Economic Diversification in The United Arab Emirates
Is the economy leaving its oil dependency?

Bachelor Thesis in Economics

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Abstract

As the public becomes more concerned with the natural environment, one of the major topics discussed is the oil. Since there is no true source of knowledge how long the oil can continue to be extracted, it is interesting to know how long the world can benefit from such a scarce resource. Instead of idly watching as oil production decreases with time, which pre-measures could be taken in order to minimize a negative impact on an economy? The UAE is a thriving oil rich countries which for the past 30 years have experienced a vast oil wealth. Even though the oil gave wealth to the UAE, they should avoid any future oil dependency since it could negatively affect its now flourishing economy. Therefore, for the UAE to continue growing in the future it is in the best interest for the government to focus on a diversifying strategy that promotes the non-oil economy. By referring to concepts and theories of previous research in this field such as the Solow growth model, Resource curse and Dutch disease the authors find that the UAE had managed to diversify or not. Three sectors in different periods between 1970 and 2007 were measured: The oil sector, the non-oil sector and the government sector. Diversification changes means a decreasing dependency of the oil sector to the non-oil sector while the latter instead depends more on the government sector. Using British Petroleum (2008) and United Nations (2008) as sources, data was collected in order to draw a time-series regression analysis and test empirically for these diversification trends. The results for all periods confirmed that the UAE have indeed diversified and it could thus be observed that it started its successful strategy already in the 1970s. With the right government policy investments and the stability in the union, the UAE prevented from becoming dependent on oil and thereby not crowding out its important non-oil economy.
Kandidatsuppsats inom Nationalekonomi

Titel: Ekonomisk Differentiering i Förenata Arabemiraten

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JEL klassifikation: O16, O43, E21

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1 Introduction

“We have to leave oil, before oil leaves us”
-Fatih Birol

The United Arab Emirates (UAE) located in the Gulf area, is one of the most flourishing unions in the world. In terms of GDP, the UAE ranks third in the Middle East-North Africa (MENA) region, after Saudi Arabia and Iran. According to UAE Interact (2007) the UAE had an estimated GDP at $192.6 billion in 2007. Additionally, in the Human Development Index they rank 39 which indicates a strong union, not only as an economy but also as a society.

One of the Emirates Dubai, has since the 1990s gained a very popular attention in media and tourism. From merely being a virtually unrecognized desert, Dubai has during two decades developed into a multicultural metropolis with an impressive skyline and soon containing the world’s highest skyscraper Burj Dubai with its 818 m. Furthermore, the UAE has developed into the largest business hub in the whole Middle East and has become a fierce competitor to other financial districts in newly industrialized countries such as Singapore. This growth would have never occurred at this pace if it was not for being endowed with its oil resources, which has financed these long-term investments.

As the authors witnessed this phenomenon during a personal visit in the UAE, interesting questions arose about the future of its economic development. When the income of oil becomes unreliable, will the UAE still manage to keep growing at the same pace? Recently, the public have raised awareness about when the world will actually reach its peak in oil extraction and how that might affect oil consuming and producing countries that have taken it for granted. What alternative incomes could be able to maintain this economic prosperity in the UAE?

The answers to these questions are interesting for long-term investors since the knowledge of economic stability is crucial for investment strategies to be taken. Furthermore this could be interesting for other nations, as the UAE could serve as a potential guideline to economic development for other resource dependent countries.

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1.1 Purpose

The intentions with this study is to illustrate the diversification trends in the UAE economy. In other words, that the government sector promotes the non-oil sector and decreases the oil sector dependency. This is done by analyzing their respective GDP income elasticity.

1.2 Method and Data

In this section the method and the variables are stated as well as the hypothesis questions on the basis of the research studied.

Methods for collecting data has been in compliance with the simple model by Choudhury M A. and Al-Sahlawi M A. (2000) in which the authors obtained three important compositions of GDP, as shown in table 1.

Table 1. Sector variables

<table>
<thead>
<tr>
<th>Sector</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP_{OIL}</td>
<td>The oil sector GDP_{OIL} is represented as the oil income generated each year by the UAE in terms of adjusted for the 1990 dollar. The data was accumulated by retrieving the BP data of all oil production in the UAE and then multiplied with the world oil prices all which have occured from 1970 to 2007.</td>
</tr>
<tr>
<td>GDP_{GOV}</td>
<td>The government sector, GDP_{GOV} data was collected from the UN statistics where it accounts for all the government expenditure made in the UAE within the same time frame.</td>
</tr>
<tr>
<td>GDP_{NON-OIL}</td>
<td>The non-oil sector GDP_{NON-OIL} was a complicated matter but was carefully appreciated by the authors as all the remaining activities such as agriculture, industries, etc. excluding the compiled GDP_{GOV}. Since the GDP_{NON-OIL} was not separately categorized in the statistics it could run the risk of being accounted twice. To avoid this, the mining and quarrying component which almost dominately represents the oil proceeds, was excluded.</td>
</tr>
</tbody>
</table>

Source: Choudhury, M. A., & Al-Sahlawi, M. A. 2000

These variables have been derived through data collection from UN (2008) and BP (2008) in order to evaluate a log-linear time series regression statistic between the 1970-2007 period with the categorical data at hand. The authors then test the changes in GDP_{NON-OIL} with the Augmented Dickey-Fuller (ADF) test in order to find for stationary evidence.

1.3 Limitations

In order to understand a country’s economic activities the authors have focused on one specific country and therein are going to restrict themselves to the oil theme and its impact on the UAE non-oil economy. Due to the vast and complex dynamics of national economies, in this case regarding an oil exporting country like the UAE, the authors have chosen to focus on the aggregate economics and by quantifying the entire GDP based on three
variables: \( \text{GDP}_{\text{OIL}} \), \( \text{GDP}_{\text{NON-OIL}} \), \( \text{GDP}_{\text{GOV}} \). The authors will follow the UAE development during the last quarter of the past 20\(^{th}\) century and choose to limit themselves to this period since it stands for one of the most important milestones regarding crude oil issues and awareness. Due to the low transparency of statistics and unreliable data the authors chose to limit themselves to the already mentioned data sources that they considered most legitimate. Because of improved reliability the authors minimized the risk of reaching false conclusions in empirical testing.

1.4 Outline

In the first section of the thesis a short introduction is given followed by the purpose of the authors intention as well as the method and data used. In section 2, a background is presented which highlights important issues, followed by the problem statement in this study as well as the authors expectations of the outcome. Furthermore, the relevant theories are presented and later supported by previous research in this field and concluded by establishing the hypothesis. In section 3, the collected data is empirically tested by the use of a time-series regression as well as the Augmented Dickey-Fuller test (ADF) and the results are analyzed together with the concepts and theories from section 2. In section 4 the UAE’s policy implications lead to a conclusion in section 5 followed by section 6, were the authors suggest further research that could be related to this field.

2 Background

2.1 Oil during the 20\(^{th}\) century

During the 20\(^{th}\) century, the western world witnessed its civilization grow rapidly with the help of its productive use of oil and natural gas resources. The U.S. is one of the world’s largest oil consumer and without this oil, it could never have experienced such a vast expansion during such a short period. However, in the 1970’s the U.S. had reached its production peak and from then it went steadily declining. This can also be noticed in other western countries such as Norway and Great Britain as they previously possessed an abundance of this commodity as well. Prior to the exhaustion of its own natural resources in many occidental countries, they where induced to search for new sources where petroleum could be found. As a result oil was discovered in developing countries whereas the majority was found in the Middle East.

The OPEC (The Organization of the Petroleum Exporting Countries), was formed in 1960 as a response to the conflicts of interest of whom should benefit from oil proceeds. Should it be the western world that discovered the sources or should it be the ones that owns the oil-rich territory? As stated by Lindstedt (2005), OPEC reached their goal in terms of controlling the supply of oil and they caused the crude oil prices to rise up to 70\% in 1973. This, not only created the world’s first oil crisis but to some extent also redistributed a balance of power from western to oil-rich countries. Another crisis was then once more prevalent between 1979-1980 following the Islamic revolution and the Iran-Iraq war.

By this time, the OPEC countries enjoyed an increasing wealth that led them into an expansion for some years ahead. During the supreme oil ruling in some Arab countries, there was an immense spending in favour of the society by constructing infrastructure like schools and hospitals. The spending led countries to use their future oil revenues as collat-
eral for loans that could maintain the ongoing financing. This made evident that the core to these countries prosperity was on oil generated income.

On the other side of the world, the western world managed to find new oil resources in Alaska, the North Sea, the Gulf of Mexico and West Africa able to provide them with a lower oil price and decrease OPEC’s share of the oil market down to 29%. As a result, in 1986 OPEC lost its influence and the member oil-countries witnessed the detrimental effects on their economies, this raised awareness of the risks incurred with heavy oil dependency in countries such as the UAE.

2.2 History of the UAE economy

According to Al Abed and Hellyer (2001) The pre-UAE region which was inhabited by a tribal society and colonized by the British, were the latter made its exploration of oil and natural gas in the 1950s. In 1971, the UAE were founded and became “…the longest surviving successful experiment in federation anywhere in the Arab world…” (Al Abed and Hellyer, 2001, p.6), comprising of seven ruling families (sheikhdoms) in the respective emirates. The emirates focused on establishing a modern society by developing institutions with the help of its natural resource wealth, mainly contributed by the capital Abu Dhabi as well as the emirates Dubai and Sharjah in their corresponding order. The trade sector was almost exclusively benefiting from the oil and gas resources which implied a great dependency from this income source. Therefore, after joining the OPEC in 1967 the UAE was experiencing some correlated effects parallel to the situations of the OPEC as a whole. With reference to Lindstedt (2005) the oil crises led to rapid improvements for the economy whilst the OPEC crisis reflected limited revenues. As can be recognized above, this country is no exception regarding the weakness of oil price fluctuations. One should therefore keep in mind that the successes of nations such as the UAE is largely due to the crucial importance of this commodity.

During the last two decades the United Arab Emirates faced a structural change in their economic policy that changed government expenditure policy as well as non-oil growth. Additionally, due to the oil price shock during the 1970s and early 1980s and its aftermath, the UAE needed to base its economy on more stable and reliable income sources. The UAE gave way for promoting a sound welfare system with infrastructure investment, utilities, basic segments as well as subsidizing basic supplies such as water, electricity and with very low demanded tax. This caused a long-term growth in the non-oil sector. Consequently, mentioned by Fasano and Wang (2001) tendencies of instability and swings in the non-oil GDP could instead be traced back to government expenditure instead of solely to the oil price fluctuations. Despite the trend in declining oil prices2, the wage bill in the UAE has increased, which also indicates that the Government’s role is increasing in terms of job creation and increasing welfare.

2.3 Problem

Hence, the UAE and its economy may experience future growth either if OPEC manages to reach an increase in oil prices, or if the UAE gradually detaches itself from the oil dependency. Although the first scenario may seem plausible in the coming years due to increasingly exhausted oil sources and relatively increasing demand, there are however controversies how long this can persist. With respect to the second scenario, it is evident that

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remaining sustainable is also about promoting alternative opportunities that separate themselves from the oil sector. Therefore, can the non-oil sector with the help of the government sector, manage to grow without being dependent on the oil sector? In other words, can any diversification trends be distinguished?

2.4 Expectations

Supported by previous findings shown in table 2 the authors illustrate the economic development of the UAE between 1975-1998. Here the authors can distinguish the important sectors and its respective shares in approximately a 5-year period. By observing the oil development throughout the years, one can see that it has steadily decreased as an important share of the economy as the percentage of 67.7% in 1975 weakened down to 22.4% in 1998. The government sector has shown an increasing role and has more than doubled since 1975 thereby showing an opposite movement with the oil trends. Other sectors, that together constitute the non-oil sector increased its importance in the economy.

Table 2. Relative importance of the UAE main economic sectors 1975-1998

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>0.7</td>
<td>0.9</td>
<td>1.5</td>
<td>2.0</td>
<td>3.6</td>
</tr>
<tr>
<td>Crude oil</td>
<td>67.5</td>
<td>56.4</td>
<td>44.0</td>
<td>41.1</td>
<td>22.4</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.9</td>
<td>6.9</td>
<td>9.2</td>
<td>8.7</td>
<td>12.4</td>
</tr>
<tr>
<td>Electricity and Water</td>
<td>0.5</td>
<td>1.3</td>
<td>2.2</td>
<td>2.1</td>
<td>1.8</td>
</tr>
<tr>
<td>Construction</td>
<td>9.0</td>
<td>8.3</td>
<td>8.8</td>
<td>8.4</td>
<td>9.4</td>
</tr>
<tr>
<td>Commerce, restaurants and hotels</td>
<td>9.3</td>
<td>9.0</td>
<td>8.8</td>
<td>10.1</td>
<td>13.7</td>
</tr>
<tr>
<td>Transport, storage and communications</td>
<td>3.0</td>
<td>3.4</td>
<td>3.8</td>
<td>5.5</td>
<td>7.0</td>
</tr>
<tr>
<td>Financing and insurance</td>
<td>1.6</td>
<td>3.5</td>
<td>5.1</td>
<td>4.3</td>
<td>6.7</td>
</tr>
<tr>
<td>Real estate</td>
<td>2.5</td>
<td>3.8</td>
<td>4.9</td>
<td>6.2</td>
<td>10.5</td>
</tr>
<tr>
<td>Government services</td>
<td>4.8</td>
<td>7.0</td>
<td>10.5</td>
<td>10.9</td>
<td>11.8</td>
</tr>
</tbody>
</table>

Source: Al Abed & Hellyer, 2001

By using table 2 as reference, the authors expect that the role of the oil sector in the economy is declining, while the government has increased its influence on the non-oil sector. Furthermore, the authors extend the time horizon with one additional decade between 1998 to 2007, expecting similar trends to occur throughout this period as well. During the two first oil crises in 1973 and 1979 the oil prices went up significantly, as the UAE was in its early stage of economic development, a high oil dependency was to be expected. In the late 1990s, the UAE economy is expected to have a relatively lower dependency due to the increasing influence of the government sector and its support to the non-oil sector.
2.5 Relevant concepts and theory

In this section, relevant concepts and theories are explained briefly in order to understand the circumstances that explains diversification in the UAE. They are important to recognize since these concept and theories are reflected in later sections such as previous findings and analysis.

Diversification

Diversification is “the technique of reducing risk by dividing ones asset among a number of different securities or types of investments” (Fridson & Alvarez, 2002, p.351). Thus spreading income sources with different and unrelated exposures to risk, one could then be compensated in the occurrence of a potential loss. This term is mainly used for portfolio selection in the fields of financial economics, but has been utilized in this context to make a clear understanding that government expenditure may be allocated in different income sectors of a country’s GDP such as in a portfolio.

Dutch disease

According to Corden & Neary (1982) a boom in one part of a country’s traded good sector, results in a real appreciation and makes the relative price of the non-tradable goods increase more compared to the price of the tradable goods. The most common event of the Dutch disease is when a country discovers natural resources or if the value of a resource dramatically increases, such as oil. For example, Norway increased its wealth, when they discovered the North Sea oil in the 1970s or Colombia’s coffee prices soared after a decrease in the world supply during the late 1970s (Sachs & Larrain, 1993).

Capital and current expenditure

Government expenditure is the spending made by federal, local or state government, which can be categorized in to either capital expenditure or current expenditure. Capital expenditure is the payments spent on assets, such as new or existing long lasting goods, ex. infrastructure, hospital buildings or electricity (i.e. long term growth). Current expenditure is a recurrent spending, such as payments for wages, interest payments, health care and education, items that are consumed but only last for a limited period of time, i.e. a short term growth, (Devarajan, Swaroop & Zou, 1996 ).

Resource curse

Some resource-rich countries have shown to be more successful than others as some of these countries have gained more power and wealth. The resource curse explains how resources instead can cause a country to experience a diminishing growth as some resource countries have experienced wealth whilst other have not. Problems suchs as rent-seeking or inefficient government management hampers savings and investment and thus inhibits a country to experience growth after the natural resources has been exhausted (Gylfason & Zoega, 2006). Oil is one of these resources that has caused the most dynamic changes in our society during the past hundred years. Consequently, oil exporting countries receive large oil revenues, something that may not hold in the long-run.
**Income elasticity**

Income elasticity shows the relationship between a percentage change in income and its effect on demand for a given good (Kristrom & Riera, 1996). With regard to this thesis, income elasticity is going to be used with respect to the definition used by Choudhury M A. and Al-Sahlawi M A. (2000). The authors can, with the elasticity illustrate the effects on the non-oil sector as a response to an diversification change in the oil as well as government sector. A high elasticity corresponds to a high dependence between two sectors analyzed, and vice versa with a low elasticity.

**Solow Growth model**

The Solow Growth model, also known as the “exogenous growth model” is a “...model in which there are diminishing returns to each factor of production but constant return to scale. Exogenous technological change generates most long-term economic growth...” (Todaro & Smith, 2006, p. 828). The model states that there exists substitutions between two important factors for the output, K the stock of capital and L the amount of labor. In order for growth to occur it is needed that the exogenously determined (A) improves with time. That depends in turn, on the rate of savings and the innovations that can result in knowledge spillovers.³

³ For detailed information see Solow Growth Model Appendix
### 2.6 Previous Research

In this section the previous findings are presented with respect to their topics. These topics are similar and related to previously mentioned concepts and theories.

<table>
<thead>
<tr>
<th>Literature</th>
<th>Topic</th>
<th>Key findings</th>
</tr>
</thead>
</table>
| Gylfason & Zoega (2006)     | Resource curse           | • Natural resources are inversely related to saving, investment and growth which lowers the level of consumption and output per capita in the long run. This is caused by exogenous factors such as inefficient policies and institutions.  
                              |                           | • Population growth and resource depletion drag, rent seeking, Dutch disease, neglect of education – can all be expected to reduce savings and investment. |
| Smith B. (2004)             | Resource curse           | • Rejects the resource curse given stable regimes (even during recessions and price-shocks) that shows no trend toward regime crisis or instability in exporting states and that durability does not merely stands for patronage and coercion.  
                              |                           | • He further stresses the importance of strong states, institutions and timing with the latter explaining governmental interests relative to different times of resource discovery. |

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4 Definition: The opportunity to capture monopoly rents provides firms with an incentive to use scarce resources to secure the right to become a monopolist. Such activity is referred to as rent-seeking. Rent-seeking is normally associated with expenditures designed to persuade governments to impose regulations which create monopolies. Examples are entry restrictions and import controls. However, rent-seeking may also refer to expenditures to create private monopolies. (OECD, 2002)
<table>
<thead>
<tr>
<th>Reference</th>
<th>Concept</th>
<th>Description</th>
</tr>
</thead>
</table>
| Nili, F., (2000) | Resource curse & Dutch disease | - The share of natural resource in the production function affect positively on the steady state amount of research effort that is required to overcome the declining trend of the exhaustible resource use.  
- To guard against the dynamics of the Resource Curse and Dutch disease in the presence of exhaustible resource, the steady state is always possible to obtain with initial values rate of consumption, research effort and rate of extraction of the resource. |
| Graham, A. D., (1995) | Resource curse & Dutch disease | - Dutch disease terminology is being used incorrectly with the unfortunate connotations implied by the word “disease.” Furthermore, the Resource curse is the exception rather than the rule.  
- This is explained by countering the resource curse with an effective resource policy that postpones the resource production and transforms itself into one of those less well-endowed until an adequate domestic environment can be ensured. |
| Corden, W.M., & Neary, J.P. (1982) | Dutch disease | - A boom in one part in country’s traded good sector, resulting in a real appreciation, makes the relative price of the non-tradable goods increase more compared to the price of the tradable goods |
| Auty R.M. (2000) | The staple trap model | - Greed for rents have a tendency to foster factional and predatory political states. Infant industry protection and minimal transparency degenerates into a corrupt rent-dispensing mechanism that distorts the economy.  
- Instead of using potentially efficient production factors, the economy becomes locked into a “staple" trap” with greater slow-maturing industry, bloated public services and undermined social capital |

5 A principal raw material or commodity grown or produced in a region (The Free Dictionary, 2008)
For the purpose of studying diversification in the UAE, the following research questions are stated:

- Can it be seen that the UAE dependence from the oil sector has diminished due to diversification changes dominated by the non-oil sector.
- During different periods of 1970-2007 has government sector increased its importance to the non-oil sector?

Based on these questions, two following hypotheses are stated:

**Hypothesis 1:**
The non-oil sector ($\text{GDP}_{\text{NON-OIL}}$) is more sensitive to changes in the government sector ($\text{GDP}_{\text{GOV}}$) than to the oil sector ($\text{GDP}_{\text{OIL}}$).

**Hypothesis 2:**
$\text{GDP}_{\text{NON-OIL}}$ is more sensitive to changes in $\text{GDP}_{\text{OIL}}$ than to $\text{GDP}_{\text{GOV}}$.  

### 2.7 Hypothesis


- In Dubai, great effort are made do diversify its economy, but does so in a slow pace. Since the growth in the non-oil sectors is still, to a less significant extend, stimulated by the oil sector.

Fasano & Wang (2001) Government expenditure

- In the short run, government current expenditure has a negative effect on non-oil GDP growth, while capital expenditure has a positive effect. In the long run, current expenditure is positive related with non-oil GDP growth and negative related to capital expenditure.

- To decrease the current expenditure without an negative effect on non-oil real GDP growth in the long run, a structural modification is needed, that results that non-oil sector development becomes independent from government spending.
3 Empirical Findings and Analysis

3.1 Regression Model

This time-series regression model represents the changes in non-oil GDP that depends on the changes incurred in the oil GDP and the government GDP between 1970 to 2007. The regression studies the elasticity of GDP_{GOV} and GDP_{OIL} relating to the GDP_{NON-OIL} therefore it is taken in a Cobb Douglas form and converted into a log-linear specification. This was originally calculated and applied by Choudhury & Al-Sahlawi (2000) on the UAE neighbour country Saudi Arabia.

\[
\log(\text{NON-OIL}) = \log \alpha + \beta_1 \log(\text{GOV}) + \beta_2 \log(\text{OIL})
\]

\text{NON-OIL} = \text{Real}^6 \text{ GDP in the non-oil sector.}
\text{GOV} = \text{Real GDP in the government sector.}
\text{OIL} = \text{Real GDP in the oil sector.}

The \( \beta \) coefficient is interpreted as the income elasticity of oil GDP and the government GDP respectively to the non-oil GDP. Thus, the authors use NON-OIL as a regressand and illustrating the impact of each regressors GOV and OIL for different periods of time.

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3.2 Regression Results

Here the authors depict four different time periods which was regarded as relevant for the descriptive analysis and for the history of the oil fluctuations and thus its relative impact on the non-oil sector.

Table 4 Time period regression results (See “Regression Appendix” table 1-4).

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP Oil</td>
<td>(t-stats)</td>
<td>0.239301***</td>
<td>0.387810***</td>
<td>0.164183**</td>
<td>-0.137354*</td>
</tr>
<tr>
<td>GDP Gov</td>
<td>(t-stats)</td>
<td>(3.467534)</td>
<td>(3.205292)</td>
<td>(2.350924)</td>
<td>(-1.865175)</td>
</tr>
<tr>
<td>R²</td>
<td></td>
<td>0.969701</td>
<td>0.955852</td>
<td>0.843435</td>
<td>0.904837</td>
</tr>
<tr>
<td>F-Value</td>
<td></td>
<td>13.90401</td>
<td>5.724583</td>
<td>14.04677</td>
<td>18.16853</td>
</tr>
</tbody>
</table>

*=Significant at 10% level.
**=Significant at 5% level.
***=Significant at 1% level.

The results in table 4 allows for the following statistical inferences. With a significant level at 1% for the whole period (Period 1) between 1970-2007, it clearly indicates an elasticity of GDP oil to GDP non-oil with a beta of 0.239301. Thus, a one-percent increase in the oil sector increases the non-oil GDP with 0.239301 of that percentage change, in other words approximately 0.24%. This means that the oil sector still has an influence in the non-oil sector. However, the GDP gov has an even higher beta value than GDP oil with an elasticity of 0.742923. Hence, it points out that GDP non-oil is largely dependent on the government sector and relatively less dependent on the oil sector.

To be able to understand the non-oil elasticity during important periods, a subdivision within Period 1 is needed. For instance, in Period 2 (1972-1986) when the first oil crisis occurred in 1973 and the second between 1979-1980 it is highly relevant to analyze the oil sector dependence during these times. As shown in table 4, with a significance level of 1%, the oil sector has a beta value of 0.387810 during 1972-1986 which implies a higher elasticity for the oil sector during this period rather than throughout Period 1. Conversely, the government sector shows a lower elasticity during this period.

On the 3rd period, between 1978-2007 the differences are more considerable with respect to the previous two periods. Here, the interval between the betas of oil and government has widened to 0.164183 and 0.987203 respectively, with the former having a 5% significance level and the latter a 1% significance level. Furthermore, the 4th period between 1990-2007 the oil sector is showing a negative elasticity of -0.137354 at a 10% significance level whilst the government sector have risen remarkably up to 1.657286 at a significance level of 1%.
In the t-statistics from table 4, the critical t-values with respect to their degrees of freedom are at the 5% level on all sectors except on the oil sector in Period 4. The same is applied to the F-test that tests all the betas simultaneously to determine if the model is good or bad. In table 4 the F-statistics are above the F-critical values with respect to their degrees of freedom. This suggest that the predictors are linearly associated and at least one of them are significant for the regression model. R² measures the goodness of fit which points out that all periods except period 3 is 90% and explains that the sample regression fits with the data fairly well. In period 3 the R² is slightly lower at 84% but also fits the data quite well. R² are generally high which is normal when doing a time-series regression.

3.3 The Augmented Dickey-Fuller Test

By using the Augmented Dickey-Fuller (ADF) test, the authors can observe if the time period analyzed is stationary or non-stationary. Time series are stationary, if autocovariance, mean and variance do not systematically vary over time. Thus, it is vital to have a stationary time series, as a non-stationary time series can only explain that there is a trend behavior in the time period. Non-stationarity makes it complicated to estimate the time period, since its probability distribution changes over times. Furthermore it indicates a possibility of a less significance value of the t-values derived, as well as the regression could show a lower relevance in R² and F-value (Gujarati, 2002). Hence a stationary time analysis point out an increased reliance on the R², F- and the t-values. As the linear regression results in table 4, shows high values of R² for all the four periods, testing for stationary is made to analyze the R² relevance in table 5 (See appendix “ADF test” table 5-8).

If the respective periods calculated ADF absolute value is large then the different critical values, the authors can reject the null hypothesis with 99% confidence. Thus the time series is stationary, additionally the more negative the ADF, the more powerful the rejection of the null hypothesis.

ADF null hypothesis:
H₀: Time series is non-stationary
H₁: Time series is stationary
Table 5 ADF test results

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Nr. of observations after adjustments</th>
<th>ADF test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period (1) 1970-2007</td>
<td>37</td>
<td>-5.023015 (Prob. 0.0029)</td>
</tr>
<tr>
<td>Period (2) 1972-1986</td>
<td>14</td>
<td>-0.156667** (Prob. 0.9869)</td>
</tr>
<tr>
<td>Period (3) 1978-2007</td>
<td>29</td>
<td>-6.41629* (Prob.0.0000067)</td>
</tr>
<tr>
<td>Period (4) 1990-2007</td>
<td>15</td>
<td>-3.312750** (Prob. 0.10463)</td>
</tr>
</tbody>
</table>

*Reject H₀
**Cannot reject H₀

By observing table 5 the authors can reject the null hypothesis for Period 1 and 3. For instance in Period 1 the absolute ADF value is (5.023015) and as it is greater than the critical value, (4.440739), thus the time series is stationary. This points out that the high R² value in the time-series regression is of high statically reliance.

On the other hand, the null hypothesis cannot be rejected for Period 2 and 4, thus the time series is non-stationary, although this could be explained by the low number of observations, 14 and 15 respectively.
3.4 Analysis on Results

Here the collected data can be seen with its respective relations in a more illustrative way by transforming it to four different figures seen in below. Figure 1 represents the whole time period that was studied while the three remaining figures are subdivisions of Figure 1. The different time periods were made to distinguish between changes in the relationships between the sectors. The graphs represent $\text{GDP}_{\text{GOV}}$, $\text{GDP}_{\text{OIL}}$ and the $\text{GDP}_{\text{NON-OIL}}$ for the four different periods.

*Figure 1 GDP income per sector in the UAE (Millions US dollars, 1970-2007)*

As stated in the purpose, one can see that the UAE economy has indeed diversified in the sense that the diversification changes have tended towards the non-oil sector. By observing the Period 1, which covers the whole time-span in question, it generally indicates a pattern of diversification. By observing figure 1 the non-oil sector has gradually increased with time on a stable path. Additionally, the oil sector has increased but in a more unstable trend and with and oscillating path due to diverse oil crises. Despite the fact that both the unstable oil sector as well as the stable non-oil sector are both showing an upward trend, it suggests that the relation between these two economic segments decreases over time. This can also be supported by the regression results shown above, where the non-oil sector has a higher elasticity towards the government sector rather than to the oil sector. One might ask if this diversification trend has persisted during this whole time considering the previously discussed history of the oil price volatility.
In Period 2, during the early 1980s the political power of oil was highly controversial as the OPEC countries constrained oil production and the first oil crisis in 1973 became a fact. At that point, the prices surged for the first time from $2/b to a new high of $17/b which became radical change for the perception of oil prices. However, this did not last long as prices decreased by the end of the year, but still remained on a higher level compared to previous years. Not long after, this was later followed by the second crisis in 1979 in which the world was introduced to a remarkably higher price at $50/b. (Campbell, 2005). In 1986, the oil prices would then later plummet as the oil consuming countries managed to regain control over their oil dependency with the help new oil discoveries in non-OPEC countries. This aligns to the results of Period 2 where the two crises and the OPEC collapse are all included. During this period, the UAE and other OPEC countries might have been highly susceptible to any sort of price movement in the oil industry. Therefore, this period differs from the conventional view of the non-oil trends during the Period 1 as supported by the regression results. In figure 2 the shape of the lines are somewhat correlated which indicates that the oil dependency in the UAE was greater than normal.
Figure 3 GDP income per sector in the UAE (Millions US dollars, 1978-2007)

Period 3 is a period that reflects the UAE economy when the first oil crisis already prevailed whilst the second one and the OPEC collapse was under way. What differs this one from Period 2 is that it also reflects the aftermath of the economy up to the not so distant present. In figure 3 it can be seen that the oil sector graph is remaining relatively low whilst the non-oil graph is gradually increasing. Also, in order to understand the regression data in table 4 in period 3 that explains a rather spacious interval, the authors need to comprehend the other non-oil efforts that increased its role during the successive years after the oil shocks. Already in the 1970s the UAE was putting a great emphasis on the future maintenance of its economy and thus started investing their wealth on its long-run capital account rather than its short run current account. The government of the UAE was very keen on having their population benefit from the current and future wealth that was incurred upon the state and promoted social and economic infrastructure as important components to foster its development. For example in 1980, the Currency Board was changed into a The UAE Central Bank to strengthen the financial institution to the outside world while capital account initiatives developed modern facilities, highways, airports, ports, schools, and hospital in order to achieve a structured stability and control over the union’s activities. These long-run efforts enabled the UAE to prudently guard itself against possible fluctuations from and oscillating oil industry and thus not solely trusting itself on the source of its fortune. Therefore, during this period, the non-oil sector is greatly affected by the government sector due to its previously mentioned efforts, while the oil sector instead shows a weakly influences it.
Period 4 is similar to Period 3 in the sense that the influences of the oil sector decreased while it increased for the government sector. However, this time the previous two oil crises are now deducted from the analysis and instead it focuses on the period from 1990 to 2007. In table 4, the oil sector elasticity was even negative during Period 4 which indicates that for every one-percent decrease in oil income would actually result in a 0,13% increase in non-oil sector. Choudhury & Al-Sahlawi (2000) points out that the independence between the GDP\textsubscript{NON-OIL} the GDP\textsubscript{OIL} has become so great, that it even occurred an negative correlation between these sectors. Conversely, the relation between GDP\textsubscript{NON-OIL} and GDP\textsubscript{GOV} has increased extensively with a beta of 1.657286 which explains that the government sector has significantly promoted the non-oil sector. Thus, a one-percent increase in GDP\textsubscript{GOV} would result in approximately 1,66% increase in GDP\textsubscript{NON-OIL}. As Choudhury & Al-Sahlawi (2000) points out, the government expenditure on goods and services has promoted growth in GDP\textsubscript{NON-OIL}. Concretely, during this period the Kuwait war made oil prices soar, but the UAE showed no strong sign of the non-oil sector’s fluctuations with respect to the oil sector. Despite inflated oil prices, the UAE non-oil activity have become a relatively independent income source due to diversification, as a results of increased government initiatives.
3.5 Theory Analysis

In this section, the contributions from the concepts and theory presented in section 2.5 and 2.6 are reflected upon the empirical results in section 4.

Due to the UAE long-term planning it enabled the emirates to apply the proper instruments for further expansion. In that sense, the federation is a practical example of what a country can commit to in order to avoid the Resource Curse that happens to countries that fail to stabilize and enrichen its state despite there fortune to be well-endowed with valuable resources. The clear symptoms of falling into a such curse are among many things population growth, resource depletion drag, rent seeking, Dutch disease, neglect of education and similarly destructive factors.

To begin with, the UAE indigenous population is too small to fall into a category of population growth. However, due to the structural changes, the inhabitants have increasingly been outnumbered by expatriates which have continuously regarded the UAE as a favorable working environment. The fact remains, that even though the foreign population is growing they are still tightly controlled under the UAE laws to inflict upon any of the prevailing order in the Emirates and its economy. In the UAE the resource depletion is approximated to last for more decades to come. However, since the oil extraction is a highly discussed issue, its controversy implies that even the oil companies appreciation of oil foundings should be questioned (Campbell, 2005). Therefore, the authors refrain from such difficult appreciation and instead treat it as a given.

Regarding rent-seeking, it can not be asserted that the UAE is excluded from that category. The government authorities assess certain elements a degree of power which impedes perfect competition, but its actions have not been proven too destructive to the UAE development. The Dutch disease gradually crowds out non-oil exports can slowly deterioate an oil-rich country’s economy. However, the UAE with Dubai in the lead, serve the union with a expanding non-oil activity and with its “liberal” trade regulations the non-oil exports are prevented from being crowded out.

Many developing countries with destabilized institutions are typically led by a totalitarian or other kind of rent-seeking government where the inducements are solely directed towards a specific interest group. But it has been conceived that bad institutions and any government managed by disincentives may not necessarily come hand in hand. As adverse as it may sound, the state can might as well be runned in autocracy as long as it still have stable institutions that guarantees the state to be strong and secure in itself. The UAE puts strong weight on its ruling families in each Emirate which controls foreign intervention and therefore protects the UAE infrastructure to establish domestically. If there may exist signs of an unhealthy state such as greed and corruption in the UAE, it can still be proven that its degree is still adequate for the union to be considered well-managed and not a deteriorating economy. What it proves is that a newly founded country like the UAE can with the right measures, establish itself quickly from being a tribal society into steadfast federal union.

The Solow’s growth model, suggests that developing countries should keep themselves away from poverty by saving capital rather than consuming, which will generate a higher productivity in the long run. Productivity and growth will then lead to a country’s development which in the model is called a steady state level. This theory is paralleled to what the UAE’s strategic policies have accomplished. However, the UAE is an exception from many developing countries since the oil enabled them to take a shortcut and leaped from a primitive to a modern stage which normally poor countries can reach after decades. Thus,
it should not to be mistaken that all resource-abundant countries can make such leaps. Some can become subject to the staple trap in which the non-resource income slowly matures and in the long-run falls below the steady state level. In contrast, the UAE manages to reach a steady state by investing their proceedings in the capital account were their income instead will be generated in the future with the help of technological advancements and durable goods. The UAE were thus early proponents of a diversification strategy which is crucial for a non-renewable resource country to develop.

The authors basic expectations is answered by observing Period 1 as the oil sector in the economy weakened its role with the respect to the non-oil sector. Furthermore, the expectations about the government sector to increase was confirmed during Period 1. Additionally, the expectation of relative higher oil dependency during the oil crises was also supported by the authors results. However as the authors anticipated, the oil dependency decreased with time and in Period 4 the UAE had diversified its economy tremendously.

4 Policy implications

In this section, the actual policies applied by the UAE are reflected upon the empirical results in section 4. To be able to understand the UAE success in economic diversification, it is important to recognize the structure of their government policy initiatives.

The United Arab Emirates consists of the seven following emirates: Abu Dhabi, Dubai Sharjah, Ajman, Ras al-Khaimah, Fujairah and Umm al-Quaiwain. The three most economically dominating emirates in the union are Abu Dhabi, Dubai and Sharjah where the differences are related to the relative resource endowment and GDP contribution from all seven emirates. Already between the years 1973-1982 the UAE managed to achieve a positive economic development with the help of policy initiatives. This coincide well with the actual formation of the federation that took place December 2nd 1971 (Al Abed & Hellyer, 2001). The federation, consisting of an establishment of economic, social and political institutions was strengthened along with the fortunate rising of oil prices prevailing about two years later. The political framework matched well with the former tribal society and with relatively good records of human rights that could guarantee internal stability of the union. It has also opened itself to the western world while still maintaining good relations to their neighbouring countries and their shared culture and religion.

The indigenous population of the UAE has generally been quite low whilst since the 1970s there has been a positive inflow of expatriates that stands for three quarters of the population (Al Abed & Hellyer, 2001). With the help of foreign labour supply, the UAE have enabled to increase its scope of the labour force whereas the unemployment rate is within the full employment range.

Structural developments was made in fields like agriculture, industrialization, demographic transition, urbanization, transformation of domestic demand and production, foreign trade, finance and employment. In the non-oil sector, the manufacturing and agriculture has increased modestly whilst a discernible sectoral shift in GDP can be seen in the service sector which include trade, restaurants, hotels, transports, storage, communications, finance, insurance, real estate and government services.

The UAE efforts to structural changes have promoted education for a long-term viable productivity in human-capital among its inhabitants. The UAE government offers free education to all the UAE citizens and to Arabic speaking children of expatriates employed in the public sector where the population can become competitive in fields such as business administration, accounting, banking, information systems, computers, engineering,
aviation technology and health sciences. The health system has gradually improved the health standard compared to other developing countries where malnutrition, morbidity and mortality has shown improvements since the start of the federation.

4.1 Structural policy differences

It should be emphasized that since not all emirates are equally abundant with oil, their income sources are quite distinctive from one to another. For instance, the differences of structures can be observed between the two most dominant Emirates Abu Dhabi and Dubai.

Abu Dhabi’s policies are more austere towards foreigners and puts its emphasis on its national citizens and legitimate their political rule with their religion. The agriculture, construction and public sector are government controlled activities that occupies 75% of the population. The government controls as well its oil and gas industry with its state-owned enterprise ADNOC that deals with its resource businesses. Despite the fact that there may be some “liberalizations” in water, energy and health its development is still entirely controlled by the ruling family. The reasons for Abu Dhabi’s engagement in liberalizing some sectors is to obtain efficient operations in technology with skilled and updated workers that can generate the Emirate’s know how in high-tech industries (Pawelka & Boeckh, 2004).

Dubai has shown some entrepreneur-friendly initiatives that indirectly has been originated from the promoting strategies made since the 1970s. By overcoming oil dependency in Dubai, one of its famous strategies has been the tourism activity. De-lux hotels and resorts, culture-exhibitions, sport-events, in-door skiing are many examples of luxurious leisure activities that visitors can enjoy. Also worth mentioning is the incredible generous trade conditions imposed on Dubai’s trade hub that benefits the Middle and the Far East, Africa and Central Asia. Apart from its relatively low custom rates, The Jebel Ali Free Zone (JAFZ) was put in place already in 1985 as the first free zones that guaranteed full repatriation of profits, fifteen years of exemption from corporate taxes and no personal income or capital taxes (Al Abed & Hellyer, 2001). Later on, more free zones has been imposed in the UAE which has made trade a competitively advantageous for the non-oil economy. The financial sector was formally established in 2000 with the Dubai Financial Market DFM as the UAE first stock exchange which some months later was followed by Abu Dhabi Stock Exchange (ADSE) that induced foreign investors to engage in their markets (Pawelka & Boeckh, 2004).

Thus, while Abu Dhabi is self-sufficiently relying itself on its vast oil reserves, Dubai reflects a dynamic service and technology based economy that attracts foreign investment to strengthen its non-oil economy. Therefore Dubai is characterized as the most prominent advocate of the non-oil activity, while Abu Dhabi almost exclusively represents the oil-sector. This means that during any oil crise, wether it is positive or negative, might not affect one emirate to the same extent as it does to another. For instance, the oil-scarce emirates rather focuses on alternative non-oil income source to a higher degree than does Abu Dhabi that stands for more than 90% of all the UAE oil reserves (Al Abed & Hellyer, 2001). One should therefore take into account that inside the federation there are some differences where the non-oil revenue is more important. However, when observing the UAE as a unity, the weighted average of the diversification changes, whether it comes from one emirate or another, should be stressed here in order to evaluate the all-in-all reactions of the whole economy.
4.2 Policy Regulation

As might expected, the UAE can not be regarded as a market economy as the ruling families are controlling private enterprises to a large extent. Politically, the ruling families have absolute power and influence in dealing with bargaining and counseling for enterprises which implies a monopolized economic power.

For instance, state-funded agriculture initiatives is evidence of rent-seeking efforts to become self-sufficient in that area. In order for the UAE to involve its national citizen in income creation, any expatriate that would be interested in engaging in any economic activity should by law always incorporate an UAE national in order for the establishment and operation of any business. Members of the ruling families in all emirates are therefore personally involved in the business involving the oil industry and also has a authority over infrastructure and institutions related to the oil affairs. Energy- and capital-intensive heavy industries originates from the resource income endowed in the country like the upcoming of downstream industries, marketing and shipping companies that exports oil and gas. There is for instance Abu Dhabi’s ADNOC conglomerate as well as Dubal (Dubai Aluminium) where the latter accounts for an amazing 60 percent of Dubai’s non-oil and ‘non-re-exports’ exports (Pawelka & Boeckh, 2004). Another private sector activity that comprises up to 99% in the UAE is the family-runned enterprises that involves retail trading and workshops in which some are distinctively successful due to the UAE’s endorsement of citizen’s income creation. The trade, tourism are big components of the private sector whilst the state-owned enterprises largely consists of construction and industries. Capital-intensive industries investments are mostly founded on personal agreements between rule-makers and rent-seekers where the capital is higher in relation to the population. Therefore, established networks between foreign investors and rule-makers of the UAE can lead to very lucrative opportunities.
5 Conclusion

From this study the authors conclude that the UAE has developed into a phase of economic development by diversifying from the oil sector to the non-oil economy with the support of the government sector. Between the investigated years 1970-2007 there has been significant diversification changes where one can notice that the non-oil sector depends less on the oil sector thereby pointing out the UAE’s long-run economic stability.

Hypothesis 1 stated that the non-oil sector is more sensitive to changes in the government sector than to the oil sector, in other words that there is signs of a diversification trend. The empirical results shows, in a chronological order, an increased diversification throughout the whole period. To begin with, in 1970s the UAE was formed and had recently joined membership in the OPEC’s which then was in its prime years with soaring oil prices that benefited its member countries. During that period, the UAE was in its highest oil dependency but the government already focused on using the oil proceeds for structural changes by investing in long-term capital expenditure. Consequently, the UAE infrastructure was beginning to develop to such a large extent that despite the fall of oil prices in 1986, they had managed to become less sensitive to the oil sector. Between the years 1990-2007 oil dependency had declined so much that the non-oil sector even became negatively correlated with the oil sector. Therefore the authors cannot reject hypothesis 1 for all the periods investigated. Conversely, hypothesis 2 is rejected since it stated the non-oil sector is more sensitive to changes in the oil sector than the government sector. In other words that there is no diversification trend but rather an oil dependency in the UAE.

The diversification of the UAE economy can be derived by different government policy implications. Domestically, the government promoted better quality in health and education thereby improving the standard of living for its indigenous population. Additionally the UAE has been successful in attracting foreign labour and capital by offering a favourable working environment such as the generous free zones conditions in trade and generally lower taxes. Besides trade, the government has also emphasized a great deal in the tourism activity and FDI that comprises the three main alternative income sources for diversification.

Due to the institutional quality and diversification the UAE’s oil abundance have not resulted in a Resource curse. The non-oil economy, with the oil as a staple good has been able to avoid the Dutch disease symptoms such as government failures. The savings rate has enabled the UAE to reach a steady state in the Solow growth model which has facilitated the diversification process.

The authors can come to the conclusion that the UAE may after all leave oil before oil leaves them.
6 Suggestions for Further Research

Due to the authors' limitations, various topics were left out. One interesting topic could be an investigation of the UAE's development into a market economy. Was the government control of the market just a way to protect the early stages of development? If so, are they approaching a more liberalized market in the long-run?

Furthermore, it can be interesting to subdivide and analyze the most prominent non-oil GDP activities such as trade, tourism, and FDI and their relationship to the oil sector.

Additionally, is the UAE an isolated case or are there other countries with even greater results on diversification? This could be studied with a cross-analysis with other resource abundant countries.

Despite the prosperity of the UAE as a federation, it would be interesting to analyze the effects on the society. Is there an indication of increased inequality as the foreign population has grown?
Reference List

Literature


Nili, F. (2000). Growth Constrained by Exhaustible Resources:


**Books**


**Internet resources**


Appendix

Solow Growth Model Appendix

Solow Growth Model described by the Cobb-Douglas equation:

\[ Y = K^a L^{1-a} \]  \hspace{1cm} \text{Eq. (1)}

\( Y \) is the gross domestic output as a function of three factors. \( A \) stands for technological productivity that grows exogenously at rate \( \lambda \); \( K \) is the stock of human and physical capital; \( L \) is the labour each year. Under the condition that the factors are all fixed, they provide an output with constant returns to scale = conditional convergence. \( Y = F(K, L) \)

\[ \frac{K}{L} = k \]  \hspace{1cm} \text{Eq. (2)}

In equation 2, \( k \) stands for productivity as an amount of capital per worker. That is, the less workers per capital the better. The growth that occurs when \( k \) rises, increases the \( k^* \) in the short run growth but not the long run growth.

In order to make the capital stock grow and thus increase productivity (\( k \)), it is needed that there is a certain level of savings (\( s \)). The level of the savings rate should offset the depreciation of capital (\( \delta \)). It should also offset capital widening (\( n \)) which are the means to equip net new workers (\( \Delta L \)) with the same relative amount of capital, since new capital need to replace old capital. The change of capital is shown in equation 3 and illustrated below.

\[ \Delta k = sf(k) - (\delta + n)k \]  \hspace{1cm} \text{Eq. (3)}

Solow growth model

\[ y = f(k) \]

\[ f(k) \]

\[ (\delta + \delta)k \]

\[ sf(k) \]

\[ k \]

Source: Todaro & Smith, 2006

If \( A \) is fixed, then there is a steady state equilibrium denoted by \( k^* \) where equation 4 holds.

\[ f(k^*) = (n + \delta)k^* \]  \hspace{1cm} \text{Eq. (4)}
**Table 1 Regression Appendix: Period 1 (1970-2007)**

Dependent Variable: LOG(NON_OIL)
Method: Least Squares
Date: 12/15/08   Time: 18:52
Sample: 1970 2007
Included observations: 38

LOG(NON_OIL) = C(1)+C(2)*LOG(GOV)+C(3)*LOG(OIL)

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C(1)</td>
<td>2.543223</td>
<td>0.657302</td>
<td>3.869186</td>
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<td>C(2)</td>
<td>0.742923</td>
<td>0.074853</td>
<td>9.925043</td>
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<tr>
<td>C(3)</td>
<td>0.239301</td>
<td>0.069012</td>
<td>3.467534</td>
<td>0.0014</td>
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</table>

R-squared    0.969701   Mean dependent var 24.51289
Adjusted R-squared 0.967970   S.D. dependent var 0.977094
S.E. of regression 0.174870   Akaike info criterion -0.573895
Sum squared resid 1.070279   Schwarz criterion -0.444612
Log likelihood 13.90401   Durbin-Watson stat 0.603281
Table 2 Regression Appendix: Period 2 (1972-1986)

Dependent Variable: LOG(NON_OIL)

Method: Least Squares

Date: 12/15/08   Time: 18:55

Sample: 1972 1986

Included observations: 15

LOG(NON_OIL) = C(1) + C(2)*LOG(GOV) + C(3)*LOG(OIL)

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
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<tr>
<td>C(1)</td>
<td>3.185060</td>
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<td>C(2)</td>
<td>0.553859</td>
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<td>C(3)</td>
<td>0.387810</td>
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R-squared 0.955852   Mean dependent var 24.08835
Adjusted R-squared 0.948494   S.D. dependent var 0.813850
S.E. of regression 0.184703   Akaike info criterion -0.363278
Sum squared resid 0.409383   Schwarz criterion -0.221668
Log likelihood 5.724583   Durbin-Watson stat 1.067923
Table 3 Regression Appendix: Period 3 (1978-2007)

Dependent Variable: LOG(NON_OIL)
Method: Least Squares
Date: 12/15/08   Time: 18:57
Sample: 1978 2007
Included observations: 30

LOG(NON_OIL) = C(1)+C(2)*LOG(GOV)+C(3)*LOG(OIL)

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Std. Error</th>
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<tr>
<td>C(1)</td>
<td>-1.195689</td>
<td>2.243064</td>
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<td>C(2)</td>
<td>0.987203</td>
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<tr>
<td>C(3)</td>
<td>0.164183</td>
<td>0.069838</td>
<td>2.350924</td>
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R-squared 0.843435  Mean dependent var 24.91423
Adjusted R-squared 0.831838  S.D. dependent var 0.389430
S.E. of regression 0.159696  Akaike info criterion -0.736451
Sum squared resid 0.688575  Schwarz criterion -0.596331
Log likelihood 14.04677  Durbin-Watson stat 0.563431
### Table 4 Regression Appendix: Period 4 (1990-2007)

Dependent Variable: LOG(NON_OIL)

Method: Least Squares

Date: 12/15/08   Time: 18:58

Sample: 1990 2007

Included observations: 18

LOG(NON_OIL) = C(1)+C(2)*LOG(GOV)+C(3)*LOG(OIL)

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<th>Std. Error</th>
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<td>C(2)</td>
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<td>C(3)</td>
<td>-0.137354</td>
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<th>Statistical Measures</th>
<th>Value</th>
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<tr>
<td>R-squared</td>
<td>0.904837</td>
</tr>
<tr>
<td>Mean dependent var</td>
<td>25.15708</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.892148</td>
</tr>
<tr>
<td>S.D. dependent var</td>
<td>0.294157</td>
</tr>
<tr>
<td>Akaike info criterion</td>
<td>-1.685392</td>
</tr>
<tr>
<td>Schwarz criterion</td>
<td>-1.536997</td>
</tr>
<tr>
<td>Durbin-Watson stat</td>
<td>0.614066</td>
</tr>
</tbody>
</table>
Augmented Dickey-Fuller Test Appendix

Table 5 ADF Test: Period 1 (1970-2007)

Null Hypothesis: LOGNONOIL has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 9 (Automatic based on AIC, MAXLAG=9)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>6.41693633731</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>0.1011</td>
</tr>
<tr>
<td>5% level</td>
<td>0.194</td>
</tr>
<tr>
<td>10% level</td>
<td>0.533</td>
</tr>
</tbody>
</table>


Table 6 ADF Test: Period 2 (1972-1986)

Null Hypothesis: LOGNONOIL has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic based on AIC, MAXLAG=3)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>3.31275099056</td>
</tr>
<tr>
<td>Test critical values:</td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>0.417</td>
</tr>
<tr>
<td>5% level</td>
<td>0.113</td>
</tr>
<tr>
<td>10% level</td>
<td>0.357</td>
</tr>
</tbody>
</table>

Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 14
Table 7 ADF Test: Period 3 (1978-2007)

Null Hypothesis: LOGNONOIL has a unit root  
Exogenous: Constant, Linear Trend  
Lag Length: 7 (Automatic based on AIC, MAXLAG=7)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>(-5.02301486607)</td>
</tr>
</tbody>
</table>

Test critical values:  
1% level | 137  
5% level | 838  
10% level | 969


Table 8 ADF Test: Period 3 (1990-2007)

Null Hypothesis: LOGNONOIL has a unit root  
Exogenous: Constant, Linear Trend  
Lag Length: 2 (Automatic based on AIC, MAXLAG=3)

<table>
<thead>
<tr>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augmented Dickey-Fuller test statistic</td>
<td>(-0.15666952464)</td>
</tr>
</tbody>
</table>

Test critical values:  
1% level | 124  
5% level | 268  
10% level | 069

Warning: Probabilities and critical values calculated for 20 observations and may not be accurate for a sample size of 15