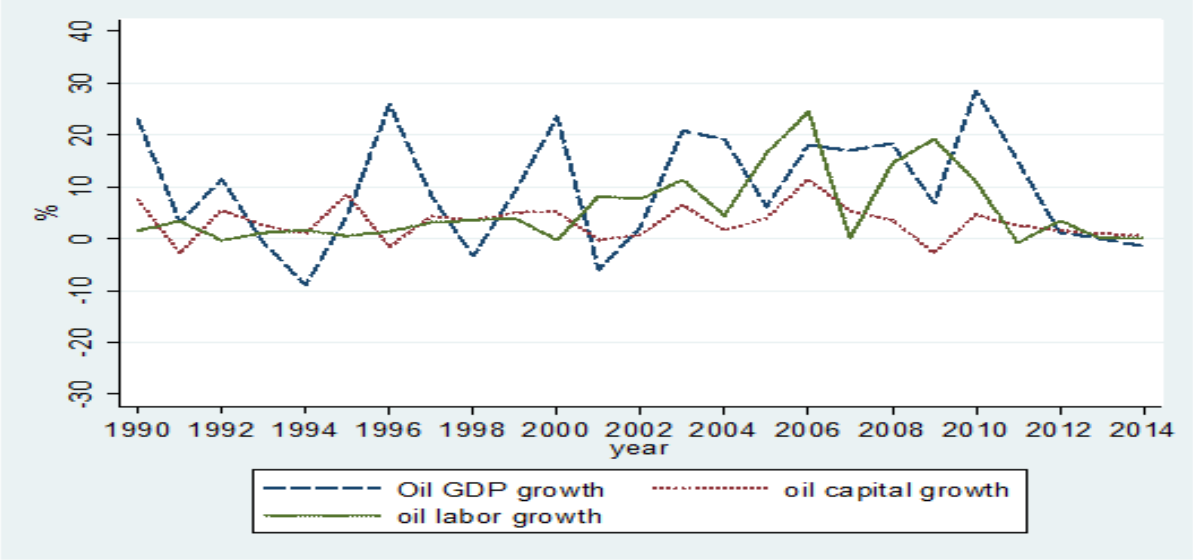

Figure 5.11 Qatar: Oil GDP, oil capital, and oil labor growth

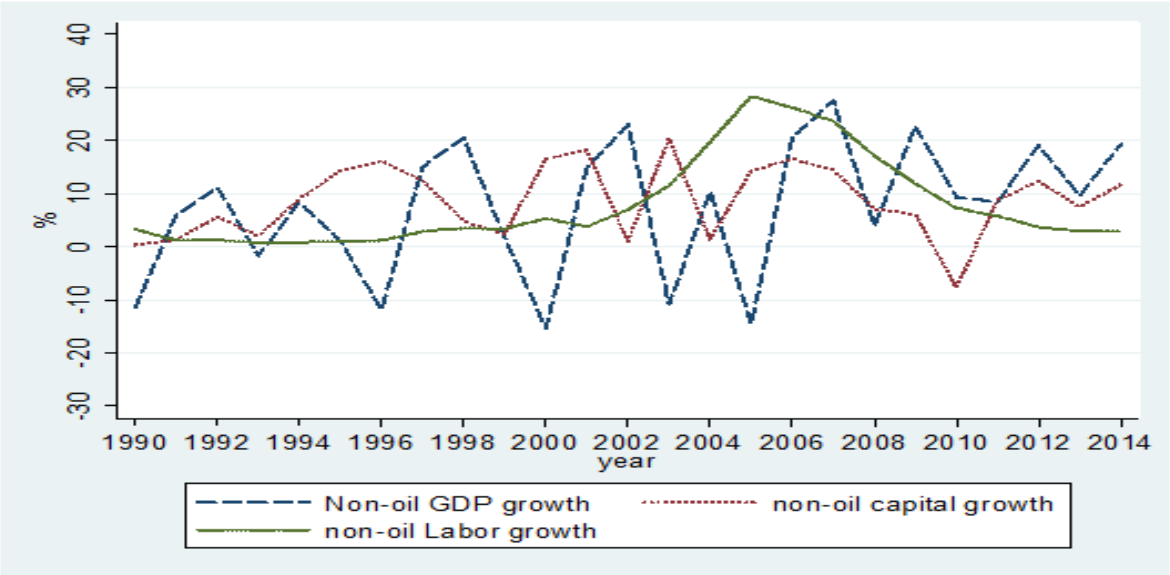

Figure 5.12 Qatar: Non-oil GDP, non-oil capital, and non-oil labor growth

5.2.5 United Arab Emirates

Table 5.7 reveals significant variations in the growth rate of all the variables, especially for oil GDP growth as result to conversion of relying on oil revenue to real production. Using standard deviation as a measure of volatility, oil GDP growth had a one of the highest measures of volatility in this period. Its growth rate varied from the highest of 14 percent in 1990 to the lowest growth of -12 percent in 1993. This fluctuation influences the conversion to non-oil production that grew by 5 percent in the period 1990-2014.

Figures 5.13, 5.14, and 5.15 show the trend in the growth of economic growth, capital growth and labor growth for both measures of GDP over the period 1990-2014. Figure 5.14 shows volatility of these variables, labor growth and capital growth move together in explaining the changes in oil GDP growth. The volatility in labor growth explains the change in output growth. Standard deviation in labor growth by 6 percent reflects the volatility in output growth by 7 percent in this period. However, the low growth in GDP reflects the fluctuation in price of oil through 1990s and the conversion of relying on oil revenue to relying on trade and production in the UAE.

Also, these changes in output growth do not reflect changes in inputs growth only but it implies that changes in output growth are due to something else other than capital and labor growth. Consequently, changes in output growth might be measured by total factor productivity (TFP) growth that cannot be explained by increases in labor and capital inputs.

Table 5.7 UAE: Descriptive Statistic: 1990-2014

Stat.	GDP growth	Capital growth	Labor growth
Total GDP			
Mean	5.042709	8.073596	8.180044
Std.	4.540904	5.368072	4.746193
Max.	18.32799	21.08524	18.22893
Min.	-5.242922	1.815705	1.127655
Oil GDP			
Mean	1.960445	2.735169	6.397724
Std.	7.497574	3.609064	6.339824
Max.	14.81552	10.65435	19.69856
Min.	-12.97119	-2.435678	-2.819263
Non-oil GDP			
Mean	5.289463	4.015778	8.197726
Std.	4.330157	3.551077	4.759925
Max.	11.73838	10.98051	18.41251
Min.	-3.512877	-3.64234	1.140453

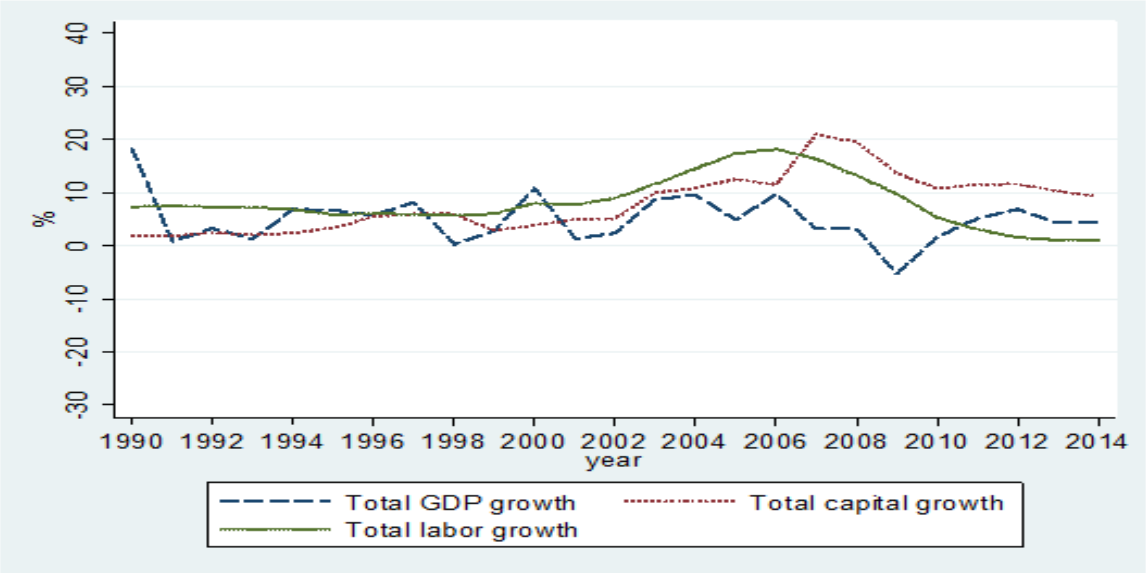

Figure 5.13 UAE: Total GDP growth, total capital growth, and total labor growth

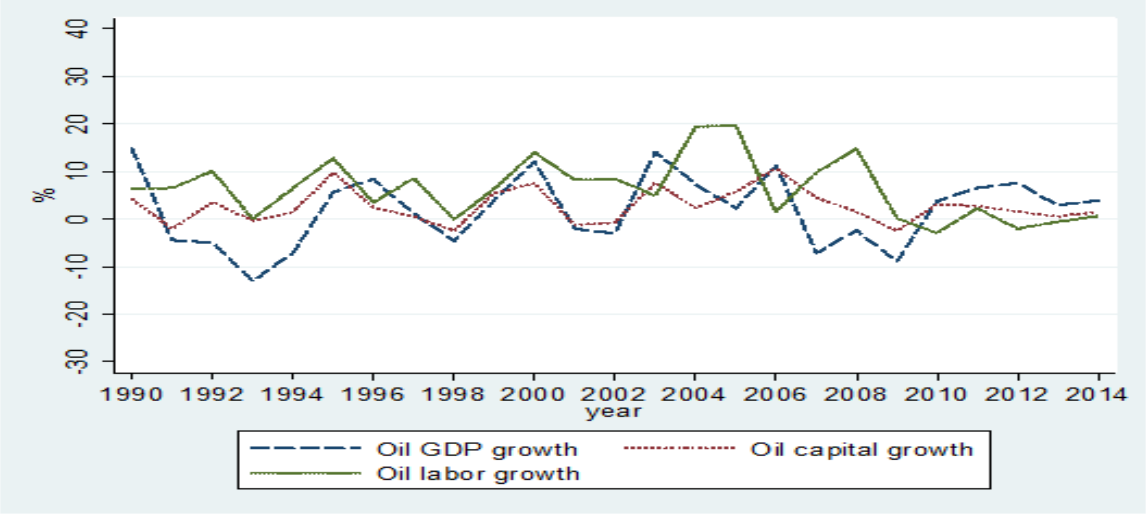

Figure 5.14 UAE: Oil GDP growth, oil capital growth, and oil labor growth

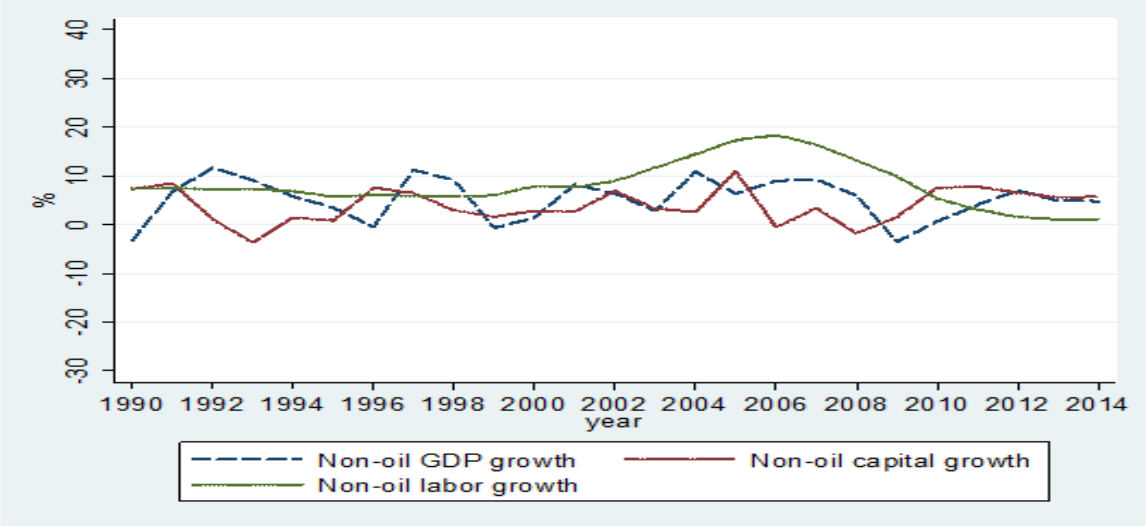

Figure 5.15 UAE: Non-oil GDP growth, non-oil capital growth, and non-oil labor growth

5.2.6 Oman

Table 5.8 presents the growth of GDP, capital stock, and labor force for Oman in the period 1990-2014 in both GDP measures. The most fluctuation in total GDP growth is the oil GDP measure. Oil capital growth varied from the highest of highest of 12 percent in 2007 to the lowest growth of 2 percent in 1991 and oil labor growth varied from 17 percent in 2011 to the lowest growth of -1 percent in 1999. This fluctuation implied to fluctuation in oil GDP growth by 6.5

percent that it does not lead to increase in the oil GDP growth. The economic growth in Oman comes from the growth in the non-oil growth that has change in sector of real production instead of oil production. Oman has a little of oil reserves, so it seeks to reduce dependence upon gradually like Bahrain.

Figures 5.16, 5.17, and 5.18 show the difference among growth in three measures. Most growth comes from non-oil sector. Non-oil GDP grew by 7 percent during the period 1990-2014. This growth comes from the growth in non-oil labor growth by 6 percent. Thus, GDP growth is less sensitive to capital growth and more sensitive to labor. However, this path of non-oil labor does not reflect the path of non-oil GDP growth in figure 5.18, so it implies that changes in output growth are due to something else other than capital and labor growth. Consequently, changes in output growth might be due to changes in total factor productivity (TFP) growth.

Table 5.8 Oman: Descriptive Statistic: 1990-2014

Stat.	GDP growth	Capital growth	Labor growth
Total GDP			
Mean	3.700133	5.695514	6.33849
Std.	2.968251	2.855908	5.124767
Max.	8.413883	12.48201	16.19463
Min.	-2.668969	2.217274	-1.299044
Oil GDP			
Mean	1.455692	3.156453	6.315588
Std.	6.547949	5.031403	5.242148
Max.	14.62014	12.21774	17.3248
Min.	-11.97251	-4.63624	-1.309141
Non-oil GDP			
Mean	7.04798	1.301164	6.349063
Std.	5.430133	1.927406	5.140597
Max.	16.69303	3.87653	16.09815
Min.	-3.509408	-2.6543	-1.378149

Figure 5.16 Oman: Total GDP growth, total capital growth, and total labor growth

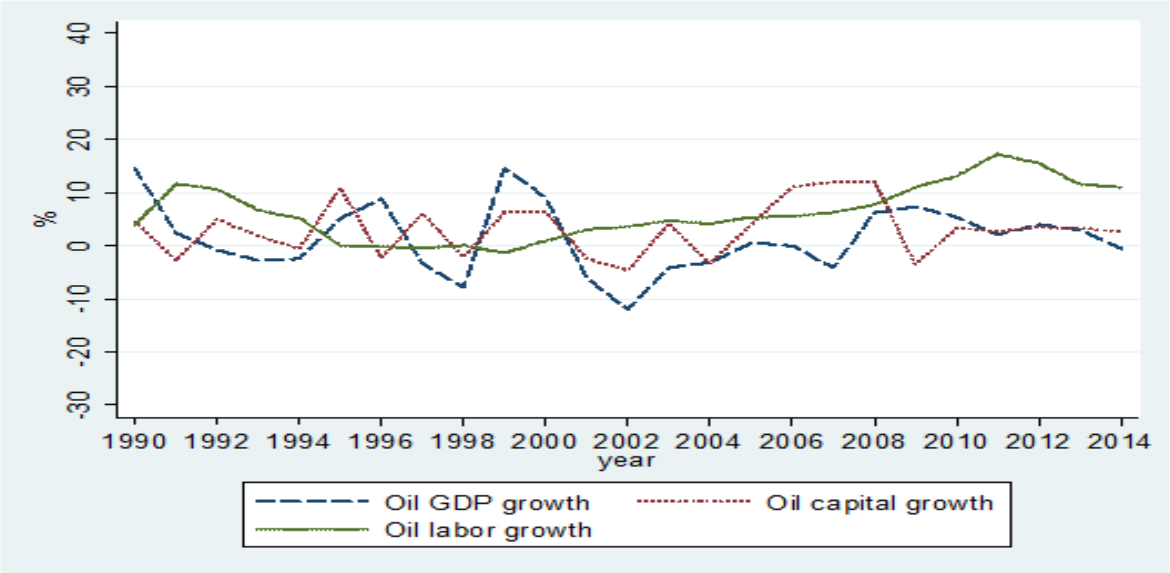

Figure 5.17 Oman: Oil GDP growth, oil capital growth, and oil labor growth

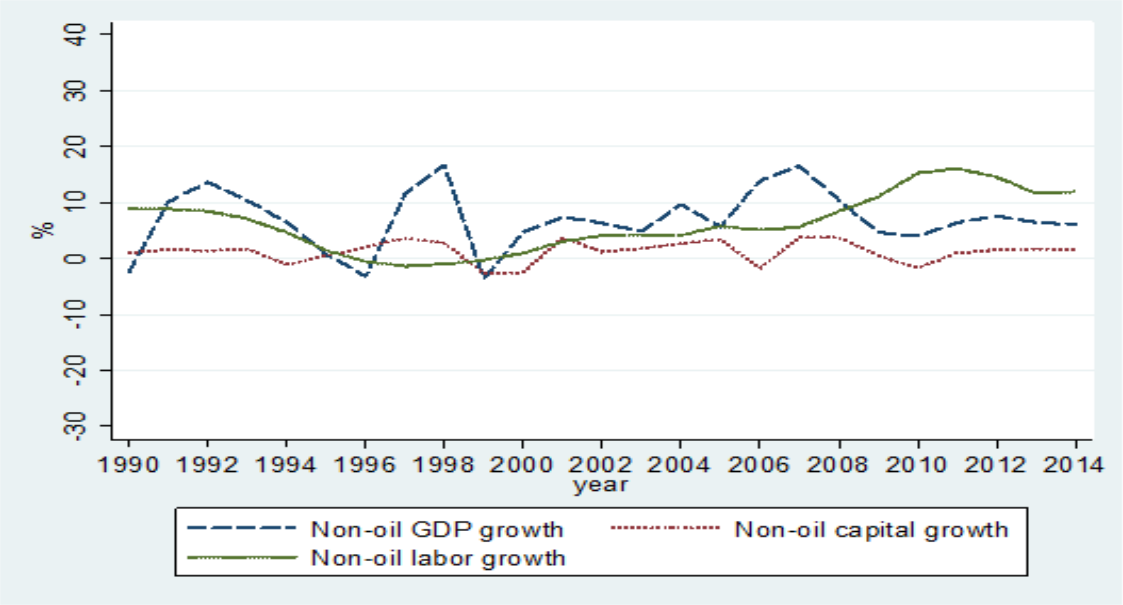

Figure 5.18 Oman: Non-oil GDP growth, non-oil capital growth, and non-oil labor growth

5.2.7 Jordan

Table 5.9 presents the growth of total GDP, total capital stock, and total labor force for Jordan in the period 1990-2014. Capital growth is the lowest growth among the AGCC countries. It varied from the highest of 7 percent in 1993 to the lowest growth of 2percent in 2001. While labor growth was the lowest growth after Kuwait in this period. The fluctuation in economic growth was lower than the average in the AGCC countries by 3.58 percent and the total GDP growth grew by 5 percent that was close to the average growth in the AGCC countries.

Table 5.9: Jordan: Descriptive Statistic: 1990-2014

Stat.	GDP growth	Capital growth	Labor growth
Total GDP			
Mean	5.107685	4.525475	4.657007
Std.	3.587505	1.540826	3.049177
Max.	18.67244	7.047951	10.9275
Min.	.9737565	2.121247	.9663928

Figure 5.19 shows that the fluctuation in capital growth and labor growth is close to the change in output growth. The path of total GDP growth follows the path of total capital growth

and total labor growth. It implies that the efficiency in using capital and labor can explain the growth of GDP in Jordan than in the AGCC countries. Thus, GDP growth is more sensitive to capital growth and labor growth than can be explained by determinants of TFP growth that will study in the next chapters.

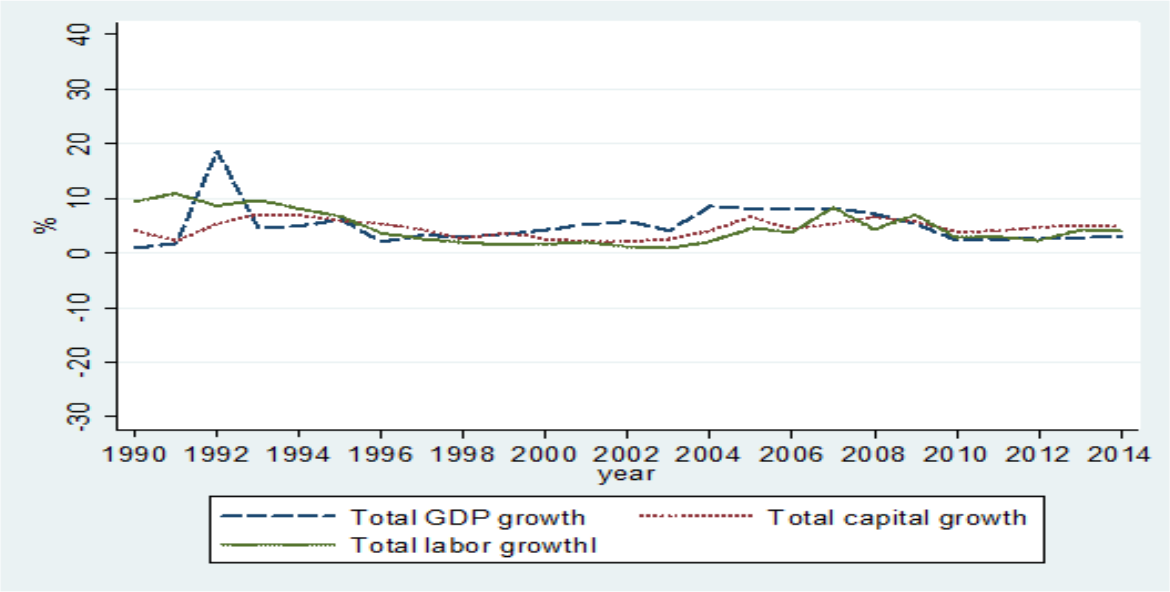

Figure 5.19 Jordan: Total GDP, total capital, and total labor growth

5.3 Summary

Table 5.10 summarizes the growth of capital stock, labor force, and GDP in the AGCC countries and Jordan over the period 1990-2014. Qatar is the highest in output growth and capital growth among these countries and UAE is the highest in growth of labor in this period. However, Saudi Arabia is the lowest in economic growth, capital growth, and labor growth among these countries. Bahrain is more stable than the rest of the AGCC countries and Jordan in economic growth in this period. However, Jordan was more stable in economic growth and capital growth than the AGCC countries on average. Jordan's growth does not seem better than AGCC countries

that depend on oil in this period. The oil revenues may make AGCC countries more productive than Jordan because it depends on subsidies from the developed countries.

Table 5.10 AGCC countries: Average growth: 1990-2014

Country	GDP growth	Capital growth	Labor growth
Total GDP			
Saudi Arabia	4.358585	4.002052	3.514918
Kuwait	6.414362	4.555	3.811053
Bahrain	5.193724	4.807421	5.20304
Qatar	9.489796	10.45168	7.710436
UAE	5.042709	8.073596	8.180044
Oman	3.700133	5.695514	6.33849
Jordan	5.107685	4.525475	4.657007

The conclusion from the above discussion is that capital and labor are complementary to explain growth in GDP over the period 1990-2014, but they do not correlate exactly with the growth of the economy. The graphs (5.1, 5.4, 5.7, 5.10, 5.13, 5.16, 5.19) show that total capital growth and total labor growth seem not to be the only controlling factors in leading total GDP growth in these countries. Using standard deviation as a measure of volatility in tables (5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8), Kuwait and Qatar have a high standard deviation in total output growth over the period of 8.4 percent and 6.6 percent per year, respectively. Bahrain and Oman have a low standard deviation of 2.7 percent and 2.9 percent per year, respectively. Comparing these countries with: USA that grows by 2.4 percent with a standard deviation of only 1.7 percent on average; with India that grows by 6.4 percent with standard deviation only of 2.1 percent; and with China that grows by 9.8 percent with standard deviation of 2.4 percent only. This implies that fluctuations in the total output growth path are due to the inefficiency of labor growth and capital growth if they are employed only to generate growth in these countries. The efficiency of labor growth and capital growth means an improvement in total factor productivity (TFP) growth if it is used in the production process. So, sustained economic growth in these countries can be achieved through a sustained growth in TFP rather than increases in capital and labor.

In general, although there has been a large increase in the growth of both capital and labor, especially in the public sector, growth of output actually is unsustainable and disappointing in the AGCC countries in this period. So, the failure in the region to achieve sustainable growth may be the result of a lack of focus of the labor market on increasing private sector activity rather than government activity. The reasoning of course, is to create an environment in which private sector could develop and become an engine for higher and sustainable output growth, crucial for the absorption of new workers. Unstable growth, which results in fluctuating growth of capital and labor in the AGCC countries, gives the impression that TFP growth may have contributed negatively to GDP growth. This study will explore this idea further in the next chapter.

CHAPTER SIX: RESULTS AND ANALYSIS

6.1 The effect of TFP growth on economic growth in each country:

Using growth accounting from equation (4-8)[5], this study accounts for total factor productivity (TFP) growth for both measures of GDP for each country of the AGCC countries and Jordan.

This study addresses the following research question: What is the difference among the six countries and Jordan in the effect of TFP growth on economic growth?

Hypothesis:

H_0: TFP growth accounts for a smaller share of economic growth than the accumulation of capital and labor contribution for each of the AGCC countries and Jordan and for pooled AGCC countries with Jordan or without Jordan.

H_1: TFP growth accounts an equal or larger share of economic growth than the accumulation of capital and labor contribution for each of the AGCC countries and Jordan and for pooled AGCC countries with Jordan or without Jordan.

6.1.1 Saudi Arabia

Table 6.1 presents the contribution of all the variables to output growth over the period 1990-2014 for all measures. For all GDP measures, labor and capital accumulation contribute to output growth more than TFP growth over this period. It is obvious that oil TFP growth accounts for -30 percent of oil GDP growth while non-oil TFP growth accounts for 54 percent of non-oil GDP growth over the period 1990-2014. This implies that non-oil TFP growth plays an important role in explaining total output growth. So, non-oil capital and non-oil labor are more efficient than

[5] $\frac{\Delta A_t}{A_t} = \frac{\Delta Y_t}{Y_t} - \delta_k \frac{\Delta K_t}{K_t} - \delta_l \frac{\Delta L_t}{L_t}$, that I found it in chapter 4

oil capital and oil labor in explaining output growth. Non-oil labor and non-oil capital contribute to non-oil GDP growth by 31 percent and 14 percent, respectively, while non-oil TFP growth contributes by 54 percent to non-oil GDP growth. Because of the strong negative effect of oil TFP growth, the contribution of total TFP growth is 15 percent on average. So, non-oil TFP plays an important in explaining output growth. The result of TFP growth accepts the null hypothesis that the TFP growth accounts for a smaller share of economic growth than the accumulation of capital and labor in the case of oil GDP and total GDP measures in Saudi Arabia.

Table 6.1 Growth Accounting for Saudi Arabia: 1990-2014

Variables	Oil GDP		Non-oil GDP		Total GDP	
	Annual average	Contribution to GDP growth	Annual average	Contribution to GDP growth	Annual average	Contribution to GDP growth
Capital stock	$\delta_k \frac{\Delta K_t}{K_t} =$ 0.472475	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.2062396	$\delta_k \frac{\Delta K_t}{K_t} =$ 1.175627	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.14748916	$\delta_k \frac{\Delta K_t}{K_t} =$ 1.256169	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.28820569
Labor force	$\delta_l \frac{\Delta L_t}{L_t} =$ 2.51565	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 1.0981039	$\delta_l \frac{\Delta L_t}{L_t} =$ 2.47347	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 0.3103116	$\delta_l \frac{\Delta L_t}{L_t} =$ 2.411652	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 0.55331076
TFP growth	$\frac{\Delta A_t}{A_t} =$ -0.69722	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ -0.304343	$\frac{\Delta A_t}{A_t} =$ 4.32183	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ 0.5421993	$\frac{\Delta A_t}{A_t} =$ 0.690764	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ 0.1584836
GDP growth	$\frac{\Delta Y_t}{Y_t} =$ 2.2909		$\frac{\Delta Y_t}{Y_t} =$ 7.9709		$\frac{\Delta Y_t}{Y_t} =$ 4.35858	

Capital and labor shares are calculated as simple average for whole period: δ_k =0.3138811, δ_l=0.6861189

Table 6.2 shows the relationship among the various sources of growth. The negative relationship between oil TFP growth and each of oil labor and oil capital supports the strong low in oil TFP growth. The table also shows a positive relationship between non-oil TFP growth and non-oil capital and between total TFP growth and total capital growth, and emphasizes the positive nature of non-oil TFP growth and total TPF growth, 54 percent and 15 percent, respectively. This finding confirms that capital is more efficient than labor in Saudi Arabia.

Figure 6.1 presents a graphical explanation of TFP and GDP growth during the 1990-2014. It is observed that total GDP growth and total TFP growth trend closely together. Non-oil TFP growth pulls total GDP growth up while oil TFP pulls total GDP growth down. Especially in 2011,

a 4.9 percent growth in total TFP growth was followed by a 9.9 percent higher growth of total GDP. In 1999, total TFP growth declined to –4.8 percent and it pulled total GDP growth down to -0.7 percent. This suggests that a time series of total TFP can explain the changes in total output growth over the period.

Table 6.2 Saudi Arabia: correlation Statistic: 1990-2014

Corr.	GDP growth	Capital growth	Labor growth	TFP growth
Oil GDP				
GDP growth	1.0000			
Capital growth	0.1347	1.0000		
Labor growth	0.4572	-0.1632	1.0000	
TFP growth	0.2621	-0.0058	-0.6999	1.0000
Non-oil GDP				
GDP growth	1.0000			
Capital growth	0.3623	1.0000		
Labor growth	0.1379	-0.0984	1.0000	
TFP growth	0.7451	0.0201	-0.4517	1.0000
Total GDP				
GDP growth	1.0000			
Capital growth	0.3893	1.0000		
Labor growth	0.1687	0.2618	1.0000	
TFP growth	0.8771	0.0636	-0.2759	1.0000

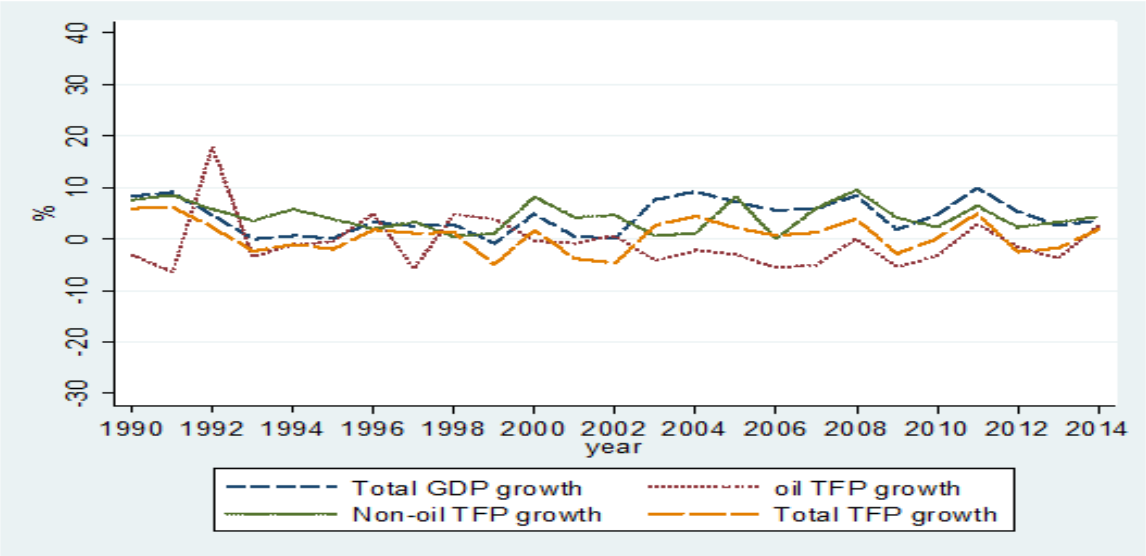

Figure 6.1 Saudi Arabia: Total GDP growth, oil TFP growth, non-oil TFP growth, and total TFP growth

6.1.2 Kuwait

Table 6.3 presents the contribution of all the variables to output growth over the period 1990-2014 for all GDP measures. For all measures of GDP, labor and capital accumulation contribute to output growth more than TFP growth over this period. Oil TFP growth contributes to oil output growth positively, while non-oil TFP growth contributes to non-oil TFP growth negatively. So, oil labor growth, oil TFP growth, and capital contribute to oil GDP growth by 48 percent, 26 percent, and 24 percent, respectively. This implies that oil TFP growth plays an important role in explaining oil TFP output growth and total GDP growth. The high of contribution of oil TFP may reflect that Kuwait has the sovereign wealth fund in which to invest part (2.5 percent) of oil revenues. The analysis of total TFP growth accepts the null hypothesis that the TFP growth accounts for a smaller share of economic growth than the accumulation of capital and labor for all GDP measures in Kuwait.

Table 6.3 Growth Accounting for Kuwait: 1990-2014.

Variables	Oil GDP		Non-oil GDP		Total GDP	
	Annual average	Contribution to GDP growth	Annual average	Contribution to GDP growth	Annual average	Contribution to GDP growth
Capital stock	$\delta_k \frac{\Delta K_t}{K_t} =$ 1.318327	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.243734724	$\delta_k \frac{\Delta K_t}{K_t} =$ 0.9975308	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.361042231	$\delta_k \frac{\Delta K_t}{K_t} =$ 1.091343	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.170140538
Labor force	$\delta_l \frac{\Delta L_t}{L_t} =$ 2.6337	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 0.486923307	$\delta_l \frac{\Delta L_t}{L_t} =$ 2.929137	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 1.060159903	$\delta_l \frac{\Delta L_t}{L_t} =$ 2.897954	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 0.451791464
TFP growth	$\frac{\Delta A_t}{A_t} =$ 1.456833	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ 0.269341969	$\frac{\Delta A_t}{A_t} =$ -1.163748	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ -0.421202206	$\frac{\Delta A_t}{A_t} =$ 2.425065	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ 0.378067998
GDP growth	$\frac{\Delta Y_t}{Y_t} =$ 5.40886		$\frac{\Delta Y_t}{Y_t} =$ 2.76292		$\frac{\Delta Y_t}{Y_t} =$ 6.414362	

Capital and labor shares are calculated as simple average for whole period: δ_k =0.2395924, δ_l=0.7604076.

Table 6.4 shows the relationship among the various sources of growth. The positive relationship between oil capital and oil TFP growth confirms the positive contribution of oil TFP growth to oil GDP growth in Kuwait. This finding suggests that oil capital growth is more efficient than other GDP measures. While the negative relationship between non-oil TFP growth and both non-oil capital and non-oil labor may reflect the strong negative relationship between the contribution of non-oil TFP growth to non-oil GDP growth. The relationship between TFP growth and GDP growth in all GDP measures suggests that TFP growth can explain changes in GDP growth beside accumulation of capital and labor.

Table 6.4 Kuwait: correlation Statistic: 1990-2014

Corr.	GDP growth	Capital growth	Labor growth	TFP growth
Oil GDP				
GDP growth	1.0000			
Capital growth	0.4640	1.0000		
Labor growth	-0.2637	-0.1365	1.0000	
TFP growth	0.9349	0.3288	-0.5673	1.0000
Non-oil GDP				
GDP growth	1.0000			
Capital growth	-0.3457	1.0000		
Labor growth	0.1874	0.0025	1.0000	
TFP growth	0.9770	-0.4166	-0.0151	1.0000
Total GDP				
GDP growth	1.0000			
Capital growth	-0.2123	1.0000		
Labor growth	-0.5235	0.6598	1.0000	
TFP growth	0.9699	-0.4021	-0.7087	1.0000

Figure 6.2 presents graphical explanation of TFP and GDP growth for all measures. It is observed that the total GDP and total TFP growth follow the same behavior. Especially, in 1993, a 29 percent growth in TFP was followed by the relatively higher33 percent growth of GDP. And in 2009, TFP growth decreased to -17 percent and it pulled down GDP growth by-7 percent. However, non-oil TFP growth started negative in 1991 through the war between Iraq and Kuwait and tended to grow positive in the beginning of 1992. Non-oil TFP growth grew by -1 percent on average in the period 1990-2014. This suggests that a time series of total TFP can explain the changes in output growth over the period.

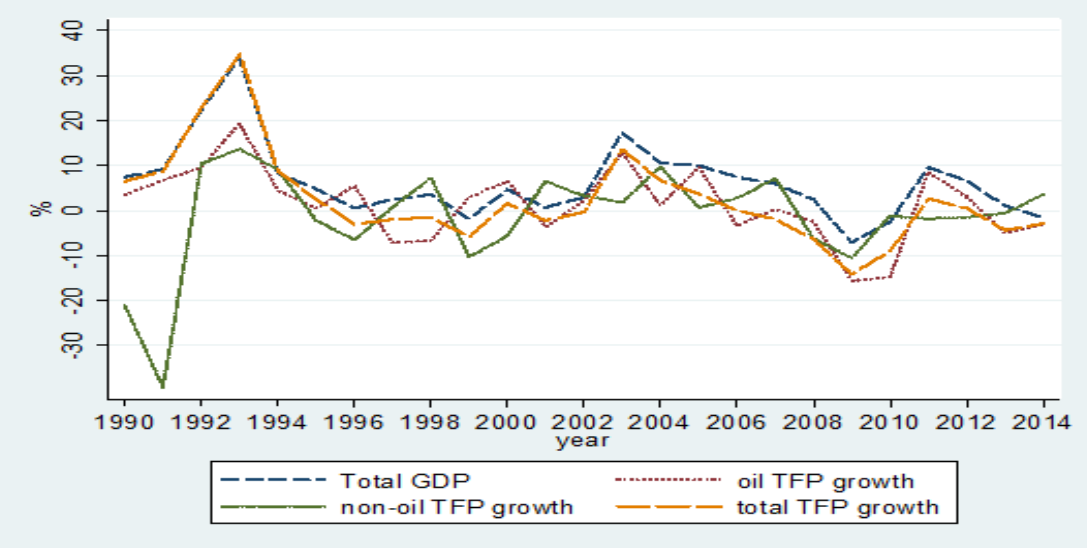

Figure 6.2 Kuwait: Total GDP growth, oil TFP growth, non-oil TFP growth, and total TFP growth

6.1.3 Bahrain

Table 6.5 presents the contribution of all the variables to output growth over the period 1990-2014 for all measures. Labor and capital contribute to output growth more than TFP growth in all measures of GDP in this period. Oil labor, oil TFP growth, and capital account for 42 percent,

38 percent, and 19 percent of oil GDP growth, respectively, while total TFP growth accounts for only 2 percent of total output growth. The low growth of total TFP may be a result of counter movement (increase versus decrease) between oil TFP growth and non-oil TFP growth. In general, the result of TFP growth accepts the null hypothesis that the TFP growth accounts for a smaller share of economic growth than the accumulation of capital and labor for all GDP measures in Bahrain.

Table 6.6 shows that the positive relationship between output growth and each of capital growth, TFP growth, and labor growth suggests that labor, capital, and TFP can explain changes in GDP in all GDP measures. The positive relationship between oil TFP growth and both oil capital growth and oil labor shows the positive contribution of oil TFP growth to oil GDP growth. This finding suggests that oil capital and oil labor are efficient in Bahrain.

Table 6.5 Growth Accounting for Bahrain: 1990-2014

Variables	Oil GDP		Non-oil GDP		Total GDP	
	Annual average	Contribution to GDP growth	Annual average	Contribution to GDP growth	Annual average	Contribution to GDP growth
Capital stock	$\delta_k \frac{\Delta K_t}{K_t} =$ 0.623629	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.192308368	$\delta_k \frac{\Delta K_t}{K_t} =$ 1.230102	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.19940957	$\delta_k \frac{\Delta K_t}{K_t} =$ 1.414602	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.272367573
Labor force	$\delta_l \frac{\Delta L_t}{L_t} =$ 1.380848	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 0.425811521	$\delta_l \frac{\Delta L_t}{L_t} =$ 3.793706	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 0.614990693	$\delta_l \frac{\Delta L_t}{L_t} =$ 3.672026	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 0.707012155
TFP growth	$\frac{\Delta A_t}{A_t} =$ 1.238384	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ 0.381879957	$\frac{\Delta A_t}{A_t} =$ 1.144913	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ 0.185599738	$\frac{\Delta A_t}{A_t} =$ 0.107096	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ 0.020620291
GDP growth	$\frac{\Delta Y_t}{Y_t} =$ 3.242862		$\frac{\Delta Y_t}{Y_t} =$ 6.168721		$\frac{\Delta Y_t}{Y_t} =$ 5.193724	

Capital and labor shares are calculated as simple average for whole period: δ_k =0.2942538, δ_l= 0.7057462

Figure 6.3 presents a graphical explanation of TFP and GDP growth during the 1990-2014. It is observed that total GDP growth followed total TFP growth in behavior. Especially, in 1993, a 9 percent growth of total TFP growth was followed by a 12 percent higher growth in total GDP growth. When total TFP growth dipped to -4 percent in 1994, it pulled total GDP growth down to

-0.25 percent. This suggests that a time series of total TFP can explain the changes in output growth over the period 1990-2014.

Table 6.6 Bahrain: correlation Statistic: 1990-2014

Corr.	GDP growth	Capital growth	Labor growth	TFP growth
Oil GDP				
GDP growth	1.0000			
Capital growth	0.1446	1.0000		
Labor growth	0.2930	-0.1425	1.0000	
TFP growth	0.9103	0.0750	0.1943	1.0000
Non-oil GDP				
GDP growth	1.0000			
Capital growth	0.2930	1.0000		
Labor growth	0.2930	0.1755	1.0000	
TFP growth	0.7128	0.1118	-0.4048	1.0000
Total GDP				
GDP growth	1.0000			
Capital growth	0.3694	1.0000		
Labor growth	0.2831	0.6775	1.0000	
TFP growth	0.4890	-0.4369	-0.6864	1.0000

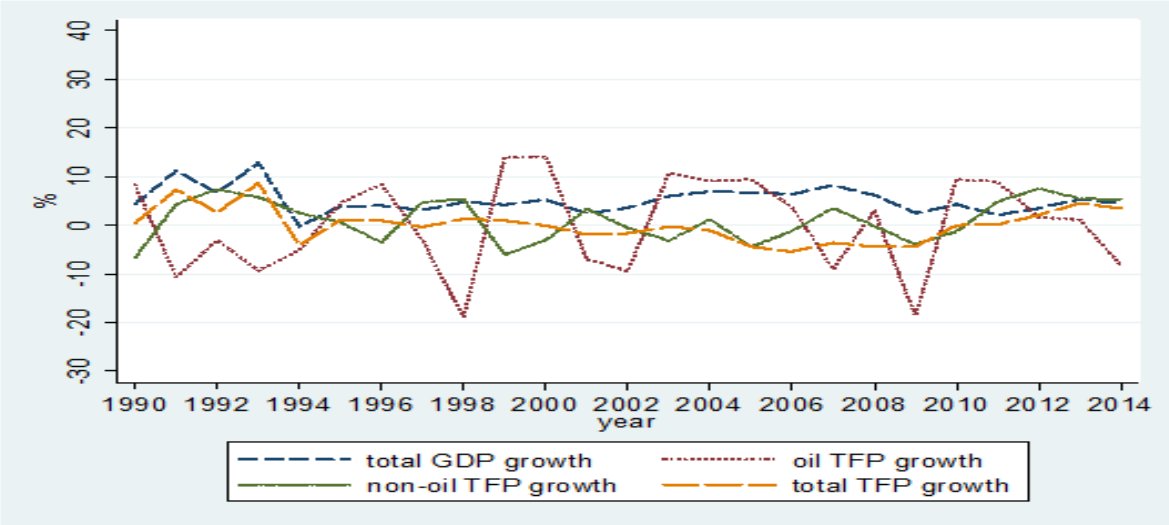

Figure 6.3 Bahrain: Total GDP growth, oil TFP growth, non-oil TFP growth, and total TFP growth

6.1.4 Qatar

Table 6.7 presents the contribution of all the variables to output growth over the period 1990-2014 for all GDP measures. Accumulation of labor and capital contribute to output growth more than TFP growth for all GDP measures in this period. Oil TFP growth, oil labor, and oil capital account for 49 percent, 40 percent, and 10 percent to oil GDP respectively, to oil GDP

growth. Non-oil TFP growth, non-oil labor growth, and non-oil capital account for 27 percent, 48 percent, and 23 percent, respectively, to non-oil output growth over the period 1990-2014. However, because that natural gas revenue that accounts for non-oil GDP and the oil revenue do not move in the same direction, but rather move counter to one another (Brown and Yücel, 2008), then total TFP growth contributes only to total GDP growth by 9 percent. So, for all measures of GDP, TFP growth accepts the null hypothesis that the TFP growth accounts for a smaller share of economic growth than the accumulation of capital and labor in all GDP measures in Qatar over the period 1990-2014.

Table 6.7 Growth Accounting for Qatar: 1990-2014

Variables	Oil GDP		Non-oil GDP		Total GDP	
	Annual average	Contribution to GDP growth	Annual average	Contribution to GDP growth	Annual average	Contribution to GDP growth
Capital stock	$\delta_k \frac{\Delta K_t}{K_t} =$ 0.979413	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.100843463	$\delta_k \frac{\Delta K_t}{K_t} =$ 2.654166	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.235800526	$\delta_k \frac{\Delta K_t}{K_t} =$ 3.184493	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.335570227
Labor force	$\delta_l \frac{\Delta L_t}{L_t} =$ 3.923466	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 0.403972151	$\delta_l \frac{\Delta L_t}{L_t} =$ 5.488047	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 0.487567231	$\delta_l \frac{\Delta L_t}{L_t} =$ 5.361164	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 0.564939858
TFP growth	$\frac{\Delta A_t}{A_t} =$ 4.80934	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ 0.495184468	$\frac{\Delta A_t}{A_t} =$ 3.11377	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ 0.27663251	$\frac{\Delta A_t}{A_t} =$ 0.9441378	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ 0.099489789
GDP growth	$\frac{\Delta Y_t}{Y_t} =$ 9.712219		$\frac{\Delta Y_t}{Y_t} =$ 11.25598		$\frac{\Delta Y_t}{Y_t} =$ 9.489796	

Capital and labor shares are calculated as simple average for whole period: $\delta_k = 0.3046873$, $\delta_l = 0.6953127$

Table 6.8 shows the positive relationship between output growth and each of TFP growth, capital growth, and labor for all GDP measures, except non-oil capital. While the negative relationship between total TFP growth and each of total capital and total labor suggests that labor and capital are inefficient in both cases of non-oil and total GDP measures.

Figure 6.4 shows the relationship between total GDP, and oil TFP growth, non-oil TFP growth, and total TFP growth. Total GDP growth followed total TFP growth in the period 1990-

2014. It reflects that, if TFP growth rises, growth of GDP also takes the same path and vice versa. Especially in 1997, a 12 percent growth in total TFP was followed by an18 percent growth of total GDP and in 2003, a -9 percent growth in total TFP was followed by a 5 percent change in total output growth. This suggests that a time series of total TFP can explain the changes in total output growth over the period.

Table 6.8 Qatar: correlation Statistic: 1990-2014

Corr.	GDP growth	Capital growth	Labor growth	TFP growth
Oil GDP				
GDP growth	1.0000			
Capital growth	0.3948	1.0000		
Labor growth	0.1686	0.1637	1.0000	
TFP growth	0.8874	0.2242	-0.2962	1.0000
Non-oil GDP				
GDP growth	1.0000			
Capital growth	-0.0043	1.0000		
Labor growth	0.2083	0.2161	1.0000	
TFP growth	0.9430	-0.1765	-0.1125	1.0000
Total GDP				
GDP growth	1.0000	0.2083		
Capital growth	0.5926	1.0000		
Labor growth	0.6071	0.7838	1.0000	
TFP growth	0.2653	-0.4882	-0.5799	1.0000

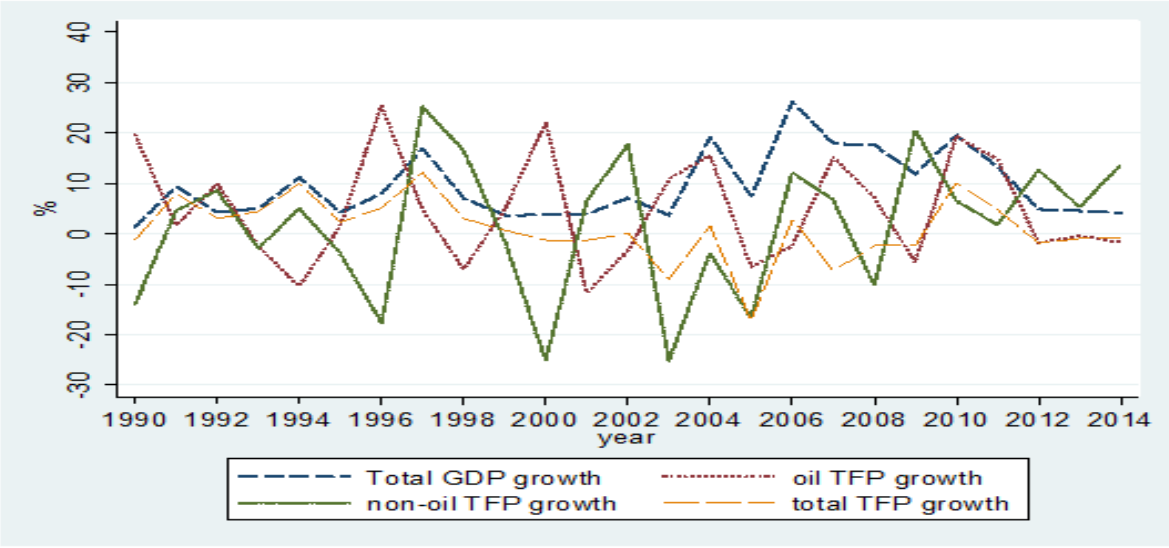

Figure 6.4 Qatar: Total GDP growth, oil TFP growth, non-oil TFP growth, and total TFP growth

6.1.5 United Arab Emirates

Table 6.9 presents the contribution of all the variables to output growth over the period 1990-2014 for all GDP measures. Labor growth and capital growth contribute to output growth more than TFP growth over this period. Total labor growth, total capital growth accumulations account for 115 percent and 45 percent, respectively, of total output growth while total TFP growth accounts for -61 percent of total output growth over the period 1990-2014. The main explanation for low productivity benefits is the concentration of economy activity in a sector with limited productivity growth, such as retail trade, construction, and tourism and exports only are concentrated in jewelry and gold (Hvidt, 2013). This implies that factors of labor force and capital stock play an important role in explaining output growth for all measures. Thus, this result accepts the null hypothesis that TFP growth accounts for a smaller share of economic growth than the accumulation of capital and labor for all GDP measures in the UAE over the period 1990-2014.

Table 6.9 Growth Accounting for UAE: 1990-2014

Variables	Oil GDP		Non-oil GDP		Total GDP	
	Annual average	Contribution to GDP growth	Annual average	Contribution to GDP growth	Annual average	Contribution to GDP growth
Capital stock	$\delta_k \frac{\Delta K_t}{K_t} =$ 0.781248	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.398505594	$\delta_k \frac{\Delta K_t}{K_t} =$ 1.14703	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.216851881	$\delta_k \frac{\Delta K_t}{K_t} =$ 2.306067	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.457307174
Labor force	$\delta_l \frac{\Delta L_t}{L_t} =$ 4.570338	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 2.33127580	$\delta_l \frac{\Delta L_t}{L_t} =$ 5.856204	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 1.107145281	$\delta_l \frac{\Delta L_t}{L_t} =$ 5.843572	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 1.158816025
TFP growth	$\frac{\Delta A_t}{A_t} =$ -3.39114	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ -1.7297812	$\frac{\Delta A_t}{A_t} =$ -1.713771	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ -0.323997162	$\frac{\Delta A_t}{A_t} =$ -3.10693	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ -0.61612319
GDP growth	$\frac{\Delta Y_t}{Y_t} =$ 1.960445		$\frac{\Delta Y_t}{Y_t} =$ 5.289463		$\frac{\Delta Y_t}{Y_t} =$ 5.042709	

Capital and labor shares are calculated as simple average for whole period: $\delta_k = 0.2856307$, $\delta_l = 0.7143693$

Table 6.10 confirms the existence of a positive relationship between output growth and TFP growth. The positive relation between oil capital growth and oil TFP growth confirms that oil capital is more efficient than oil labor. The UAE has attempted to reduce the reliance on crude oil export and reliance on trade since the 1990s. However, the existence of an inverse relationship

between non-oil TFP growth and non-oil capital growth and between non-oil TFP growth and non-oil labor growth confirm that non-oil labor and non-oil capital are inefficient.

Figure 6.5 confirms that the variables of GDP, capital, labor, and TFP in UAE show less fluctuation than Saudi Arabia, Kuwait, Bahrain, and Qatar. This result suggests that the UAE will likely have sustained economic growth in the future. After 2009, all sectors tend to grow in the same direction; for example, in 2012, oil TFP growth grew by 8 percent, non-oil GDP growth grew by 4 percent, and total TFP growth grew by 2 percent and total GDP growth followed them by 6 percent. The figure suggests that a time series of total TFP growth can explain the changes in economic growth over the period.

Table 6.10 UAE: correlation Statistic: 1990-2014

Corr.	GDP growth	Capital growth	Labor growth	TFP growth
Oil GDP				
GDP growth	1.0000			
Capital growth	0.6395	1.0000		
Labor growth	0.2276	-0.2239	1.0000	
TFP growth	0.8024	0.2964	-0.5287	1.0000
Non-oil GDP				
GDP growth	1.0000			
Capital growth	-0.2075	1.0000		
Labor growth	0.2276	-0.2239	1.0000	
TFP growth	0.7546	-0.2307	-0.4383	1.0000
	Total GDP			
GDP growth	1.0000			
Capital growth	-0.1848	1.0000		
Labor growth	0.0935	0.4337	1.0000	
TFP growth	0.7248	-0.6180	-0.5839	1.0000

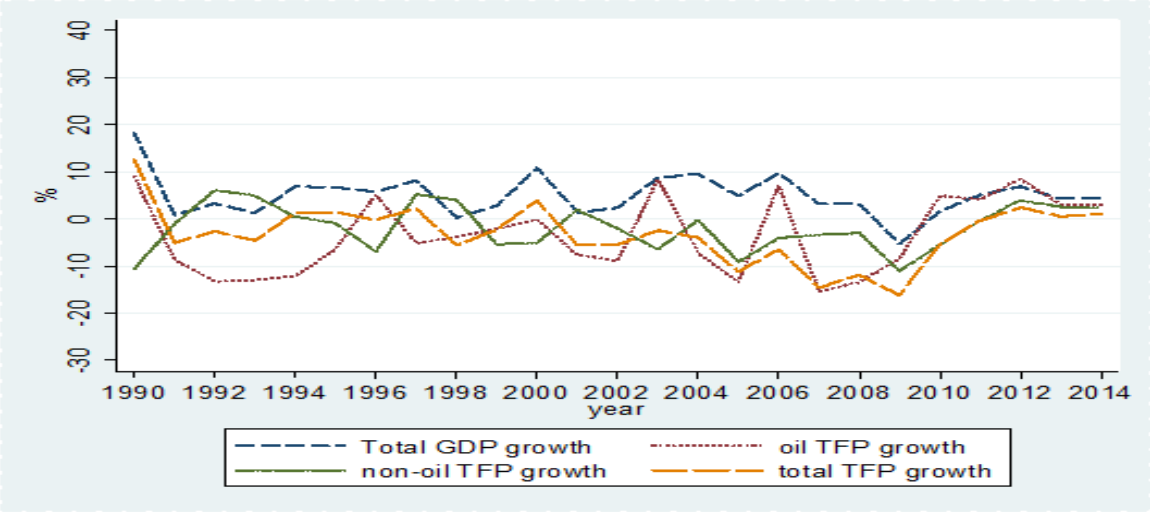

Figure 6.5 UAE: Total GDP growth, oil TFP growth, non-oil TFP growth, and total TFP growth

6.1.6 Oman

Table 6.11 presents the contribution of all the variables to output growth over the period 1990-2014 for all GDP measures. The contribution of labor growth and capital growth accumulation was more than the contribution of TFP growth over the period 1990-2014. The contribution of oil TFP growth to oil GDP growth is strong, low, and negative. This finding may reflect inefficiency in the allocation of capital and /or labor, which prevents full gains of investment in the oil sector and relates to poor human resource management practices[6]. While the contribution of non-oil TFP growth to non-oil GDP growth is low, it is positive in this period. For example, non-oil labor growth and non-oil capital contribute to non-oil GDP growth by 66 percent and 4 percent while non-oil TFP growth contributes by 29 percent. This implies that non-oil TFP and non-oil capital play an important role in explaining non-oil output growth. Non-oil output growth grew by 7 percent higher than oil output growth in this period. The result of TFP growth accepts

[6] To read more about industrial production in Oman see: https://www.oxfordbusinessgroup.com/.../more-better-government-working-boost

the null hypothesis that the TFP growth accounts for a smaller share of economic growth than the accumulation of capital and labor for all GDP measures in Oman over the period 1990-2014.

Table 6.11 Growth Accounting for Oman: 1990-2014

Variables	Oil GDP		Non-oil GDP		Total GDP	
	Annual average	Contribution to GDP growth	Annual average	Contribution to GDP growth	Annual average	Contribution to GDP growth
Capital stock	$\delta_k \frac{\Delta K_t}{K_t} =$ 0.841428	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.5780264	$\delta_k \frac{\Delta K_t}{K_t} =$ 0.3468567	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.049213	$\delta_k \frac{\Delta K_t}{K_t} =$ 1.518277	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t} =$ 0.4103303
Labor force	$\delta_l \frac{\Delta L_t}{L_t} =$ 4.632016	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 3.1820027	$\delta_l \frac{\Delta L_t}{L_t} =$ 4.656567	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 0.660695	$\delta_l \frac{\Delta L_t}{L_t} =$ 4.648813	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t} =$ 1.2563907
TFP growth	$\frac{\Delta A_t}{A_t} =$ -4.01775	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ -2.7600289	$\frac{\Delta A_t}{A_t} =$ 2.044556	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ 0.290091	$\frac{\Delta A_t}{A_t} =$ -2.46695	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t} =$ -0.6667211
GDP growth	$\frac{\Delta Y_t}{Y_t} =$ 1.455692		$\frac{\Delta Y_t}{Y_t} =$ 7.04798		$\frac{\Delta Y_t}{Y_t} =$ 3.700133	

Capital and labor shares are calculated as simple average for whole period: δ_k =0.2665741, δ_l= 0.7334259

Table 6.12 shows the positive relationship between output growth and each of TFP growth, capital growth, and labor growth in all GDP measures. The negative relationship between oil TFP growth and oil labor and between non-oil TFP and non-oil labor confirms that labor input is inefficient in both cases. In addition, the negative relationship between total TFP growth and both total capital growth and total labor confirms that capital and labor inputs are inefficient over the period 1990-2014.

Figure 6.6 presents a graphical explanation of TFP and GDP growth during the 1990-2014. It is observed that the total GDP growth follows closely the total TFP growth. Especially in 1992, a 7 percent growth in non-oil TFP and a 1 percent growth in total TFP were followed bya8 percent growth of GDP. After 2000, the gap between total TFP growth and total GDP growth was because of the negative effect of oil TFP growth. For example, in 2003, oil TFP growth grew by -7 percent and it pulled total TFP growth down to -7 percent and then pulled total GDP growth downto-2

percent. So, in general, this result suggests that a time series of total TFP can explain the changes in economic growth over the period.

Table 6.12 Oman: correlation Statistic: 1990-2014

Corr.	GDP growth	Capital growth	Labor growth	TFP growth
Oil GDP				
GDP growth	1.0000			
Capital growth	0.2962	1.0000		
Labor growth	0.0215	-0.0629	1.0000	
TFP growth	0.8373	0.1159	-0.4995	1.0000
Non-oil GDP				
GDP growth	1.0000			
Capital growth	0.4072	1.0000		
Labor growth	0.0346	-0.0472	1.0000	
TFP growth	0.8039	0.2962	-0.5619	1.0000
Total GDP				
GDP growth	1.0000			
Capital growth	0.2346	1.0000		
Labor growth	0.1300	0.5515	1.0000	
TFP growth	0.4828	-0.4486	-0.7958	1.0000

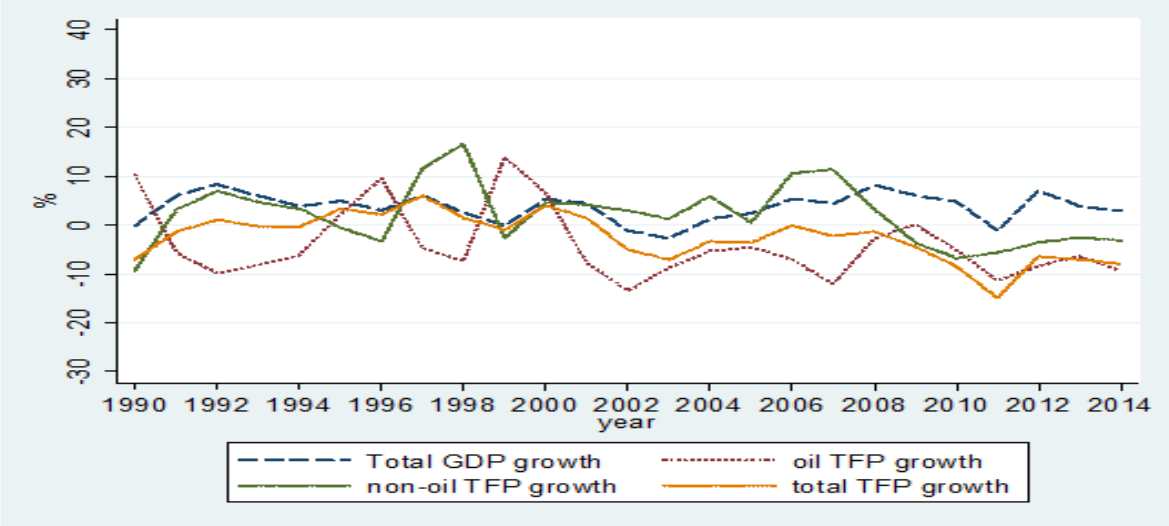

Figure 6.6. Oman: Total GDP growth, oil TFP growth, non-oil TFP growth, and total TFP growth

6.1.7 Jordan

Table 6.13 presents the contribution of all the variables to output growth over the period 1990-2014. Total labor growth and total capital growth contribute by 70 percent and 20 percent respectively while total TFP growth contributes only by 9 percent to total GDP growth over this

period. This implies that labor and capital accumulation play an important role in explaining output growth for Jordan. The result of TFP growth accepts the null hypothesis that the TFP growth accounts for a smaller share of economic growth than the accumulation of capital and labor in Jordan over the period 1990-2014.

Table 6.14 confirms the existence of a positive relationship between output growth and each of capital growth, labor growth, and TFP growth over the period. Low TFP growth is due to an inverse relationship between total TFP growth and both total labor growth and total capital growth, which confirms that labor and capital are inefficient in Jordan.

Table 6.13 Growth Accounting for Jordan: 1990-2014

Variables	Total GDP	
	Annual average	Contribution to GDP growth
Capital stock	$\delta_k \frac{\Delta K_t}{K_t}$ =1.034514	$\delta_k \frac{\Delta K_t}{K_t} / \frac{\Delta Y_t}{Y_t}$ = 0.202540681
Labor force	$\delta_l \frac{\Delta L_t}{L_t}$=3.592425	$\delta_l \frac{\Delta L_t}{L_t} / \frac{\Delta Y_t}{Y_t}$= 0.703337226
TFP growth	$\frac{\Delta A_t}{A_t}$=0.4807459	$\frac{\Delta A_t}{A_t} / \frac{\Delta Y_t}{Y_t}$=0.094122073
GDP growth	$\frac{\Delta Y_t}{Y_t}$= 5.107685	

Capital and labor shares are calculated as simple average for whole period: δ_k =0.2285978, δ_l= 0.7714022

Figure 6.7 presents a graphical explanation of TFP and GDP growth during the 1990-2014. It is observed that total TFP growth is followed closely by the GDP growth. Especially in 1992, an 11 percent growth of total TFP was followed by a 19 percent growth of total GDP. In 1993, TFP growth grew by -10 percent and it pulled GDP growth up by 4 percent. So, this suggests that a time series of TFP can explain the changes in economic growth over the period. The change in total GDP growth and total TFP growth during this study is more stable. The standard deviation

for total GDP growth is 2 percent and for total TFP growth is 3 percent. This result confirms that path of total GDP growth follows the path of total TFP growth over the period 190-2014. So, time series of total TFP growth can explain the change in the total GDP growth in this period.

Table 6.14 Jordan: correlation Statistic: 1990-2014

Corr.	GDP growth	Capital growth	Labor growth	TFP growth
Total GDP				
GDP growth	1.0000			
Capital growth	0.2860	1.0000		
Labor growth	0.1958	0.4692	1.0000	
TFP growth	0.7742	-0.1099	-0.4643	1.0000

Figure 6.7 Jordan: total GDP growth and total TFP growth

6.1.8 Pooled AGCC countries with Jordan or without Jordan

Table 6.15 shows that the contribution of oil TFP growth to oil GDP growth is negative while the highest positive contributions to oil GDP growth are from labor and capital in the pool of AGCC countries. However, the contribution of non-oil TFP growth to non-oil GDP growth is

low but it is positive in the pool of AGCC countries with and without Jordan, but with Jordan it is little bit better. The contribution of total TFP growth to total GDP growth is -10 percent, the contribution of labor is 78 percent, and the contribution of capital is 32 percent for AGCC countries, but with Jordan it is 77 percent, 30 percent, and -7 percent, respectively. These results of TFP growth accept the null hypothesis that the TFP growth accounts for a smaller share of economic growth than the accumulation of capital and labor in pooled AGCC countries with Jordan or without Jordan. These results of TFP growth are still low compared to developed countries; in the Western countries, including the USA, TFP growth accounts for about 25 percent of GDP growth, for Southern Europe, it accounts for 20 percent, and it accounts for 18 percent of GDP growth for Newly Industrialized Countries (NICs) (Baier, Dwyer, and Tamura, 2006).

Table 6.15 Pooled AGCC with or without Jordan: contribution of TFP, capital, and labor to GDP growth

Variables	Contribution to oil GDP in AGCC	Contribution to non-oil GDP in AGCC	Contribution to non-oil GDP in AGCC +Jordan*	Contribution to total GDP in AGCC	Contribution to total GDP in AGCC +Jordan*
Capital	0.286609714	0.201634501	0.201763955	0.322320265	0.305208896
Labor	1.321348252	0.706811672	0.706315322	0.782043509	0.770799754
TFP	-0.607957895	0.091553873	0.091920759	-0.104363776	-0.076008654

* Jordan is accounted within non-oil GDP and total GDP

6.2 Summary

Every country attempts to raise the welfare of its citizens and this objective cannot be achieved without sustained growth in output. A study on productivity growth in the AGCC countries is important for several reasons. First, sustained economic growth can only be achieved through a sustained growth in total factor productivity (TFP). Second, rapid growth in output that comes as result of increases in labor and capital rather than TFP cannot continue indefinitely because of diminishing returns of production. For example, expansion experience in AGCC

countries shows that the past growth strategy based on accumulation of labor and capital is unfeasible. Finally, higher productivity is a key to resuming the economic growth and to raising the efficiency of economy in both sectors.

Using the first part of table 6.16, it can be shown that Qatar has the highest growth of oil TFP, 4 percent per year, while Oman has the lowest growth among the AGCC countries, -4 percent per year. For the most part, the efficiency of capital in Qatar implies that TFP growth is positive and higher than in other countries, but it could be slightly better in the short term if capital continues to be used more efficiently. However, because the standard deviation of oil TFP growth in Qatar is high, it may not help to continue this growth for a long time.

In the case of the non-oil GDP measure, Saudi Arabia has the highest growth of non-oil TFP, 4 percent. The standard deviation of non-oil TFP growth is low in Saudi Arabia compared to other countries, and that may not only help to continue this growth for a long time, but also reflects the growth of non-oil TFP in the future.

For the total GDP measure, Kuwait has the highest growth of total TFP among these countries, 2.4 percent, while total TFP growth for Qatar, Saudi Arabia, Jordan, and Bahrain is positive but low. Using standard deviation as a measure of volatility, Saudi Arabia has the lowest volatility at 3 percent, Jordan at 3.4 percent, and Bahrain at 4.3 percent. This implies that Saudi Arabia, Jordan, and Bahrain may be the best countries among these countries to achieve a sustained economic growth in the future.

On the other hand, the contribution of oil TFP growth for Qatar is the highest among the AGCC countries and Jordan at 49 percent. This improvement may involve a reallocation away from natural resources, such as crude oil, and results from trends to manufacturing that depend on petrochemical industries. This result is supported by the data on efficiency of capital that correlates

positively with oil TFP growth. The contribution of non-oil TFP growth for Saudi Arabia is the highest among these countries at 54 percent. This implies that non-oil TFP growth plays an important role in explaining total output growth. This leads to the idea that the non-oil capital is more efficient in explaining output growth in Saudi Arabia than other AGCC countries. The contribution of non-oil TFP growth to non-oil output growth in Bahrain, Qatar, Oman, and Jordan is slightly positive. These results may reflect the low share of manufacturing exports in these economies. Kuwait is the highest contribution of total TFP growth to total GDP growth among these countries by 37 percent. Although domestic labor and capital are not efficient, Kuwait has invested 2.5 percent of oil revenues abroad by establishing Oil and Stabilization Funds (OSF) to save part of the oil revenues (Ministry of Financial in Kuwait, 2015). Therefore, positive TFP growth is important because it indicates that factors of production are used efficiently, for example, most growth successes can be attributed to positive development in TFP such as USA and China in the past 25 years (92 percent and 80 percent, respectively, on average in this period) (Espinoza, 2012).

Figures 6.8 and 6.10 show the trend in the growth of TFP and GDP over the period 1990-2014. The growth rates are certainly not the same for each country, but the overall pattern is very similar: Saudi Arabia, Jordan, and Bahrain show the least fluctuation in non-oil TFP growth among these countries. Non-oil GDP in Saudi Arabia, Bahrain, and Jordan grow by 7 percent, 6 percent, and 4.7 percent per year, respectively, with more stability in non-oil TFP growth. On the other hand, the non-oil GDP in Qatar and Kuwait grew by 11 percent and 2 percent, but the standard deviation is high, 13 percent and 11 percent, respectively. If these groups are compared, the countries that have less standard deviation achieved the highest growth over this period. Figure 6.10 shows that Kuwait; Qatar, and UAE exhibit more fluctuation. Non-oil GDP in Kuwait grows

by 0.9 percent with a standard deviation of 10 percent, while Saudi Arabia grows by 0.6 percent with a standard deviation of only 3 percent per year. Figure 6.11 confirms that the volatility of total GDP growth for Saudi Arabia is less than Kuwait. Therefore, strong GDP growth in some of AGCC countries suggests support by rising government spending and by financing through rapidly increasing oil revenues. In the AGCC countries, non-oil TFP growth contributes to non-oil GDP growth by 3.19 percent per year on average while Jordan contributes only by 0.28 percent over the period 1990-2014. This confirms that the contribution of non-oil sector to non-oil GDP in the AGCC countries is better than in Jordan. However, total TFP growth of Jordan contributes to total output growth by 0.28 percent, contrasting with AGCC countries, which show a -0.23 percent change on average over this period. These findings suggest that the share of the non-oil (private) sector is still more limited in the AGCC countries. Finally, the volatility in non-oil TFP growth results from most of the industries in AGCC countries being likely to be oil-related. Finally, the result of the growth accounting model suggests that the expansion of the AGCC countries and Jordan is hindered by decline in TFP growth.

In general, the results show that growth in non-oil GDP and total GDP for AGCC countries in average is better than Jordan. AGCC countries grow by 6.7 percent and 5.6 percent, respectively, per year in average while Jordan grows by 4.7 percent per year over the period 1990-2014. However, low or often negative growth of TFP may reflect the low-growth performance in the AGCC countries and Jordan. These results of TFP growth may be because capital and labor are employed to generate growth in these countries. So, most of the output growth occurs as result of increases in the contribution of labor and capital rather than the contribution of TFP. The decline in TFP growth results from failure in the production environment due to excessive public sector involvement, and low quality of human capital (Sala-i-Martin and Artadi, 2003). Also, the fraction

of labor force in the private sector remains relatively lowin comparison to developed countries because of the dominance of the public sector in the economy of AGCC (Makdisi and others, 2005). Moreover, Expansion experience in AGCC countries shows that the past growth strategy based on accumulation of labor and capital alone is unfeasible (Espinoza, 2012). This discussion suggests that oil revenues are not the only reason for the low TFP growth but that there are some other reasons regarding education, health, manufacturing, foreign direct investment (FDI), government consumption, inflation rate, migration rate, and technology that may raise the efficiency of inputs. For example, the AGCC countries have petrochemical industries that may make these countries more productive than Jordan, which depends on service industries for part of its economy. Therefore, this study will look at the factors that explain the portion of output that is not accounted for by the capital and labor inputs directly. These results shown in the above graphs and tables suggest that one can use the time series of human capital accumulation (gross enrollment ratio in secondary school and higher life expectancy), the share of manufacturing exports to total goods exports, share of openness of trade to GDP, the share of high technology exports to total goods exports, the share of foreign direct investment to GDP; the share of government spending to GDP, inflation rate; share of oil revenues to GDP, and the immigrant percentage to total population to explain the difference in growth patterns in total TFP among individual AGCC countries and Jordan and the pool of these countries with or without Jordan.

Table 6.16 Growth Accounting for AGCC countries and Jordan: 1990-2014

Country	Variable	Mean	Std. Dev.
Oil GDP			
Saudi Arabia	TFP growth	-.6972229	5.105731
	GDP growth	2.290906	4.160827
Kuwait	TFP growth	1.456833	8.031194
	GDP growth	5.408859	7.295698
Bahrain	TFP growth	1.238384	12.33823
	GDP growth	2.602862	8.706126
Qatar	TFP growth	4.80934	10.66291
	GDP growth	9.712215	10.68128
UAE	TFP growth	-3.391142	8.104984
	GDP growth	1.960444	7.497574
Oman	TFP growth	-4.017753	7.247274
	GDP growth	1.455688	7.247274
Non-oil GDP			
Saudi Arabia	TFP growth	4.321837	2.756027
	GDP growth	7.970937	2.684462
Kuwait	TFP growth	-1.163747	11.09175
	GDP growth	2.762918	10.96776
Bahrain	TFP growth	1.144912	4.326959
	GDP growth	6.168725	4.666729
Qatar	TFP growth	1.75377	13.76352
	GDP growth	11.25599	19.80293
UAE	TFP growth	-1.713771	4.99172
	GDP growth	5.289466	4.330161
Oman	TFP growth	2.044556	6.331873
	GDP growth	7.047981	5.430134
Jordan	TFP growth	.2807458	3.464539
	GDP growth	4.747685	2.43652
Total GDP			
Saudi Arabia	TFP growth	.6907645	3.176445
	GDP growth	4.358585	3.288287
Kuwait	TFP growth	2.425065	10.11761
	GDP growth	6.414368	8.499436
Bahrain	TFP growth	.1070961	3.548088
	GDP growth	5.193724	2.775973
Qatar	TFP growth	.9441377	6.287919
	GDP growth	9.489795	6.620234
UAE	TFP growth	-3.106929	6.218539
	GDP growth	5.04271	4.540906
Oman	TFP growth	-2.466957	4.765907
	GDP growth	3.700132	2.968251

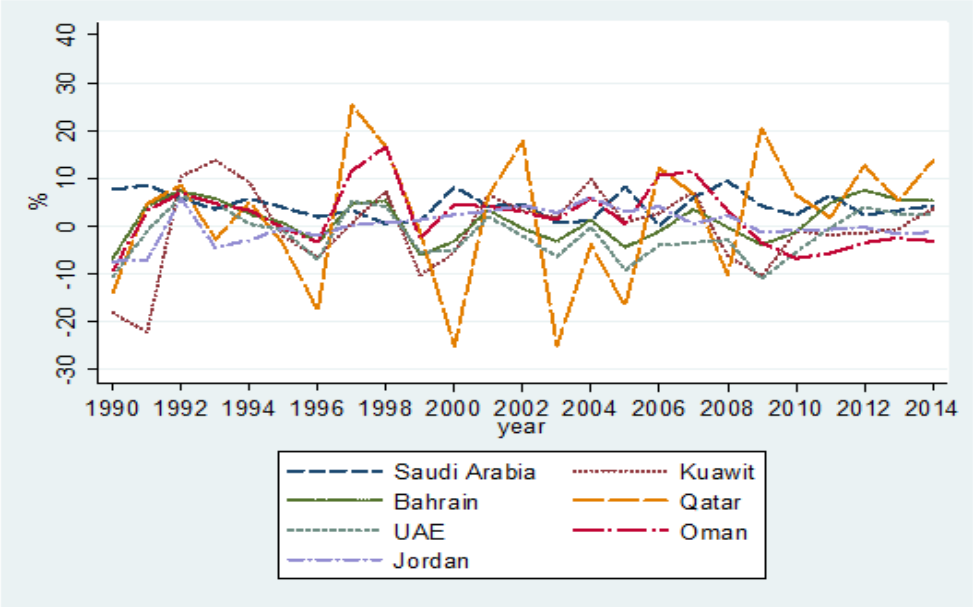

Figure 6.8 Non-oil TFP growth for the AGCC countries and Jordan

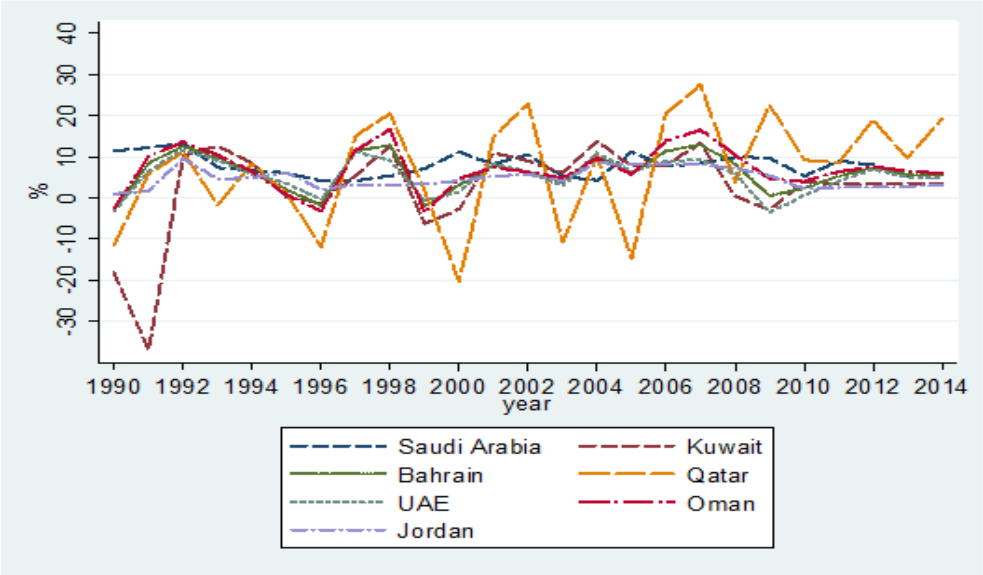

Figure 6.9 Non-oil GDP growth for the AGCC countries and Jordan

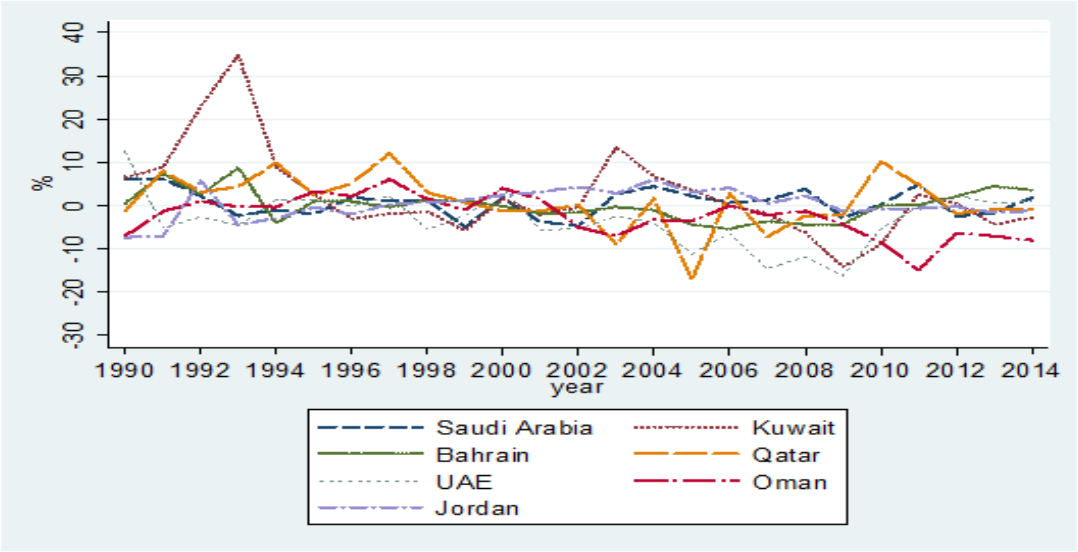

Figure 6.10 Total TFP growth for the AGCC countries and Jordan

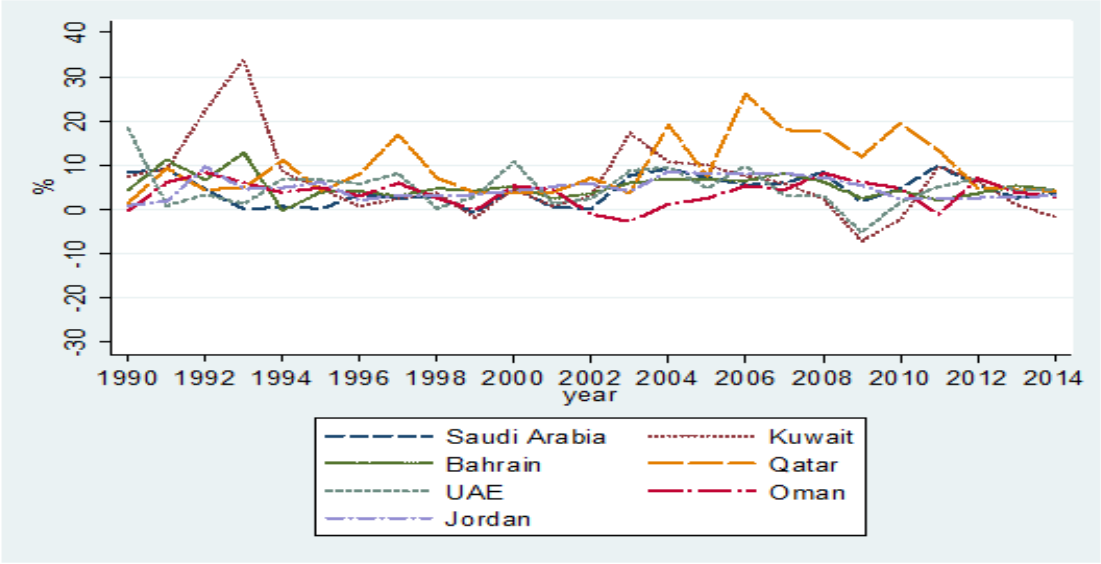

Figure 6.11 Total GDP growth for the AGCC countries and Jordan

6.3 Determinants of TFP in each country of the AGCC countries and Jordan

This study is addressed to answer the following question: what is the expected effect of human capital (gross enrollment ratio in secondary school and life expectancy) and other factors such as: the share of manufacturing exports to total goods exports; share of openness of trade to GDP; share of high technology exports to total goods exports; share of foreign direct investment to GDP; share of government spending to GDP; inflation rate; share of oil revenues to GDP; and the immigrant percentage to total population on TFP growth of each country of the AGCC countries and Jordan?

6.3.1 Hypothesis

H_0: Human capital accumulation (gross enrollment ratio in secondary school and higher life expectancy) and other factors such as: the share of manufacturing exports to total goods exports; share of openness of trade (exports and imports) to GDP; share of high technology exports to total goods exports; share of foreign direct investment to GDP; share of government spending to GDP; inflation rate; share of oil revenues to GDP; and the immigrant percentage to total population all have effects on TFP growth in each country of the AGCC countries and Jordan and in pooled AGCC, with or without Jordan.

H_1: Human capital accumulation (gross enrollment ratio in secondary school and higher life expectancy) and other factors such as: the share of manufacturing exports to total goods exports; share of openness of trade (exports and imports) to GDP; share of high technology exports to total goods exports; share of foreign direct investment to GDP; share of government spending to GDP; inflation rate; share of oil revenues to GDP; and the immigrant percentage to total population all do not influence TFP growth in each country of the AGCC countries and Jordan and in pooled AGCC, with or without Jordan.

The following neoclassical growth model is estimated to investigate the role of macroeconomic and other variables in determining total factor productivity (TFP) growth for each country:

$$TFP_i = \gamma_{0i} + \gamma_{1i} manufim_i + \gamma_{2i} govc_i + \gamma_{3i} highex_i + \gamma_{4i} edp_i + \gamma_{5i} trad_i + \gamma_{6i} infl_i + \gamma_{7i} fdi_i + \gamma_{8i} life_i + \gamma_{9i} oilrev_i + \gamma_{10i} migrant_i + \mu_i \quad (6\text{-}1)$$

where TFP is total factor productivity growth, $manufim$ is manufactured exports(percent of goods exports), $govc$ is a measure of government spending (percent of GDP), $highex$ is high technology exports (percent of goods exports), edp and $life$ are gross enrollment ratio in secondary school and expectancy life at birth (represent investment levels in human capital),$trad$ is trade openness (percent of GDP), $infl$ is the rate of inflation, fdi is foreign direct investment (percent of GDP), $oilrev$ is oil revenue (percent of GDP), $migrant$ is the number of migrants (percent of total population), γ_0 is the constant term, and μ is the error term.

In this section, this study uses multiple regressions to learn more about the relationship between several independent variables and a dependent variable[7]. I investigate the time series properties of all the variables and countries using three diagnostic statistics to test the validity of the model. I use some equations that start from general-to-specific methodology by removing the irrelevant variables or collinear between variables in this model (Gujarati, 2009).This study uses Skewness/Kurtosis tests to examine the normal distribution of the residual (H_0: residual is normally distributed), Breusch-Pagan/ Cook-Weisberg test for heteroskedasticityto examine the constant variance of residuals (H_0: residuals are homoscedastic (constant variance)), and Durbin's Alternativeto examine the serial correlation of residuals (H_0: residuals are serially correlated) for each country of the AGCC countries and Jordan.

[7]The term was first used by Pearson, 1908

This study hypothesizes that these variables in equation (6-1) are primarily determinants of TFP growth in the AGCC countries and Jordan. The basic purpose of the presentation of the results in four regressions is to include the wide-ranging determinants of TFP growth (Khan, 2005).

6.3.2.Saudi Arabia: determinants of TFP growth

Table 6.15 summarizes the results of all regressions; the first regression includes all variables while the rest of the regressions are more independent in choice of variables to some extent. Regression 1 shows a collinear relationship between independent variables. By using variance inflation factors (VIF), life and trade are correlated with each other in regression 1 which does not provide any useful information about TFP growth. So, this study uses the last three regressions that include only explanatory variables (Gujarati, 2009)[8]. In these regressions, the residuals are distributed normally and are free of heteroscedasticity and serial correlation (AR)[9].

Table 6.15 shows that there are five variables that have a positive effect on TFP growth. **Trade openness** rate appears with a positive coefficient and is statistically significant. Regression 4 shows that a one-unit increase in trade openness rate leads to a 0.31 percent increase in TFP growth. This finding is consistent with economic theory. Trade openness is expected to enhance technological innovation out of either the direct or indirect benefits of trade that boost productivity (Sachs et al., 1995). **Oil revenue s**have a positive effect on total TFP growth. Regression 3 shows that a one-unit increase in oil revenue rate increases TFP growth by 0.41 percent. This result

[8]This strategy of building a model is called the bottom-up approach (starting with a smaller model and expanding it as one goes along) (Gujarati, 2009).

[9]The primary objective of data mining is to develop the "best" model after several diagnostic tests (normally distributed, constant variance, and serial correlation) so that the model finally chosen is a "good" model in the sense that all the estimated coefficients have the "right" signs, they are statistically significant on the basis of the t and F tests, the R^2 value is reasonably high and the Durbin–Watson d has acceptable value (around 2), etc. make model finally chosen is a "good" model in the sense that all the estimated coefficients have the "right" signs, they are statistically significant on the basis of the t and F tests, the R^2value is reasonably high.

emphasizes that government uses oil revenue to finance infrastructure, improve education, develop cities, and manage the economy to make it more modern (Espinoza, 2012). **Manufacturing exports** have a positive impact on total TFP growth. Regression 3 shows that a one-unit increase in manufacturing rate leads to a 0.78 percent increase in TFP growth. This finding confirms that reforms in Saudi Arabia involve a reallocation of programs away from natural resources and toward manufacturing sector with the potential for improvements in productivity and quality. The information indicates that manufacturing in Saudi Arabia contributes around 10 percent of the GDP on average during the period 1990-2014 (Ministry of Financial in Saudi Arabia, 2014; World Bank, 2015). **Government spending** rate has a positive effect on total TFP growth. Regression 3 shows that a one-unit increase in government spending rate leads to a 0.54 percent increase in TFP growth. Rains (1989) and Hakura (2004) point out that government can promote or hinder the process of economic growth depending upon the nature of its activities. In addition, Khan (2005) confirms that public goods can boost the productivity of labor and overall productivity, and finds that government consumption as a share of GDP affects TFP positively. The **Migration rate** has a positive effect on total TFP growth. Regression 3 shows that a one-unit increase in migration rate leads to a 0.48 percent increase in TFP growth.

This result may come from the fact that migrants can boost competitiveness through innovation and bring new ideas, work in new occupations, and set up new businesses. Also, immigrants may be less risk averse than the locally born population in Saudi Arabia (Peri, G., 2012), which explains their participation in oil industry jobs.

On the other hand, table 5.17 shows that there are two variables which have a negative effect on TFP growth. The effect of **education** on TFP growth is negative and significant. Regression 3 shows that a one-unit increase in education (enrollment rate) leads to a 0.07 percent

decrease in TFP growth. This result is not consistent with economic theory. In The 2011 Trends in International Mathematics and Science Study (TIMSS), Saudi Arabia ranks below the international average in the measure of quality of education (World Economic Forum, 2013). This finding shows that the educational system may not prepare students for the present world of information technologies and global knowledge (Sala-i-Martin and Artadi, 2003). Also, it may emphasize that there is a lack of skills being taught that contribute in the production process in the private sector (Khan, 2005). The educational system in Saudi Arabia focuses more on replication of definitions and knowledge of facts and less on developing serious thinking and problem resolving capability. Moreover, most of the labor force is not equipped with skills needed for an occupation in the private sector. In fact, national workers in Saudi Arabia are prepared to work in governmental positions, where wages are not related to productivity. The qualifications of new entrants in Saudi Arabia to the labor market do not match the requirements of the private sector (Al-Yousif, 2004). In the same time, the private sector has more than 90 percent foreign workers; there are 98 percent in manufacturing, 97 percent in construction, and 93 percent in private services (Karl, 2007). This in turn can translate into lower levels of productivity for national workers who graduate from the public education. **High technology** has a negative effect on TFP growth. Regression 3 shows that a one-unit increase in high technology rate leads to a 0.59 percent decrease in TFP growth. Recent data from the World Bank suggests that while the USA spends about 2.8 percent of GDP on research and development (R&D), Saudi Arabia spends only 0.08 percent of GDP. The impact of technology on TFP growth may also refer to the weak share of foreign direct investment (FDI) and human capital in Saudi Arabia. Van der Eng (2013) indicates that FDI is a key channel for technology change but most of FDIs involve inappropriate technology for production in the AGCC countries.

The effect of lack for education, high technology, health, and FDI on TFP growth may confirm the low in growth of TFP in case of Saudi Arabia as reported in previous studies. This study confirms in the last section that TFP grows only by 0.7 percent and contributes to total GDP growth by 15 percent over the period 1990-2104. Al Awad (2010) shows that the success of the efforts to improve productivity and competitiveness is related to some important factors such that education system, health system, and research in knowledge and technology which are improving very slowly in Saudi Arabia and AGCC countries. This study suggests that the development is harmed by the negative effects of education and technology, and the lack of any effect of health and foreign direct investment (FDI) on productivity in Saudi Arabia.

Table 6.17 Saudi Arabia: OLS Estimations of Total TFP (Dependent Variable: TFP)

TFP growth	Regression1[10]	Regression2	Regression3	Regression4
Constant	-125.5178 (113.5872)	-43.80402 (10.7704)***	-42.56489 (9.991692)***	-34.01858 (11.01448)***
$infl$	-.0298046 (.099217)	.0338208 (.0847941)	------	-----
$migrant$	1.191432 (.618804)**	.5557278 (.2920183)*	.4848609 (.2578912)*	-----
edp	-.1144494 (.0808924)	-.0652489 (.0462288)	-.0777593 (.0425975)*	-----
$oilrev$	.7260754 (.2644343)**	.3938118 (.1160188)***	.4156746 (.0847891)***	-----
$trad$	.3125041 (.2176274)	-----	-----	.3119546 (.0922439)***
$life$	1.04878 (1.465252)	-----	----	------
$govc$	.6519294 (.2964682)**	.515679 (.1908995)**	.5447996 (.1605818)***	.399269 (.1944081)*
$highex$	-.4878325 (.4384901)	-.6584467 (.3644299)*	-.5930297 (.2785415)**	-.6874147 (.3248911)**
$manufim$	.7298485 (.4428586)	.7870768 (.3261555)**	.7893491 (.3088278)**	.3760392 (.363015)
fdi	.0087357 (.3413251)	-.1213408 (.3226666)	-----	-.5045946 (.3289007)
R-squared	0.7186	0.6765	0.6594	0.4193
Adjusted R-squared	0.5176	0.5147	0.5459	0.2664
Pro-F	0.0150	0.0072	0.0016	0.0498
Diagnostic Test				
Normality (Pro>z)[1]	0.8842	0.3234	0.3875	0.3201
Hetero (Prob> chi^2)[2]	0.8172	0.8003	0.9737	0.9589
AR (Prob>chi^2)[3]	0.9572	0.6695	0.7607	0.8314

Figure in (…) shows the value of standard deviation and *, **, and ***are the level of significance at 10%, 5%, and 1%. Diagnostic: normality, heteroscedasticity, autocorrelation, it cannot be rejected the null hypothesis at 10%. 1: residuals are normally distributed at 5%. 2: residual is constant variance at 5% .3: there is no serial correlation between residuals at 5%.

6.3.3. Kuwait: The determinants of TFP growth

Table 6.18 presents determinants of TFP growth in Kuwait. Regression 1 has a collinear relationship between independent variables. By using variance inflation factors (VIF), government

[10]The general regression1 includes variance inflation factor (VIF) for life and trade, where VIF=$\frac{1}{1-R^2} > 5$. So, I use three regressions to remove the collinear between variables.

consumption and oil revenues are correlated with each other in regression 1, a pattern which does not provide any useful information about TFP growth. So, this study uses the last three regressions that represent the result. **Oil revenues** rate have a positive effect on TFP growth. Regression 2 shows that a one-unit increase in oil revenues rate implies to a 0.37 percent increase in TFP growth. This finding emphasizes that the government in Kuwait uses oil revenue to finance infrastructure, improve education, develop cities, and manage the economy to make it more modern (Espinoza, 2012).

On the other hand, **education** (enrollment rate) has a negative effect on TFP growth. Regression 2 shows that a one-unit increase in education (enrollment rate) leads to a 0.41 percent decrease in TFP growth. This result is not expected with the huge spending on education in this country. However, this finding is supported by former studies. Kuwait ranks below the international average in the measure of quality of education (World Economic Forum, 2013). So, the educational system does not prepare students for the present world of information technologies and worldwide knowledge (Sala-i-Martin and Artadi, 2003). Moreover, a high percentage of nationals in labor force are employed in the public sector and they are paid wages higher than their productivity (Sassanpour, 1997). So, the educational system in Kuwait has focused on preparing students for public sector employment rather than private sector, which would increase productivity in the economy. **Health** also has a negative effect on TFP growth. Regression 2 shows that a one-unit increase in health (life expectancy) decreases TFP growth by 7.1 percent. This result is expected for Kuwait because the Kuwait oil fire generated a crowd of environmental crises, which resulted in pollution of the land, water, and air, and in turn affect individuals at the peak of their labor productivity and could have a negative effect on TFP growth (Acemoglu and Johnson,

2006; Sadiq and McCain, 2012)[11]. Also, this study emphasizes that oil countries are linked with more than unexpected shifts in levels of poverty and quality of the health (Karrl, 2007).

The negative effect of education and health and the lack of any effect of FDI and high technology on TFP growth in this study may confirm the low growth of total TFP in Kuwait. As discussed in the last section, this study confirms that TFP grows only by 2.4 percent and contributes to total GDP growth by 37 percent over the period 1990-2104. This study suggests that development in Kuwait is harmed by the negative quality of education and health effects, and the lack of any effect of high technology and foreign direct investment (FDI) on productivity.

11Seehttp://www1.american.edu/ted/kuwait.htm

Table 6.18 Kuwait: OLS Estimations of Total TFP (Dependent Variable: TFP)

TFP growth	Regression1[12]	Regression2	Regression3	Regression4
Constant	464.1761 (742.3237)	546.766 (289.2538)*	77.41353 (24.6839)***	77.78109 (40.23656)*
$infl$	-.0609785 (.2226585)	-----	.1668144 (.1462606)	.0586278 (.1527058)
$migrant$	.1478341 (1.183001)	-----	-----	-.5851329 (.4824107)
edp	-.2580294 (.313685)	-.414992 (.1227181)***	-.5932134 (.144837)***	-.4128554 (.1851757)**
$oilrev$	.8659113 (.6796771)	.3710002 (.198965)*	----	-----
$trad$	-.3478224 (.3257835)	-----	-.20571 (.1591437)	-----
$life$	-6.409444 (10.83703)	-7.101663 (4.073177)*	----	------
$govc$	.7327363 (.7828996)	-----	-----	-.0110594 (.2408414)
$highex$	-.32875 (.511556)	------	-.240898 (.4563616)	-----
$manufim$	.1149759 (.482592)	-----	----	-.3820556 (.3523993)
fdi	-1.65439 (3.909259)	-2.8828 (2.972321)	-3.918095 (2.619813)	-----
R-squared	0.6349	0.5866	0.5680	0.5409
Adjusted R-squared	0.3742	0.5039	0.4543	0.4201
Pro-F	0.0625	0.0010	0.0043	0.0073
Diagnostic Test				
Normality (Pro>z)[1]	0.05245	0.1185	0.4958	0.2343
Hetero (Prob> chi^2)[2]	0.2846	0.3217	0.4785	0.2087
AR (Prob>chi^2)[3]	0.1286	0.0605	0.0746	0.0875

Figure in (…) shows the value of standard deviation and *, **, and ***are the level of significance at 10%, 5%, and 1%. Diagnostic: normality, heteroscedasticity, autocorrelation, it cannot be rejected the null hypothesis at 10%. 1: residuals are normally distributed at 5%. 2: residual is constant variance at 5% . 3: there is no serial correlation between residuals at 5%.

6.3.4. Bahrain: The determinants of TFP growth

Table 6.19 presents determinants of TFP growth in Bahrain. Regression 1 shows a collinear relationship between independent variables. By using variance inflation factors (VIF), life

[12]The general regression1 includes variance inflation factor (VIF) for government consumption and oil revenues, where VIF=$\frac{1}{1-R^2} > 5$. So, I use three regressions to remove the collinear between variables.

expectancy, trade openness, migration, oil revenues, and government consumption, and manufacturing are correlated with each other in regression 1 which does not provide any useful information about TFP growth. So, this study uses the last three regressions that represent the result. **Education** has a positive effect on TFP growth. This result is consistent with economic theory. Regression 3 shows that a one-unit increase in enrolment rate leads to a 0.43 percent increase in TFP growth. **Health** also has a positive impact on TFP growth. Regression 2 shows that a one-unit increase in health index implies a 1.4 percent increase in TFP growth. This finding is supported by former studies. Murray and Chen (1992) show that higher life expectancy that is correlated with high human development and this in turn increases income per capita by increasing the TFP of available resources (Jayachandran and Lleras-Muney, 2008). According to the UNDPN 2013 report, Bahrain ranks 3rd among Arab countries and 48th among world countries with very high human development that reflects the improvement in the health and education (Malik, 2013). **Manufacturing** has a positive impact on total TFP growth. Regression 2 shows that a one-unit increase in manufacturing rate leads to a 0.41 percent increase in TFP growth. This finding confirms that the industrial sector in Bahrain works in good way. The information indicates that the aluminum sector is the second most important export; currently manufacturing contributes around 15 percentof GDP on average during the period 1990-2014 (World Bank, 2015). **Government spending** also has a positive effect on TFP growth. Regression 4 shows that a one-unit increase in government spending rate leads to a 1.04 percent increase in TFP growth. This finding supported by former studies, Rains (1989) and Hakura (2004) show that government can promote or hinder the process of economic growth depending upon the nature of its activities and Khan (1012) confirms that government consumption as a share of GDP can affect TFP growth positively. The **Migration rate** has a positive effect on total TFP growth. Regression 3 shows that

a one-unit in migration rate implies a 0.17 percent increase TFP growth. This result is because that the flow of labor benefits the host country by providing it with the skills it needs at lower cost (Al-Yousif, 2004). This finding alsomay come from the fact that migrants can boost competitiveness through on foreign technical and managerial expertise, innovation and development of new ideas, work in new occupations, and the set up new businesses (Peri, G., 2012).

On the other hand, **technology** has a negative effect on TFP growth. Regression 2 shows that a one-unit increase in technology rate implies to a 1.18 percent decrease in TFP growth. Recent data from the World Bank suggest that while the USA spends about 2.8 percent of GDP on research and development (R&D), Bahrain spends only 0.04 percent of GDP. Also, this result may refer to the weak share of foreign direct investment (FDI) in Bahrain. Van der Eng (2013) indicates that FDI is a key channel for technology change but most FDIs involve inappropriate technology for production in the AGCC countries.

Table 6.19 Bahrain: OLS Estimations of Total TFP (Dependent Variable: TFP)

TFP growth	Regression1[13]	Regression2	Regression3	Regression4
Constant	42.57359 (222.659)	-156.1847 (57.6598)**	-54.27823 (16.6268)***	-60.82534 (20.53461)***
$infl$	.1487077 (.1204977)	.021665 (.0731683)	-----	------
$migrant$	.4168634 (.3875863)	-----	.1755968 (.0999945)*	.4128236 (.165477)**
edp	.2397213 (.1714034)	.3942973 (.1429757)**	.4311758 (.1457021)***	.2433619 (.1662608)
$oilrev$	.1854599 .4548721	-----	-----	.0634601 (.1552667)
$trad$	-.1558693 (.1293505)	------	-----	-----
$life$	-1.128702 (2.895294)	1.486599 (.6811638)**	-----	------
$govc$	.7953994 (.4765196)	-------	-----	1.046174 (.3102638)***
$highex$	-.3705713 (.8060209)	-1.180366 (.6319778)*	-.6347109 (.6733109)	.537517 (.5980403)
$manufim$	.3192895 (.1591225)*	.4118662 (.0990261)***	.3255184 (.0773645)***	-----
fdi	-.0346467 .0887484	------	-.1245914 (.0775672)	-.1052917 (.0896465)
R-squared	0.7305	0.5956	0.6056	0.5604
Adjusted R-squared	0.5381	0.4891	0.5018	0.4139
Pro-F	0.0117	0.0025	0.0020	0.0124
Diagnostic Test				
Normality (Pro>z)[1]	0.1214	0.4854	0.1784	0.1837
Hetero (Prob> chi^2)[2]	0.0643	0.3852	0.4941	0.0650
AR (Prob>chi^2)[3]	0.1676	0.4743	0.9738	0.4591

Figure in (…) shows the value of standard deviation and *, **, and ***are the level of significance at 10%, 5%, and 1%. Diagnostic: normality, heteroscedasticity, autocorrelation, it cannot be rejected the null hypothesis at 10%. 1: residuals are normally distributed at 5%. 2: residual is constant variance at 5% .3: there is no serial correlation between residuals at 5%.

6.3.5. Qatar: The determinants of TFP growth

Table 6.20 presents determinants of TFP growth in Qatar. Regression 1 shows a collinear relationship between independent variables. By using variance inflation factors (VIF), life

[13]The general regression1 includes variance inflation factor (VIF) for life expectancy, trade openness, migration, oil revenues, and government consumption, and manufacturing, where VIF=$\frac{1}{1-R^2} > 5$. So, I use three regressions to remove the collinear between variables.

expectancy, manufacturing, government consumption, migration, trade openness are correlated with each other in regression 1 which does not provide any useful information about TFP growth. So, this study uses the last three regressions that represent the result. **Trade openness** has a positive effect on TFP growth. Regression 2 shows that a one-unit increase in trade openness rate leads to a 0.37 percent increase in TFP growth. Trade openness plays a positive role in enhancement of technological innovation with either direct or indirect benefits (Sachs et al., 1995). Also **Government spending** rate affects TFP growth positively. Regression 4 shows that a one-unit increase in government spending rate leads to a 0.41 percent increase in TFP growth. Government in Qatar makes investment decisions and the result of this study shows that public investment is productive. This result is supported by Rains (1989) and Hakura (2004) who point out that the government can promote or hinder the process of economic growth, depending upon the nature of its activities. However, this process still needs to be more efficient.

On the other hand**, inflation rate** has a negative effect on TFP growth. Regression 2 shows that a one-unit increase in inflation rate leads to a 0.21 percent decrease in TFP growth. Fischer (1993) and Sarel (1996) point out that high volatility in inflation reduces GDP growth by diminishing investment and growth of productivity. For example, Qatar has unstable inflation over the period 1990-2014 that causes volatility in exports and reduces purchasing for consumers; it also has a negative effect on output growth and TFP growth. Qatar is the highest in the fluctuation of inflation among the AGCC countries; the maximum reaches 30 percent and the standard deviation is 11 percent on average during 1990-2014.

The lack of any effect of the quality of education and health, manufacturing, high technology exports, and foreign direct investment raises important questions. For example, will Qatar continue to grow in the long run? Sala-i-Martin and Artadi (2003) suggest that the main

determinant of economic growth is the investment rate, and they point out that countries that grow more quickly are countries that invest an important fraction of their GDP. Countries that fail to grow are those that fail to invest. This study emphasizes that the fluctuation in TFP growth and GDP growth for Qatar are high among these countries, 13 percent and 19 percent, respectively, as result of the lack of investment, and the poor quality and efficiency in accumulation of labor and capital.

Table 6.20. Qatar: OLS Estimations of Total TFP (Dependent Variable: TFP)

TFP growth	Regression 1[14]	Regression2	Regression3	Regression4
Constant	-74.81236 (550.4452)	-39.70798 (20.75477)*	-42.7614 (21.40479)*	-45.38828 (23.32776)*
$infl$	-.1693172 (.1943244)	-.2146088 (.1049835)*	-.2144349 (.1120795)*	-.2154037 (.1041822)*
$migrant$	.2464208 (.4076918)	-----	------	.1185151 (.1931981)
edp	-.0964802 (.2543102)	-----	.0467999 (.1721107)	-----
$oilrev$	-.0655224 (.4830398)	-----	-----	----
$trad$	.3831044 (.3353123)	.3767585 (.201141)*	.354275 (.2577718)	.3426677 (.2013946)
$life$	.3430343 (7.399636)	-----	-----	-----
$govc$	.3517609 (.2896459)	.3608029 (.1820672)*	.4264478 (.177768)**	.4184101 (.1637444)**
$highex$	-75.33759 (86.12588)	-60.16547 (66.80996)	------	-71.82753 (68.15762)
$manufim$	.3076038 (.6684909)	.1021594 (.2603689)	-----	-----
fdi	-.1510833 .8616466	------	-.1681046 (.6093044)	-----
R-squared	0.4972	0.4683	0.4430	0.4744
Adjusted R-squared	0.1381	0.3284	0.2964	0.3361
Pro-F	0.2807	0.0246	0.0358	0.0224
Diagnostic Test				
Normality (Pro>z)[1]	0.0919	0.0666	0.1268	0.17896
Hetero (Prob> chi^2)[2]	0.1852	0.0517	0.0525	0.2503
AR (Prob>chi^2)[3]	0.1903	0.2181	0.1872	0.1669

Figure in (…) shows the value of standard deviation and *, **, and ***are the level of significance at 10%, 5%, and 1%. Diagnostic: normality, heteroscedasticity, autocorrelation, it cannot be rejected the null hypothesis at 10%. 1: residuals are normally distributed at 5%. 2: residual is constant variance at 5% .3: there is no serial correlation between residuals at 5%.

6.3.6. UAE: The determinants of TFP growth

Table 6.21 presents determinants of TFP growth in UAE. Regression 1 shows a collinear relationship between independent variables. By using variance inflation factors (VIF), life

[14]The general regression1 includes variance inflation factor (VIF) for life expectancy, manufacturing, government consumption, migration, trade openness, where VIF=$\frac{1}{1-R^2} > 5$. So, I use three regressions to remove the collinear between variables.

expectancy, trade openness, government consumption, education, migration, and foreign direct investment are correlated with each other in regression 1, which does not provide any useful information about TFP growth. So, this study uses the last three regressions that represent the result of this study. **Migration** rate have a positive and statistically significant effect on TFP growth but with a small coefficient. Regression 3 shows that a one-unit increase immigrants rate implies to a 0.65 percent increase in TFP growth. The inflows of immigrants may increase market size and increase consumption for final goods and intermediate inputs in the UAE. On other hand, **health** index has a negative effect on TFP growth. Regression 3 shows that a one-unit increase in health index leads to a 3.17 percent decrease in TFP growth. This result is supported by previous studies; Al Nahyan (2012) suggests that diabetes and cancer are the main causes of death in the UAE, and statistics have indicated that the UAE has one of the highest rates of diabetes in the world that affect individuals at the peak of their capita productivity and could have a large negative impact on TFP growth (Acemoglu and Johnson, 2006). In addition, Karrel (2007) shows that oil-exporting countries are related with more than unexpected shifts in levels of poverty and low productivity due to chronic overcrowding.

These results show the lack of any investment that is considered a key determinant of output growth. Foreign direct investment, manufacturing exports, high technology, and education do not appear to contribute to TFP growth. The development in the UAE is harmed by the negative of effect of quality health care and the lack of any effect of education, government, technology, manufacturing, and foreign direct investment (FDI) on productivity. These results may refer to a rapid transformation that leads to failure in implementation of some reforms to support economic diversification by decreasing reliance on oil revenues.

Table 6.21 UAE: OLS Estimations of Total TFP (Dependent Variable: TFP)

TFP growth	Regression1[15]	Regression2	Regression3	Regression4
Constant	178.3516 (444.7207)	207.6882 (62.60451)***	186.0929 (58.16545)***	184.2755 (57.94271)***
$infl$	-.0721469 (.2167928)	.1584023 (.1599466)	----	----
$migrant$	1.62399 (.6931957)	.7383654 (.3620836)*	.6594475 (.3435827)*	.6117942 (.3386227)*
edp	.5915959 (.3370024)	-------	-----	----
$oilrev$	.4450567 (.5237743)	-----	.2164693 (.2330092)	----
$trad$	-.2488811 (.2220178)	------	-----	----
$life$	-4.633657 (6.139017)	-3.63323 (1.0867)***	-3.308455 (.996324)***	-3.174592 (.9826302)***
$govc$	-.0283658 (.4955853)	----	-----	-----
$highex$	1.49036 (.7031085)	1.050965 (.714892)	.9747969 (.7133672)	.9804504 (.7110118)
$manufim$	-.0012013 (.2410434)	------	-----	-----
fdi	.6367344 (1.068793)	-----	------	------
R-squared	0.5803	0.3784	0.3749	0.3479
Adjusted R-squared	0.2574	0.2541	0.2499	0.2548
Pro-F	0.1596	0.0412	0.0433	0.0270
Diagnostic Test				
Normality (Pro>z)[1]	0.2974	0.8475	0.7994	0.9055
Hetero (Prob> chi^2)[2]	0.3569	0.8832	0.9679	0.8077
AR (Prob>chi^2)[3]	0.0934	0.2861	0.2077	0.4078

Figure in (…) shows the value of standard deviation and *, **, and ***are the level of significance at 10%, 5%, and 1%. Diagnostic: normality, heteroscedasticity, autocorrelation, it cannot be ejected the null hypothesis at 10%. 1: residuals are normally distributed at 5%. 2: residual is constant variance at 5% .3: there is no serial correlation between residuals at 5%.

6.3.7. Oman: The determinants of TFP growth

Table 6.22 shows four regressions; the first regression includes collinear and serial correlation between variables. By using variance inflation factors (VIF), life expectancy, education, migration, government consumption, and trade openness are correlated with each other

[15]The general regression1 includes variance inflation factor (VIF) for life expectancy, trade openness, government consumption, education, migration, and foreign direct investment, where VIF=$\frac{1}{1-R^2} > 5$. So, I use three regressions to remove the collinear between variables.

in regression 1, which does not provide any useful information about TFP growth. So, the last three regressions represent the result of this study. In regression 3, **high technology** has a positive effect on TFP growth. Regression 3 shows that a one-unit increase in high technology rate leads to a 0.67 percent increase in TFP growth. Technology sector in Oman has a positive effect on TFP growth because of that Oman spends on research and development twice what spending Saudi Arabia and Bahrain by 0.17 percent on average. This finding is low but it is the best among AGCC countries where high technology exports reach a maximum of 3.9 percent of GDP during 1990-2014.). **Oil revenue** has a positive effect on TFP growth. Regression 4 shows that a one-unit increase in oil revenues implies to a 0.33 percent increase in TFP growth. This finding emphasizes that government in Oman uses oil revenue to finance infrastructure, improve education, develop cities, and manage the economy to make it more modern (Espinoza, 2012). **Trade openness** has a positive effect on TFP growth. Regression 4 shows that a one-unit increase in trade openness rate leads to a 0.15 percent increase in TFP growth. Trade openness plays a positive role in enhancement of technological innovation with either direct or indirect benefits (Sachs et al., 1995).

On the other hand, **Manufacturing** has a negative impact on TFP growth. Regression 2 shows that a one-unit increase in migration rate leads to a 0.32 percent decrease in TFP growth. This finding confirms that manufacturing is still related to oil revenues and the efforts of diversification are not fully independent from oil in Oman (Al Awad, 2010). Also, some kinds of capital that are made in Oman (motor vehicle, aircraft, and electrical equipment) are not fully productive because citizens workers are not educated enough (Espinoza, 2012). In regression 4, **migration rate** has a negative effect on TFP growth. Regression 4 shows that a one-unit increase in migration rate leads to a 0.77 percent decrease in TFP growth. The labor market in Oman is the smallest among AGCC countries and most of workers are foreign workers. Foreign workers work

in agriculture and fishing, retail trade and wholesale, restaurants, and hotels that do not require any skills. These jobs represent 88 percent of the total private sector and workers in them are 95 percent foreign workers (Das, K. C., &Gokhale, N., 2010). **Foreign direct investment** has a negative effect on TFP growth. Regression 4 shows that a one-unit increase in FDI rate leads to a 0.98 percent decrease in TFP growth. Van der Eng (2013) indicates that FDI is a key channel for technology change but most FDIs involve inappropriate technology for production in the AGCC countries. Also, because of that, foreign-owned firms employee most of the skilled workers and hence deprive local firms of their services. The level of this investment in Oman is low and the economy may not be sufficiently diversified or developed to receive benefits from foreign investment (Aitken and Harrison, 1999). Finally, this study suggests that development is harmed by the negative effects of manufacturing, FDI, and migration rate, and the lack of any effect of education indicator, and health indicator on TFP growth in Oman.

Table 6.22. Oman: OLS Estimations of Total TFP (Dependent Variable: TFP)

TFP growth	Regression1[16]	Regression 2	Regression 3	Regression 4
Constant	7.288157 (189.4485)	-5.521665 (17.0916)	9.050468 (33.24883)	-2.202325 (5.972253)
$infl$	.0429993 (.0755905)	.0120364 (.0695382)	----	-----
$migrant$	-.83732 (.5998611)	-----	-----	-.7779247 (.2399171)***
edp	.1926911 (.4645769)	-.0305644 (.0627375)	----	-----
$oilrev$	.2010013 (.2322351)	.2147737 (.2148501)	.2242413 (.1886704)	.3333727 (.1396598)**
$trad$	.1252225 (.1132602)	-----	-----	.1507749 (.0810041)*
$life$	-.3439809 (3.184232)	-----	-.2238742 (.3375419)	-----
$govc$	.3760118 (.6245746)	.0632881 (.3889601)	.0242836 (.3609117)	-----
$highex$	.6222835 (.3431948)	.6754926 (.2655356)**	.6763538 (.2371276)***	----
$manufim$	-.3139083 (.2399053)	-.3208983 (.1845897)*	-.3292824 (.1797665)*	-----
fdi	-.6151359 (.6267228)	-----	-----	-.9857946 (.3901371)**
R-squared	0.6961	0.4877	0.6187	0.5266
Adjusted R-squared	0.4790	0.4877	0.5183	0.4320
Pro-F	0.0233	0.0043	0.0015	0.0035
Diagnostic Test				
Normality (Pro>z)[1]	0.2731	0.7570	0.8680	0.1306
Hetero (Prob> chi^2)[2]	0.9631	0.9719	0.8681	0.6549
AR (Prob>chi^2)[3]	0.0052	0.3841	0.3396	0.3226

Figure in (…) shows the value of standard deviation and *, **, and ***are the level of significance at 10%, 5%, and 1%. Diagnostic: normality, heteroskedasticity, autocorrelation, it cannot be rejected the null hypothesis at 10%. 1: residuals are normally distributed at 5%. 2: residual is constant variance at 5% .3: there is no serial correlation between residuals at 5%.

6.3.8. Jordan: The determinants of TFP growth

Table 6.23 presents determinants of TFP growth in Jordan. By using variance inflation factors (VIF), life expectancy, migrants, subsidies, manufacturing, education, and government

[16]The general regression1 includes variance inflation factor (VIF) for life expectancy, education, migration, government consumption, and trade openness, where VIF=$\frac{1}{1-R^2} > 5$. So, I use three regressions to remove the collinear between variables.

consumption are correlated with each other in regression 1 which does not provide any useful information about TFP growth. So, this study uses three specific regressions to remove the collinearity between independent variables. In regression 2, **inflation rate** has a negative effect on TFP growth. Regression 2 shows that a one-unit increase in inflation rate leads to a 0.25 percent decrease in TFP growth. Fischer (1993) and Sarel (1996) point out that high volatility in inflation reduces GDP growth by diminishing investment and growth of productivity. For example, Jordan has unstable inflation over the period 1990- 2014 that causes volatility in exports, reduces purchasing for consumers and has a negative effect on output and TFP growth (Sweidan, 2004). Jordan has a high fluctuation of inflation; the maximum reaches 20 percent and the standard deviation is 4.5 percent on average during 1990-2014. **Health** indicator has a negative impact on TFP growth. Regression 2 shows that a one-unit increase in health indicator leads to a 2.35 percent decrease in TFP growth. Some health systems in Jordan fail to provide the necessary services and some suffer from inefficient provision of services for all people. Also, because of rising costs of health care delivery; a 30 percent of Jordan's population does not have formal 'health insurance' and services are delivered through an extensive network of public hospitals that is still quality low (World Health Organization, 2006). So, the health system could have a negative effect on labor productivity and then on TFP growth (Acemoglu and Johnson, 2006). Also, **Subsidies rate** has a negative impact on TFP growth. Regression 3 shows that a one-unit increase in subsidies rate leads to a 0.22 percent decrease in TFP growth. Subsidies as fraction of GDP and total government spending are widely recognized as costly and inequitable (Abed and Davoodi, 2003).

On the other hand, the **foreign direct investment** (FDI) has a positive effect on TFP growth. Regression 3 indicates that a one-unit increase in FDI is associated with an estimated 0.24 percent increase in TFP growth. This result is higher compared to the study of Gehringer and others (2013) that finds that a one-unit increase in FDI, in 17 European countries, increases TFP by only 0.122

percent. So, Obalade (2014) suggests that FDI in Jordan contributes efficiently in reducing unemployment and foreign companies (Chinese companies) can hire local workers and create new jobs that lead to new sources of income. **Manufacturing** also has a positive impact on total TFP growth. Regression 2 shows that a one-unit increase in manufacturing rate leads to a 0.22 percent increase in TFP growth. This finding confirms that the industrial sector in Jordan works in a good way. For example, petroleum refining and other nonmetallic minerals contribute at 39 percent and 13 percent, respectively, while industrial chemicals and iron and steel contribute at 8 percent and 10 percent, respectively, to gross output manufacturing (Ministry of Financial in Planning and International Cooperation in Jordan, 2015). The information indicates that currently manufacturing contributes around 17 percent of GDP on average during the period 1990-2014 (World Bank, 2016). **Education** indicator also contributes positively to TFP growth. Regression 4 shows that a one-unit increase in education indicator leads to a 0.38 percent increase in TFP growth. Jordan requires students to be computer educated and able to apply their studies in computers, especially the mathematical and scientific courses. According to international standards, the secondary education program is accepted in first-class universities, thus, Jordan ranks number one in the Arab World in education (Malik, 2013). Jajri (2007) suggests that human resource development and human resource management may affect productivity positively. These results show that FDI, manufacturing, education, inflation rate, and subsidies can explain changes in TFP growth in Jordan over the period 1990-2014.

Table 6.23 Jordan: OLS Estimations of Total TFP (Dependent Variable: TFP)

TFP growth	Regression1[17]	Regression 2	Regression 3	Regression 4
Constant	183.5184 (170.3072)	126.1148 (61.29707)*	-42.05263 (64.53557)	-17.217 (23.87537)
$infl$	-.0403077 (.1879539)	-.2516001 (.1394937)*	-.1092582 (.1465407)	----
$migrant$	1.409005 (.8178803)	-----	----	----
edp	-.1052086 (.3684985)	.3579487 (.2261463)	----	.3849066 (.1650589)**
$subsidies$	-.0569234 (.1957548)	-----	-.220451 (.1076812)*	-.1785808 (.0773543)**
$trad$	-.0711942 (.0893268)	-----	----	-----
$life$	-2.775862 (2.731135)	-2.354722 (.9565822)**	.8882608 (.8914838)	-----
$govc$	-.7934342 (.782382)	-----	-.8344763 (.5119456)	-.5389252 (.5802504)
$highex$	-.3823712 (.3592542)	-.2623026 (.2871215)	-----	-.2538418 (.3164876)
$manufim$	-.0236251 (.1861632)	.2264425 (.1225163)*	----	-----
fdi	.0312756 (.1958396)	-----	.2437112 (.122203)*	----
R-squared	0.5856	0.4554	0.4274	0.3820
Adjusted R-squared	0.2897	0.3120	0.2767	0.2584
Pro-F	0.1180	0.0299	0.0446	0.0392
Diagnostic Test				
Normality (Pro>z)[1]	0.00222	0.14817	0.06978	0.0825
Hetero (Prob> chi^2)[2]	0.9354	0.9142	0.9153	0.8039
AR (Prob>chi^2)[3]	0.2302	0.2285	0.8032	0.8883

Figure in (…) shows the value of standard deviation and *, **, and ***are the level of significance at 10%, 5%, and 1%. Diagnostic: normality, heteroscedasticity, autocorrelation, it cannot be rejected the null hypothesis at 10%. 1: residuals are normally distributed at 5%. 2: residual is constant variance at 5% .3: there is no serial correlation between residuals at 5%.

6.3.9 Comparing between AGCC countries and Jordan

Table 6.24 shows the difference among these countries in the impact of independent variables on TFP growth. But, there are some variables that are common among AGCC countries.

[17]The general regression1 includes variance inflation factors (VIF) for life expectancy, migration, subsidies, manufacturing, education, and government consumption, where VIF=$\frac{1}{1-R^2} > 5$. So, I use three regressions to remove the collinear between variables.

These countries have had stable inflation and the benefit of manufacturing exports, oil revenues, trade openness, and government consumption size. However, the negative effects of human capital and technology can explain the stagnation in TFP growth. Sala-i-Martin and Artadi (2003) show that investment rate is the key determinant of output growth and point out that countries which invest a substantial fraction of their GDP grow more quickly and that those which fail to grow are countries that fail to invest. So, the lack of FDI has a direct negative effect on productive investment in the AGCC countries. Poor quality education, health, FDI, and technology exports, all of which are possible indicators of a resource effect, could explain the disappointing TFP growth in AGCC countries.

On the other hand, in Jordan, the contribution of education, FDI, and manufacturing is positive but low to TFP growth. This finding reflects the Jordanian government efforts in improving and encouraging rates of investments and also it reduces the role of the public sector in providing more space to the private sector in leading the development of the capital market to facilitate the investment process (Obalade, 2014).This finding is the opposite of the policies that are applied in the AGCC countries through crowding out of the public sector for the private sector. However, the negative effects of subsides, health, and inflation rate may explain the disappointing TFP growth in Jordan. Jordan seems better than AGCC countries in foreign direct investment, manufacturing exports, and education because growth in GDP in Jordan is not robustly correlated with government consumption size and oil revenues as in the AGCC countries. For example, a one-unit increase in FDI leads to a 0.24 percent increase in TFP growth in Jordan compared to 17 European countries in which TFP growth increases by 0.122 percent (Gehringer and others, 2013).The contribution of government spending rate and oil revenues rate is of benefit to

productivity in the short term but in the long term; it will harm the economy in the AGCC countries through weak development of the private sector and its ability to absorb new domestic laborers.

Table 6.24 AGCC countries and Jordan: OLS Estimations of Total TFP (determinants of TFP as signs)

TFP growth	Saudi Arabia	Kuwait	Bahrain	Qatar	UAE	Oman	Jordan
$infl$				-			-
$migrant$	+		+		+	-	
edp	-	-	+				+
Oil revenues	+	+				+	
$trad$	+			+		+	
$life$		-	+		-		-
$govc$	+		+	+			
$highex$	-		-			+	
$manufim$	+		+			-	+
fdi						-	+
$subsidies$							-

6.4 Determinants of TFP in pool of AGCC countries and Jordan

Panel data models describe the individual's behavior both across time series and across individuals. They have both time series and cross-sectional dimensions. This study includes 175 individuals observed at 25 set time periods *(t).*This method assumes correlation (clustering) over time for a given individual, with independence over other individuals. There are three types of models, Pooled OLS Model, Fixed Effects Model, and Random Effects Model. The pooled model specifies constant coefficients, the usual assumptions for across-sectional analysis.

$$TFP_{it} = \gamma_{0i} + \gamma_{1i} manufim_{it} + \gamma_{2i} govc_{it} + \gamma_{3i} highex_{it} + \gamma_{4i} edp_{it} + \gamma_{5i} trad_{it} + \gamma_{6i} infl_{it} + \gamma_{7i} fdi_{it} + \gamma_{8i} life_{it} + \gamma_{9i} oilrev_{it} + \gamma_{10i} migrant_{it} + \mu_{it} \quad (6\text{-}2)$$

6.4.1 Pooled OLS Regression Model

This process pools all countries together as one country and runs the regression model, neglecting the cross-section and time series nature of the data. However, the major problem with this model is that it does not distinguish between the various countries. This model assumes that

there is unobserved heterogeneity across individuals. Tables 6.25 shows the pooled OLS estimator that is obtained by stacking the data over *i* individual and *t* period into one long regression with NT observations and estimating it by OLS in both cases: AGCC countries and Jordan as one country and AGCC countries as one country. A higher value of **inflation** is associated with higher value of TFP growth in both cases of the pooled countries. It implies that a one-unit increase of inflation rate leads to 0.22 percent higher in TFP growth. Sarel (1996) shows that there is a positive correlation between inflation and economic growth if the inflation is lower than 8 percent. **Government spending** has a positive effect on TFP growth in both cases of the pooled countries. This implies that a one-unit increase in government spending leads to 0.32 percent higher in TFP growth. However, **foreign direct investment** has a positive impact on TFP growth in the case of AGCC countries and Jordan. It means that a one-unit increase in foreign direct investment leads to 0.26 percent higher in TFP growth.

The inflation rate and government-spending rate tend to be the same for both sets of countries, however, foreign direct investment plays an important role only when Jordan is added to this group of countries. This result reflects an important role for foreign direct investment in Jordan economy and that it is lacked in the AGCC countries.

Table 6.25. Estimates of total TFP by Pooled OLS Regression Model

TFP growth	AGCC countries and Jordan	AGCC countries
Constant	-36.54471 (34.00606)	-40.80292 (38.42978)
$infl$	.2318805 (.0683116)***	.2189852 (.0759927)***
$migrant$	.035478 (.0404407)	.0221265 (.0437103)
edp	-.0771018 (.0760884)	-.092666 (.0830795)
$oilrev$	.0250489 (.0680475)	.0453222 (.0758435)
$trad$	.0046753 (.0281777)	.0304667 (.0337631)
$life$	.4371168 (.5041959)	.4883062 (.5685515)
$govc$	.3229626 (.0848479)***	.3732747 (.0944031)***
$highex$	.0339645 (.2414489)	-.0398468 (.2715882)
$manufim$	-.0073016 (.0544457)	-.1719292 (.1266408)
fdi	.2699183 (.1588122)*	.3031568 (.1937239)
R-squared	0.1472	0.1719
Adjusted R-squared	0.0949	0.1119
Pro-F	0.0030	0.0028

Figure in (…) shows the value of standard deviation and *, **, and ***are the level of significance at 10%, 5%, and 1%.

6.4.2 Fixed Effects Model

This method allows for heterogeneity or individuality among countries by allowing each individual to have a different intercept term, but the intercept does not vary over time, that is it is time invariant[18]. Table 6.26 shows the estimation of equation 6.2 for the Fixed Effects Model in both cases: AGCC countries and Jordan as one country and AGCC countries as one country. This result for **inflation rate** and **government spending** share tends to be the same as the result of the

[18] The equation for the fixed effects model is $Y_{it} = a_i + X'_{it}\beta + u_{it}$, where Y_{it} is dependent variable, X_{it} is one independent variable for each country, and $a_i = z_i'\alpha$ embodies all the observable effects and specifies an estimable conditional mean and this intercept is unknown for each country.

Pooled OLS estimator. For example, each additional one-unit of inflation above the average leads to 0.22 percent higher TFP growth and each additional one-unit of government consumption above the average leads to 0.26 percent higher TFP growth.

Education has a negative effect on TFP growth in the case of AGCC countries. It means each additional one-unit in enrollment rate in school above the average leads to 0.13 percent lower TFP growth. This finding is not consistent with economic theory. It may emphasize that there is lack of skills being taught that contribute in the production process (Khan, 2005). Also, this study shows that the problem with education is not in enrollment rates but the quality of the education system and because it is unconnected to the needs of labor market (Sala-i-Martin and Artadi, 2003).

In the case of AGCC countries only, **manufacturing exports** appears to have a negative effect on TFP growth. This process means that each additional unit percent in manufacturing exports above the average for an individual leads to 0.29 percent lower TFP growth. This may be because the kind of capital that accumulates in aircraft, computer, equipment, and electrical equipment is not fully produced by a labor force that is not educated enough in the AGCC countries (Espinoza, 2012).

Rho is the proportion of variation due to the individual specific term. This regression has a small proportion (26 and 19 percent) explained by the individual specific term with the remainder due to idiosyncratic error. The R^2-squares show the Random Effects estimator in both cases of countries can explain 15 percent and 18 percent, respectively of the variation within one country, 0.9 percent and 0.1 percent, respectively of the variation between countries, and 7.3 percent and 12 percent, respectively of overall variation.

Table 6.26. Estimations of Total TFP by Fixed Effect Model

TFP growth	AGCC countries and Jordan	AGCC countries
Constant	-4.139229 (41.47231)	22.74639 (48.60387)
$infl$	.2237209 (.071212)***	.2079478 (.0784691)***
$migrant$	.142372 (.1630549)	.0623285 (.1774559)
edp	-.1049949 (.0878136)	-.1318408 (.0792963)*
$oilrev$	.0490759 (.1116997)	.056026 (.1186539)
$trad$	.0068243 (.0354345)	.0407448 (.0420643)
$life$	.0233304 (.6523252)	-.3598127 (.7553223)
$govc$	.2630641 (.1017257)**	.2919416 (.1087336)***
$highex$	.2239907 (.2462866)	.2029802 (.2787022)
$manufim$	-.1220795 (.0931532)	-.290593 (.1367393)**
fdi	.2540293 (.1565438)	.1683371 (.190787)
R^2-within	0.1557	0.1864
R^2-between	0.0093	0.0011
R^2-overall	0.0738	0.1250
Sigma_u	4.5507912	3.8678222
Sigma_e	7.5735066	7.9371784
rho	.26527873	.19189673
Pro-F	0.0024	0.0016

Figure in (…) shows the value of standard deviation and *, **, and ***are the level of significance at 10%, 5%, and 1%.

6.4.3 Random Effects Model

This model assumes that the individuals have a common mean value for the intercept, allows slopes to vary over an individual, and also the error term of each country is not correlated with the independent variables, which allows for time-invariant variables to play a role as explanations[19]. Table 6.27 shows the result of the Random Effects Model for AGCC countries and

[19] $Y_{it} = a + X'_{it}\beta + \varepsilon_{it} + u_i$, where ε_{it} is error term for each country error and u_i is a group-specific random element, similar to ε_{it} except that for each group.

Jordan as one group and AGCC countries as one group. This result is similar to the result of the Pooled OLS Model. The result of rho confirms that there is no specific effect among these countries. Also, lambda is small, so the Random Effects Model estimates are much closer to the Pooled OLS Model than to the Fixed Effects Model estimates. The R^2-squares show the Random Effects estimator in both cases of countries can explain 12 percent and 14 percent, respectively, of the variation within a country, and 46 percent and 41 percent, respectively, of variations between countries, and 14 percent and 17 percent, respectively, of overall variation.

Table 6.27. AGCC countries and Jordan: Estimations of Total TFP by Random Effects Model

TFP growth	AGCC countries and Jordan	AGCC countries
Constant	-36.54471 (34.00606)	-40.80292 (38.42978)
$infl$	.2318805 (.0683116)***	.2189852 (.0759927)***
$migrant$	.035478 (.0404407)	.0221265 (.0437103)
edp	-.0771018 (.0760884)	-.092666 (.0830795)
$oilrev$	.0250489 (.0680475)	.0453222 (.0758435)
$trad$	.0046753 (.0281777)	.0304667 (.0337631)
$life$	.4371168 (.5041959)	.4883062 (.5685515)
$govc$	.3229626 (.0848479)***	.3732747 (.0944031)***
$highex$	.0339645 (.2414489)	-.0398468 (.2715882)
$manufim$	-.0073016 (.0544457)	-.1719292 (.1266408)
fdi	.2699183 (.1588122)*	.3031568 (.1937239)
R^2-within	0.1208	0.1484
R^2-between	0.4697	0.4192
R^2-overall	0.1472	0.1719
sigma_u	0	0
sigma_e	7.5735066	7.9371784
rho	0.0009	0.0009
Prob> chi2	0.0017	0.0014
theta	0.0009	0.0009

Figure in (…) shows the value of standard deviation and *, **, and ***are the level of significance at 10%, 5%, and 1%.

6.4.4 Comparing the three models and discussion

Comparing the previous methods types, this study applies the **Hausman Test** to test which model, the Fixed Effect Model or the Random Model, is appropriate to accept (Green, 2008)[20]. The null hypothesis is that the Random Model is appropriate, and the alternative hypothesis is that the Fixed Effect Model is appropriate. So, if *p*-value is statistically significant, one should use the Fixed Effect Model, otherwise use the Random Effect Model. And then this study compares the result of the Huasman Test with the Pooled OLS Model. Also, I can double test whether the Random Effects Model or the Pooled OLS Model is appropriate by using the Bruesch and Pegan LM Test. The null hypothesis is that Pooled OLS Model is appropriate; the alternative hypothesis is that Random Effects Model is appropriate.

The Huasman test shows significant differences between the coefficients for the Fixed Effects and the Random Effects Models. Therefore, this study needs to use the Fixed Effects Model for both cases ,i.e., for AGCC countries and Jordan and only AGCC countries. Also, the Pasaran CD (cross-sectional dependence) Test shows there is no serial correlation in residual[21] (Pearson and Lee, 1908). The Bruesch Pegan Test shows that the Pooled OLS model is more appropriate than the Random Effects Model in both sets of countries.

Finally, comparing the Fixed Effects model versus Pooled OLS model, this study is interested in differences across groups and then it can test the null hypothesis that the constant terms in the Fixed Effects model are all equal (H_0: $a_1 = a_2 = \cdots = a_n = \alpha$)[22]. When this study runs the Fixed Effects regression for the AGCC countries with Jordan and without Jordan, it gets the

20 See Green, 2008, chapter 9: The Hausman Test tests whether there is significant difference between the Fixed Effects and Random Effects estimators. The Hausman Test statistic can be calculated only for the time-varying repressors where H=$(\tilde{\beta}_{RF} - \tilde{\beta}_{FE})(V(\tilde{\beta}_{RF}) - V(\tilde{\beta}_{FE}))((\tilde{\beta}_{RF} - \tilde{\beta}_{FE})$.

21 The null hypothesis is: there is no serial correlation, the alternative hypothesis is: there is serial correlation. The second diagnostic Test is to test whether residuals are heteroskedastic.

22 This $Y_{it} = a_i + X'_{it}\beta + u_{it}$ indicates to the Fixed Effects equation.

result is significant, F test, *prob.>F=0.0044* and *prob.>F=0.036*, respectively (Green, 2008)[23]. It implies that the null hypothesis is rejected that the intercepts do not take a common value in both cases of countries. This study concludes that the Fixed Effects model is better than the Pooled OLS model. Indeed, in the sample of six AGCC countries I find strong evidence in the data of considerable homogeneity on this relationship across these countries.

Now, since it appears that the Fixed Effects Model is most appropriate among these models. This study also can re-estimate the model and use the option of **'robust'** to control for heteroscedasticity because it speeds up exploratory work between dependent variable and independent variables. This result in table 6.28 is similar to the result of the Fixed Effects model in table 6.26. In general, this number of *prob.-F<0.05* shows that the Fixed Effects Model is appropriate and all the coefficients are different than zero. *R-square* shows that 24 percent and 27 percent of variance of TFP growth is explained by independents variables in both sets of countries. Also, *Adj. R-square* shows the same as R-square but is adjusted by the number of cases and number of variables. When the number of variables is small and the number of cases is very large, then the *Adj. R-square* is closer to *R-square.*

The Fixed Effects model is important because it analyzes the effect of variables that vary over time and it explores the relationship between dependent variable and independent variables within countries. In the last section, each country has its own individual characteristics that may or may not affect the independent variables (migrants, trade, oil revenues, education, health, government consumption, manufacturing sector, high technology, and inflation). When using the Fixed Effects model it assumes that something within the individual may affect or bias the

[23] $F(n-1, nT-n-K) = \frac{(R^2_{FIXED} - R^2_{pooled})/(n-1)}{(1-R^2_{fixed})/(nT-n-K)}$, where fixed indicates the dummy variable model and Pooled OLS indicates the Pooled model with only a single overall constant term (Green, 2008, chapter 9, page 197).

independent variables and the model needs to compensate for this. So, this is the rationale behind the assumption of the correlation between a country's error term and independent variables. The Fixed Effects model removes the impact of those time-invariant characteristics so this study can assess the net effect of the independent variables on the pooled TFP growth.

Table 6.28 shows the net effect of independent variables on pooled TFP growth. The higher value of **inflation** rate is associated with higher values of TFP growth for the AGCC countries with and without Jordan. It means that a one–unit increase in inflation rate leads to a 0.20 percent and 0.22 percent increase in TFP growth in the AGCC countries and in the AGCC countries with Jordan, respectively. Since the inflation rate in AGCC countries is 4.9 percent and in the AGCC countries with Jordan is 4.94 percent, this result is supported by former studies; Sarel (1996) finds that there is a positive correlation between inflation and economic growth if the inflation is lower than 8 percent. Espinoza (2012) suggests that the positive effect of inflation rate on TFP growth reflects the stability in inflation rate in AGCC countries that benefits the economy and is favorable to exports for AGCC countries. Also, the higher value of **government spending** share is associated with higher values of TFP growth in both sets of countries. It means that a one-unit increase in government spending rate leads to a 0.29 percent and 26 percent increase in TFP growth in the AGCC countries and in the AGCC countries and Jordan, respectively. This finding is supported by former studies; Rains (1989) shows that government can promote or hinder the process of economic growth depending upon the nature of its activities and Khan (1012) confirms that government spending as a share of GDP can affect TFP growth positively. The positive effect of government size is because the governments in the AGCC countries are clearly a driving force in the economy. These countries receive a large income from oil revenues and invest this income in the infrastructure, education, and health. However, the large spending may, in the long run, cause

crowding out of opportunities in private sector investment and leads to shrinkage in its growth. This argument suggests that TFP growth in the long run may be hurt by rent-seeking activities and then the private sector becomes unproductive.

On the other hand, the higher value of **education** index is associated with a lower value of TFP growth for the AGCC countries compared to Jordan in table 6.23. It means that a one-unit in education index leads to a 0.13 percent decrease in TFP growth in the AGCC countries, compared to Jordan that increases by 0.38 percent in TFP growth. This finding is supported by former studies that I mentioned in Saudi Arabia and Kuwait. The Middle East countries rank below the international average in the measure of quality of education (World Economic Forum, 2013). The negative effect of education on TFP growth reflects the quality of education in the AGCC countries. The quality of the educational system is low and sometimes the curriculum is unrelated to the needs of market labor and demand-side requirements in these countries (Sala-i-Martin and Artadi, 2003). In fact, the labor markets in the AGCC countries are oriented to the public sector rather than the private sector because the public sector offers more attractive wages and benefits in addition to social status and job security. So, the qualifications of new entrants to market labor do not match the requirements of the private sector that needs specific skills. This results in a mismatch between public sector and private sector in employment for nationals. Moreover, the quality of institutions can play an important role in regulation-patterned forms of social behavior and interaction among humans to achieve future vision in economic gains. These institutions in AGCC countries still lack qualifications to match the requirements future development (Makdisi, Fattah, and Limam, 2005). The higher value of **manufacturing** share is associated with a lower value of TFP growth for the AGCC countries compared to Jordan in table 6.23. It means that a one-unit in manufacturing rate leads to a 0.29 percent decrease in TFP growth in the AGCC

countries. This result emphasizes that some industries, such as aircraft, computer, equipment, and electrical equipment, are not fully productive in the AGCC countries because the labor force does not have high enough skills Espinoza, 2012). Also, the level of investment in AGCC countries is low and the economy may not be sufficiently diversified. For example, the private sector receives less government aid for productivity-enhancing activities and support systems. The efforts of diversification are not fully independent from oil in AGCC countries (Al Awad, 2010). Most economies in the these countries remain dominated by large public sectors that are deeply vested in petrochemical industries that would normally be produced by private sector in a competitive environment (Abed and Davoodi, 2003). Finally, the remaining variables are insignificant for the estimator of the Fixed Effects model.

Table 6.28 AGCC countries and Jordan: Estimates of Total pooled TFP by Fixed Effects Model (Robust**)**

TFP growth	AGCC countries and Jordan	AGCC countries
Constant	-4.139229 (41.47231)	22.74639 (48.60387)
$infl$	.2237209 (.071212)***	.2079478 (.0784691)***
$migrant$	.142372 (.1630549)	.0623285 (.1774559)
edp	-.1049949 (.0878136)	-.1318408 (.0792963)*
$oilrev$	.0490759 (.1116997)	.056026 (.1186539)
$trad$	.0068243 (.0354345)	.0407448 (.0420643)
$life$	.0233304 (.6523252)	-.3598127 (.7553223)
$govc$	.2630641 (.1017257)**	.2919416 (.1087336)***
$highex$	.2239907 (.2462866)	.2029802 (.2787022)
$manufim$	-.1220795 (.0931532)	-.290593 (.1367393)**
fdi	.2540293 (.1565438)	.1683371 (.190787)
R-squared	0.2428	0.2730
Pro-F	0.0024	0.0016

Figure in (…) shows the value of standard deviation and *, **, and ***are the level of significance at 10%, 5%,and 1%.

The following result in the table 9.29 is estimated to investigate the role of macroeconomic and other variables in determining economic growth in three measures: total GDP, non-oil GDP, and oil GDP growth. This result supports the previous results of total TFP growth in case of inflation and government spending. The higher value of **inflation** rate is associated with higher values of GDP growth for the AGCC countries with or without Jordan. It means that a one-unit increase in inflation rate leads to a 0.32 percent and 0.34 percent increase in non-oil GDP growth in the AGCC countries with or without Jordan, respectively and it leads to a 0.31 percent and 0.08 percent increase in oil GDP and total GDP growth, respectively, in the AGCC countries. This finding is supported by Sarel (1996) who shows that there is a positive correlation between inflation rate and economic growth if the inflation rate is lower than 8 percent. Also, the higher value of **government spending** rate is associated with higher values of GDP growth in both sets of countries. It shows that a one-unit increase in government spending share leads to a 0.08 percent and 0.11 percent increase in total GDP growth, respectively, in the AGCC countries with or without Jordan. In case of oil GDP measure, also a one-unit increase in government spending rate leads to a 0.12 percent increase in oil GDP growth in the AGCC countries. This result is supported by Rains (1989) and Hakura (2004) who point out that the government spending can promote or hinder the process of economic growth depending upon the nature of its activities.

On the other hand, trade openness and foreign direct investment are more impact on GDP growth than TFP growth. The higher value of **trade openness and foreign direct investment** are associated with higher values of GDP growth for the AGCC countries with or without Jordan. It means that a one-unit increase in trade openness rate implies to increase in non-oil GDP growth by 0.08 percent in both sets of countries and it leads to increase in total GDP by 0.04 percent in AGCC countries. Also, a one–unit increase in FDI rate leads to increase in non-oil GDP growth

by 0.36 percent and 0.35 percent in AGCC countries with and without Jordan, respectively and leads to increase in total GDP growth by 0.21 percent and 0.35 percent in AGCC countries with or without Jordan, respectively. These results are supported by study of Nachega and Fontaine (2006) that suggest that trade openness and foreign direct investment enhance competition and efficiency in production and also allow for technology transfer all these powerful forces for increase GDP growth.

Table 6.29. AGCC countries and Jordan: Estimates of pooled GDP by OLS pooled Model (Robust**)**

GDP growth	AGCC countries with Jordan		AGCC countries		
	Non-oil GDP	Total GDP	Oil GDP	Non-oil GDP	Total GDP
Constant	-5.284391 (36.66672)	-25.59141 (21.36751)	48.2354 (37.34401)	-4.284351 (32.11672)	56.51486 (28.13786)**
$infl$	.3264148 .110316)***	.054431 (.0482796)	.3110283 (.09602)***	.3464148 .108369)***	.0889825 (.0399817)**
$migrant$	-.0228712 (.037029)	.0137624 (.022288)	-.0396521 (.0455104)	-.0124712 (.036029)	-.000393 (.0273558)
edp	-.0464441 (.0750681)	-.0554609 (.0684558)	.1600336 (.0793194)	-.0432341 (.05643681)	.0463673 (.0426105)
$oilrev$	.0347119 (.0537857)	.0567629 (.0474853)	-.0982816 (.0863435)	.03217119 (.06347857)	-.0420448 (.0483746)
$trad$	.0809753 (.0317586)**	.0089934 (.0194242)	.0213403 (.0309249)	.0819654 (.0328786)**	.0438727 (.0176964)**
$life$	.4479114 (.539128)	.3666376 (.3270845)	-.7452908 (.5583614)	.3373414 (.639128)	-.5594709 (.3950795)
$govc$	-.1262147 (.1642916)	.0828624 (.0427123)**	.1294503 (.0707934)*	-.11600147 (.0642926)	.1191695 (.0562871)**
$highex$	-.2397989 (.1788482)	-.0103127 (.1145745)	.0589735 (.1943148)	-.2189779 (.1821382)	-.0962211 (.138269)
$manufim$	.013164 (.0454186)	.0155254 (.0247175)	-.0923517 (.103289)	.015154 (.0444086)	-.1082478 (.0665067)
fdi	.3665508 (.2210206)*	.2189829 (.108693)**	.1973472 (.1623931)	.3575509 (.2190307)*	.3572065 (.1174472)*** *
R-squared	0.2063	0.1187	0.1594	0.3073	0.1568
Pro-F	0.04311	0.0184	0.0175	0.035211	0.0134

Figure in (…) shows the value of standard deviation and *, **, and ***are the level of significance at 10%, 5%, and 1%.

CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATIONS

This study estimates the contribution of labor force, physical capital, and total factor productivity (TFP) to economic growth in all GDP measures for the AGCC countries and Jordan in the period 1990-2014. The results from this study show that the contribution of accumulation of total capital and total labor is higher than the contribution of total TFP to total economic growth over this period. However, using a non-oil GDP measure, Saudi Arabia has a higher contribution of non-oil TFP to non-oil GDP growth than non-oil capital and non-oil labor, while for the rest of the countries, non-oil TFP contribution is still very small. Also, the contribution of total TFP growth to total GDP growth is still low and negative compared to the developed countries; for the Western countries, including the USA it accounts for about 25 percent, For Southern Europe, it is 20 percent and 18 percent for Newly Industrialized Countries (NICs) (Baier, Dwyer, and Tamura, 2006). These findings imply that AGCC countries need to augment TFP growth to increase its contribution to economic growth. TFP growth is important as it involves efficiency in inputs use and this is linked to reducing the cost of production and improvement. Because of volatile oil revenues and the low contribution of TFP, the economy of AGCC countries need to encourage crucial reforms and diversification in production and involvement of private sector.

This study also estimates all the effects of trade openness, human capital, manufacturing, foreign direct investment, high technology, government consumption size, migrants, oil revenues, and inflation rate on total TFP growth for each country and a pooled cross-section, time series panel data set of the AGCC countries with or without Jordan. This study first estimates each country separately and uses three panel models, the Pooled OLS Model, the Fixed Effects Model, and the Random Effects Model to study them. This study shows the specific determinants of TFP growth for each country and the common determinants. The most impactful variables are trade

openness, oil revenues, and government consumption. The lack of any effect of education, health, manufacturing, and foreign direct investment of most AGCC countries leads to lower growth of TFP as reported in some other studies (Sala-i-Martin, and Artadi, 2003;Andersen and Dalgaard, 2006; Karrl, 2007; and Espinoza, 2012). Education fails to have an independent positive impact on TFP growth except for Bahrain and Jordan. Manufacturing fails to have a positive effect on TFP growth for all countries except for Saudi Arabia and Bahrain, and foreign direct investment also fails to have a positive effect on TFP growth for all countries except for Jordan. Technology exports fail to have positive impact on TFP growth for all countries except Oman. The positive effect of government size on TFP growth in pooled countries comes from achievement of high scores in terms of infrastructure quality and other business quality indicators (Cherif and Hasanov, 2014).This helps in raising standards of living and supports private sector activity, especially in the services sector. However, the continued availability of public sector in spending and jobs discourages citizens from practicing entrepreneurship and private sector work in the AGCC countries.

The lack of influence of determinants on TFP growth that is confirmed in the previous studies raised the following questions: for example, what are the policies that contribute in delaying the reforms versus the policies that will help in achieving reforms?

First, a key challenge for AGCC countries is to find ways to diversify the economy and develop non-oil sectors, which in turn should support creating sustainable private sector employment. The governments should not be the dominant force in the economy by receiving oil revenues and in turn distributing them to citizens through transfers and public sector jobs. Rather it should create policies (including training, job search assistance, etc.) that encourage the private sector to hire a highly qualified work force in order to increase investment in industry. The AGCC

countries need a high system of education and heath care. This system should be presented by a private sector that can provide these services in high quality and on time and it can present these services anywhere. The citizens should get insurance and the government hospitals should be changed to private hospitals to cover all areas, and the delay in getting appointments should be decreased. This will allow human capital to take its place in economies. The AGCC countries should apply the system of dual-education that helps match training with employers' needs. This system is practiced in Germany where it helps to enable low unemployment and success in high-end manufacturing. Also, governments should create policies that reduce public sector jobs through reduction of public employment, privatization of goods and services that may be produced more efficiently in the private sector, and improving private sector performance through better incentives and institutions. The private sector should depend on a competitive international environment and it should not be based on supplying protected domestic markets. Finally, governments should create policies to reduce wage gaps such as wage subsidies and fees on foreign workers as well as the availability of unemployment benefits.

Second, a change in the stock of knowledge in the AGCC countries is very important as result of various domestic investments in the public and private sector, especially with an increase in the population. In this study, the negative effect of education on TFP growth reflects the quality of education in the most of AGCC countries. According to the World Economic Forum (2013) the Middle East countries rank below the international average in the measure of quality of education. The educational system is poor and sometimes curriculum is unrelated to the needs of market labor and demand-side requirements in the AGCC countries. That is, the education system may not prepare students for the present world of information technologies and worldwide knowledge (Sala-i-Martin, and Artadi, 2003). These countries should create policies, which encourage

investment to improve quality of education, and training that can potentially increase the stock of knowledge. The AGCC countries have started to send many students abroad to make it an explicit aim to transform their economies into knowledge economies. For example, Saudi Arabia has more than 120 thousand students in the USA to study in different majors (Ministry of education in Saudi Arabia, 2015).Policies should be made to motivate citizens to participate in economic activities, ownership of processes, and active learning, so that aspirations and entrepreneurship will become an intrinsic culture of the individual. Only if the education system teaches citizens to adapt to a dynamic world of rapid technical change, will firms feel confident in citizens as workers. Also, these countries should increase financial support for serious research and training at universities and other research that it is related to oil industries. Governments should encourage solid relationships between public and private research to allow knowledge to flow between the two sectors because private sector research is focused on meeting the consumption and investment needs of domestic markets, but it still employs few citizens. Therefore, all the visions (vision 2020 in Oman, vision 2021 in UAE, and the vision 2030 in Saudi Arabia, Bahrain, and Qatar) in the AGCC countries aim to promote sustainable development, reduce reliance on oil revenues and increase private sector jobs to absorb new employees so that all citizens can hope to achieve success in time. For example, a recent New York Times article describes a dairy farms created in Saudi Arabia under the auspices and encouragement of government that strive to use modern techniques to produce milk locally in a country so arid that it has never been tried before(Kulish, OCT. 13, 2016).

Third, the previous studies mention that trade and FDI have indirect impacts on TFP growth, albeit with no direct impact on their individual income growth. Foreign direct investment (FDI) can provide AGCC countries with management, expertise, training, programs, and market

outlets for advanced technology. FDI and trade openness can bring new ideas through research and development (R&D) that may create new demands on domestic labor pools that carry high skills in different fields. However, the AGCC countries economies are still small open economies that have relied on the rest of the world to sell their major resource, oil, and buy all the needs of consumer goods. AGCC countries' markets should diversify needs for products and services, attracting foreign companies to enter the domestic market and competing on providing the services and necessary goods, especially food, electronics, and cars that satisfy their needs and wants. The governments of the AGCC countries should create policies that open economies more to be better positioned to acquire knowledge from foreign countries and they should start to apply these experiences in production and exports. The pervious experiences in the "East Asian Tigers" emphasize that growing exports of manufactured and non-traditional goods create dynamism in the domestic economy with very significant spillover impacts (Jennifer and Nabil, 2002). Also, trade openness has a positive impact on TFP growth in only three countries of the AGCC countries but its effect is low. Technology is represented in goods, so the imports should have high knowledge content that can be used as source of education in the AGCC countries. Trade openness looks more encouraging for technology transfer, but there are strong suggestions that the efficiency of transfer depends on the absorptive capacity of the AGCC countries and on human capital and capital intensity. Knowledge embodied in foreign capital should receive attention from governments in the AGCC countries. The reforms of trade should be vital to increase access to foreign capital.

Finally, international experience indicates that diversifying away from oil revenues is very difficult. Oil exports still overpower non-oil exports in the AGCC countries but the push for diversification has also created additional export revenues. So, governments should look at the

structure of exports to reduce reliance on oil revenues and increase the share from non-oil sectors in the economy. For example, the distribution of oil returns within the economy of AGCC countries crowds out non-oil goods production. Consequently, the diversification will reduce exposure to fluctuation and doubt in the global oil market, establish the non-oil sector, help create private sector businesses, and increase productivity and sustainable growth in the AGCC countries' economies. In general, the AGCC countries are politically stable, a low-inflation economic environment has been achieved, education has been expanded, foreign direct investment and trade have been liberalized, and the business climate has been appropriate. So, AGCC governments should implement these plans quickly towards boosting the human capital of citizens and developing new industries and services that can absorb high-skilled laborers that learn new skills abroad. So, these countries should focus on export diversification and upgrading of educational quality by encouraging corporations to develop export markets and by supporting laborers in gaining the relevant skills and education to boost productivity. The private sector should focus on export expansion instead of serving the domestic market.

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