

The Effect of Natural Resource Abundance on Economic Growth: A Case Study of Iran and Natural Resource Curse

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Abstract. This major paper examines the existence of natural resource curse in Iran. We use a time-series data set for a 46 year period from 1965 to 2011. Our major proxies to measure the presence of oil dependency and thus the resource curse are the terms of trade (tot) and the ratio of oil revenues to government total revenues(oil rev/gov rev). The obtained results from our empirical regression support the existence of resource curse in this country.

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Abbreviation

BCM	Billion Cubic Meters
BP	British Petroleum
CBI	Central Bank of Iran
CIA	Central Intelligence Agency
EIA	US Energy Information Administration
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
IMF	International Monetary Fund
IRF	Impulse Response Function
MBD	Million Barrels a Day
MENA	Middle East and North Africa
OECD	Organisation for Economic Co-Operation and development
OPEC	Organization of the Petroleum Exporting Countries
OSF	Oil Stabilization Fund
UN	United Nations

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Section 1

1.1. Introduction

The history of oil in Iran began in 1901 when William Knox D'Arcy (later on, he became the director of British Petroleum) received a concession from Mozzafar Al-Din Shah Qajar to explore and develop any oil and gas fields in Iran. In exchange for this right, the Shah received a lump-sum payment of £20,000 in cash, an equal amount worth of shares of the company that received the right to explore the oil and 16 percent of annual net profits of the company. After six years searching finally, on the 26th of May 1908 the first pit of oil was found in Masjid- Suleiman (one of the south western cities of Iran).

Today, Iran has one of the largest proven crude oil and natural gas reserves in the world (after Russia, has the second largest proven gas reserves, 33610 billion cubic meters (BCM), and the fourth in terms of proven oil reserves, 154.6 bbl).¹

Between 1965 and 2011, the Islamic Republic of Iran has been characterized by a chaotic growth performance and a high and persistent dependence on natural resources. As it can be found from figure 1 of appendix A, before the first oil price shock, gross domestic product (GDP) had an increasing trend. Once the first oil price shock (1973) occurred and the oil revenues have started to become a main part of Iran's economy, the fluctuations and chaos in GDP started and made the economy vulnerable. For instance, the reduction of oil price from \$27 per barrel to less than \$10 in 1986 caused Iran's GDP per capita to fall substantially from \$6000 in 1986 to \$4000 in 1987. On the other hand, from 1973 (after the first oil price shock) to 2011 the share of natural resource (oil) to total merchandise exports has grown and its share has reached about 66%. Is there any causality nexus between Iran's poor economic performance and the abundance of natural resources? In this paper, I try to answer this question. More specifically, I study whether oil abundance is the cause or one of the causes of underdevelopment of different sectors of Iran's economy.

Two groups of economic papers may cast some light on this question. The first group investigates the natural resource curse hypothesis. Some economists such as Sachs and Warner (1995 and 2001) and Auty (1993), among others, believe that it is the natural resource that causes

¹ <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2253rank.html> and <http://www.eia.gov/countries/country-data.cfm?fips=IR>

an economy to have a slower economic growth. By contrast, economists such as Mehlum et al. (2006) and Boschini et al. (2007) among others, show that the natural resources are not curse per se. They propose other factors that may cause the resources to become a curse rather than to be a blessing.

1.2. Literature Review

Auty (1993) was the first economist who used the word *natural resource curse* to show the slowing effect of resource abundance on the economic growth of primary goods exporting countries. In his paper, he points out the disadvantages that the resource abundance had on the economic growth of countries such as Peru, Bolivia, Chile, Jamaica, Zambia, and Papua New Guinea. Sachs and Warner (1995 and 2001) carry out an empirical cross-country study and conclude that higher dependence on natural resources leads to a poor economic performance. Their study reveals that the price level in resource abundant countries is higher which in turn makes the export sector unable to compete in the international market and thus the country cannot have an export-led economic growth. They argue that revenue obtained from the export of primary goods such as oil makes a nation wealthier thus results in an increase in the demand for non-traded goods and subsequently raises the price of those goods. Those non-traded goods are mostly used as input in manufacturing sector. Hence, the cost of production of traded goods which is determined domestically increases while the price of those goods that is determined in international markets remains constant. Therefore, production becomes non-profitable. By contrast, a study by Manzano and Rigobon (2001) finds that the result from Sachs and Warner can be seen in cross-section data but not in panel data. The reason for this finding is the existence of omitted variables in the cross-sectional data. In their paper, they found that when the price of commodities in 70s increased the government of resource abundant countries used the obtained revenues to increase their foreign debt. Hence, in 80s when the prices shifted down, the governments were unable to repay their debt and “found themselves on a debt overhang”.² Furthermore, Gylfason et al. (1997), and Gylfason (2001) show that the presence of natural resource abundance reduces the incentive to accumulate human capital. He points out that the industries in the resource abundant economies demand low-skilled labour. Consequently, when there is no labour market for educated people then there would be no incentive left for families to

² Manzano & Rigobon (2001). See the conclusion part of this paper.

invest in the education of their children and thus the economy fails to take advantage of human capital accumulation which brings a sustained growth not only in economy but also in all aspects of the country.

Numerous studies pay attention to other aspects such as the quality of institutions and corruption that may cause the natural resources to become a curse for the economy. A study by Mehlum et al. (2006) suggests that natural resource intensity is not a factor by itself. They argue that the reason of differences in economic growth among natural resource abundant countries is the differences in the quality of institutions in these countries. Similarly, Boschini et al. (2007) propose that it is the appropriability of the resources that determines the negative or positive effect of the resource abundance. They show that there is a lower probability for those countries rich in minerals to have a curse compare to precious metals abundant countries. Boschini et al. (2007) believe that mineral abundant countries are subject to curse only if they are ruled by low quality institutions. Van der Ploeg (2010) shows that the presence of natural resource does not always act as a deterrent and the resource curse can be avoided. He shows that if the quality of the state and the institutions improve, then there is a chance for the economy to use its natural resource abundance as a tool for development. In his paper, he states that to reduce the dependence of the government on the natural resource revenues and to make the government to consider taxes as a tool to finance its spending, changing the constitution in a way that guarantees the transfer of these revenues to the citizens can be a good option.

Other papers show that the natural resource intensity leads to rent seeking, corruption and also bribe which in turn result in low quality institutions and hence, poor economic performance. Leite and Weidmann (1999) carry out both theoretical and empirical studies to investigate the effect of resource abundance on the formation of corruption, how the existence of corruption affects the growth of an economy, and policies that can be used to reduce the corruption level. They argue that the rents obtained from natural resources cause the officials who rule the country to become rent seekers and follow personal interests rather than the country's interests. They conclude that the success level of policies used to eradicate corruption depends on the development of the economy. Both of their models show that policies such as generating penalties for those who are corrupted are more effective and successful in developing countries while anti-corruption policies such as monitoring the staff are more effective in developed countries. Similarly, Isham et al.

(2005) shows that whereas the quality of institutions is important, the type of natural resource that the country owns and also the “export structure”³ have an important effect on the formation of institutions. In other words, they show that if the country is abundant in resources like oil and minerals which are centralized geographically, it is more likely to have low quality institutions and corruptions relative to those countries that are abundant in less geographically concentrated resources such as farmlands.

Another problem which is widely believed to be an important consequence of resource abundance and so a lot of researches and studies have been devoted to shed some lights on this matter is civil war and violent conflict. These studies suggest that the presence of natural resource abundance increases the probability of violent conflicts. For instance, a study by Mähler (2010) confirms the hypothesis that the presence of oil plays an important role in increasing violence. She studies the situation of the Niger Delta and concludes that while oil intensity is a crucial factor to explain the violence in this delta since 1995, this cannot be the only factor. In other words, the oil abundance increases the intensity of problems that the country already encountered, problems such as socioeconomic distortions, corruption, etc. De Soysa and Neumayer (2007) show that the revenues from export of natural resource constitute the main incentive to civil war. These revenues provide “finance and motive”⁴ for armed groups and thus increase the probability of civil war.

³ Isham et al. (2005), P.162

⁴ De Soysa & Neumayer (2007), P.201.

1.2.1. Oil Abundance and Resource Curse in Iran

Here, I provide a brief literature review of what has been done so far by economists to explain how the presence of oil intensity has led to resource curse in Iran. The general idea underlying these researches is that oil abundance causes the country to be ruled by rent seeking officials and so there is a high level of corruption in the country, poor economic performance, etc.

Farzanegan et al. (2011) show that the “unstable nature of factionalism”⁵ is a curse and not the oil abundance per se. They conduct both an empirical and a theoretical study to show the effect of factionalism on the economy. According to this paper, the distribution of power between different political parties, not only in Iran but also in Middle East and North Africa (MENA) region, destroys the positive role that the resource abundance could have played in those countries and make them unable to have a sustained economic growth. In another study, Farzanegan (2013) shows the oil revenues per se do not hinder the economic growth in Iran. His study reveals that the economic performance during the Shah’s era was better than that after the revolution of Iran. Factionalism and, in fact, the political structure of Iran after the 1979 revolution is the main reason for this economic backwardness.⁶ He shows that *factionalism* is one of the most important factors that causes this backwardness. He states that solutions such as oil stabilization fund(OSF), which was set up during the presidency of Mohammad Khatami, to transfer the oil revenues, and also financing the government expenditures through tax revenues cannot be very practical and influential in the case of Iran. The problem of conducting the former solution (Oil Stabilization Fund) is the access right to this fund and the issue on the latter solution (taxing) is that higher taxes lead to a worsening of the “shadow economy”.⁷ Farzanegan and Habibpour (2014) extend their work to further analyze the effect of oil abundance on the different angles of the economy both at the macro and micro levels. In this study, the authors’ purpose is to examine the effect of oil rents on the income distribution and how the GINI coefficient responds to the shocks of oil rent. They carry out a country specific time-series analysis using the autoregressive (VAR) model

⁵ Factionalism is the splitting of a group into factions.

⁶ There are different political factions in Iran. The main parties are as follow:

- a. Conservatives or Hardliners: Khomeini, Khamenei, Ahmadinejad
- b. Pragmatists: Ayatollah Akabar Hashemi Rafsanjani
- c. Reformist: Khatami

Each party has its own supporters among the officials.

⁷ Farzanegan (2013), p.17

to estimate the impulse response function (IRF). They conclude that the oil shocks have an important effect on the variations of the GINI coefficient. Their results are as follows: “Approximately 48% of the variance of the GINI coefficient in the first year following the initial shock can be explained by changes in oil rents per capita, while the GDP per capita explains approximately 7%. The power of oil rents in predicting the future variance of GINI coefficient increases to 49% in the 6th year after the shock, and remains at approximately 46% until the 10th year following the initial shock”.⁸

Pesaran et al. (2013) show that during the past fifty years, the oil incomes have been a blessing per se for GDP growth in the long run while the mismanagement of these revenues and also increased demand for goods made these revenues to become a curse. These revenues become a curse in terms of exchange rate volatility and increasing inflation rate. In a similar manner, Roshani (2013) analyses the effect of oil revenues on the liquidity in Iran and shows how the mismanagement of these revenues causes many difficulties for the economy and the country. He concludes that, despite of the fact that the economy of Iran is unable to absorb this volume of liquidity, the high injection of these revenues to the economy provides a fertile field for inflation. Another issue caused by the mismanagement of oil revenues is the use of import as a tool to convert these revenues to local currency by the government which causes the bankruptcy of many domestic producers. Therefore, these revenues transform the economy of Iran to a consumer economy. A paper by Maleki (2009) studies the effects of a positive shock in oil price and its consequences on the economy. According to his theoretical paper, the injection and also the mismanagement of these revenues provide the ground for a high inflation rate and high unemployment rate and also weaken the private sector; a consequence is high dissatisfaction. He also shows that these revenues lead to corruption.

I use these two groups of economic papers, both in the world and in Iran, together to analyze whether resource abundance is a curse within the Iran context. The remainder of this paper is structured as follows: given the importance of the quality of institutions and the role of decision making agents, section 2 provides a brief summary of Iran’s political structure from Shah’s era to the present. Section 3 presents the data description and the regression framework to analyze the

⁸ Farzanegan and Habibpour (2014), p.5.

resource curse and also the effect of the other aspects of the economy on the real per capita GDP. Finally, section 4 concludes the paper.

Section 2

History of Power in Iran

Given the important role that institutions and the power structure play in an economy, in section 2 we present a brief history of political structure and also the role of oil revenues in different eras of Iran. During the last century, different regimes have ruled the country. The share of fossil fuels revenues in the government's budget varied from regime to regime and from president to president. Some governments used these revenues as the main resource of their budget while this share was minor for others (depending on the world price of oil and the political situation of the country in the world).

2.1. The Last Emperor of Iran Pahlavi Dynasty

In October 1925, after the deposal and exile of Ahmad Shah, the last king of the Qajar Dynasty, by Majlis (Parliament), Reza Khan who was the commander of the Iranian army was declared as the Shah of Iran and ruled the country until 1941.

The main goal of Reza Shah was to run projects and plans that provide the appropriate field to modernize Iran and thus improve the economic situation of the country. He strongly believed in the important role of education and educated people in transformation of the economy and the country. Therefore, he supported foreign education and sent many Iranian students and also his son to abroad for further education. His other important achievement to facilitate the higher education within the country was the establishment of University of Tehran. Other major projects and plans implemented during his period ruling the country were the establishment of a cross country railway system, improvements of health care, etc.

One of the main features of Reza Shah was his belief to make the country independent of foreign powers. Hence, to finance these plans, domestic financial sources were used and foreign loan were excluded. Two sources of revenues that were used to finance these projects included the revenues from APOCs⁹ royalty which was \$2,886,375 in 1933 and also the imposition of tax on

⁹ Angelo-Persian Oil Company, later on renamed to Angelo-Iranian oil Company. Today it is known as British Petroleum (BP).

every products such as sugar, tea, etc. This point underscores the importance of tax revenues before 1960s.

Reza Shah's sense of independence and his efforts to make the country immune from the penetration of foreign powers and also his declaration of neutrality in World War II resulted in his abdication. In 1941, Reza Shah was forced by the allied powers of Great Britain and the Former Soviet Union to abdicate and went into exile. His son, Mohammad Reza Pahlavi, was declared as the shah of Iran and ruled the country for almost four decades until 1979.

During his power, the price of oil varied between \$1.02 and \$1.3 in dollar values of the day (\$15.59 and \$22.78, dollar values of 2009, respectively) and the role of oil in economy was not very important.

Mohammad Reza Pahlavi ruled the country from 1941 until the Islamic revolution in 1979. Before 1960s, oil revenues did not play a determinant role in the economy. Since these revenues were inadequate, a significant amount of Iran's export was non-oil commodities such as agricultural and handicrafts goods like carpet and jajim. In 1973, when the first oil price shock occurred and the price of oil rose from \$3 to \$12 per barrel, the role of oil in Iran's economy and in government's budget increased dramatically. From 1974 until 1979 with the help of massive oil revenues which provided abundant and cheap capital, the Shah of Iran tried to improve the manufacturing sector and transform Iran into an industrialized country. In this regard, many consumer industries such as basic metals, chemicals and steel were imported. The development of these industries reduced the unemployment rate and increased the production of the country. It is worth to mention that the oil price boom and subsequent development plans caused many farmers and villagers to migrate to cities since the wage rate in the manufacturing and resource sectors in cities was much higher than that in the farming sector.

To sum up, we can point out the most important economic and political events under the ruling of Mohammad Reza Shah Pahlavi:

1. *The Nationalisation of Anglo-Iranian Oil Company (AIOP) by his Prime Minister Mohammad Musaddiq(1951-1953)*. Mussadiq attempted to run the oil industry by relying on the Iranian knowledge and power independent of western countries intervention during an economic blockade and also tried to strengthen the role of parliament in Iran.

2. *White Revolution* (started in 1963): Through this process, the Shah started an industrialization process. He began his program with a land reform. The main motivation for

running this plan was to eradicate the power of landlords. The Shah bought the lands from landlords and sold those lands 30% below the market value to the villagers and made them able to cultivate their own lands. He nationalized the forests and pasturelands and all water resources. More importantly, the first and second oil shocks provided massive foreign exchange reserves and, as a result, made the state able to import consumer goods and raw materials. Because the Shah had support from western countries, particularly the U.S., he was also able to attract foreign investments. The most important point is that the government financed all of these programs with oil revenues.

Unfortunately, the massive oil revenues and the support from the U.S. and other Western countries made the Shah and the state non-accountable and separate them from its citizens. Hence, they became unresponsive to the economic situations of the citizens and created a large gap between rich and poor people which at the end led to social unrest.

During 1978, people massively appeared on the streets to show their objection to the policies of the Shah. After a year or so of protests, in 1979, the clergy launched the revolution and they seized the power.

2.2. Islamic Republic of Iran

On April 1, 1979, about 99% of people voted for an Islamic Republic in the hope of a better management of oil revenues,¹⁰ freedom, equity and a bright future. Khomeini became the Supreme Leader of Iran and other political oppositions were eliminated one after another.

After the revolution of Iran and also early years of the 1980s, the production of oil dropped substantially from 5.5 million barrels/day (mbd) in 1979 to 1.2 mbd in 1981 because of the foreign sanctions, war and also the migration of many well-educated Iranians who had the needed knowledge to work in the oil industry. Despite this reduction, the oil revenues were still the main source of government income. The reduction of oil production created an opportunity for other sectors of the economy to grow.

¹⁰ One of the prominent slogans during the revolution of Iran was to bring the oil revenues that used to be belonging to the Royal Family on the table of citizens.

a) Akbar Hashemi Rafsanjani

After the war, in 1989, Akbar Hashemi Rafsanjani was elected as the president of Iran and ruled the country until 1997 (for two consecutive terms from 1989-1993 and 1993-1997). Despite other clergies, Rafsanjani favoured free market and the reinforcement of the private sector's role in the economy, supporting the privatization of state-owned corporations. Given the importance of foreign direct investment (FDI) for economic growth and the fact that the FDI decreased after the revolution, Rafsanjani tried to create a secure environment for both domestic and foreign investments and tried to attract foreign investors. He proposed the five year economic development plans. During the first and second five year economic development plans (from 1990-2000), the share of oil in Iran's economy increased and its average share in total export was never less than 79%. With the help of foreign debts and massive oil revenues, the country experienced an unprecedented economic growth in 1990 and 1991, 14% and 13% respectively, which was unprecedented after the revolution (according to the World Bank).

Hashemi Rafsanjani is known as a centric and pragmatic conservative and his influence on the oil industry, the vital vessel of Iran's economy, has made him one of the most powerful men of Iran who had the support from a part of military and the Revolutionary Guard of Iran.

b) Seyyed Mohammad Khatami

After Hashemi Rfsanjani, Seyyed Mohammad Khatami came to power and served the country from 1997 to 2001 and from 2001to 2005.

In terms of economic policies, he followed the policies of Rafsanjany. In other words, he took his policies in a way that supported free market, continued the sale of state-owned enterprises to the private sector and also to stabilize the economy and to maintain good relationship with the rest of the world, particularly with the West in order to attract foreign investment.

He tried to improve the infrastructures needed for a sustained economic growth, also improved the private sector and non-oil export by reducing the obstacles that this sector encountered such as providing them low price inputs and also more Rials (Iran's Currency) for their exports. Iranian farmers benefited from reasonable guaranteed prices, which boosted the agricultural sector and also he tried to attract foreign direct investment (FDI). He imposed restrictions such as higher tariffs on imports, particularly on those goods that could be produced domestically.

One of the most important achievements of President *Khatami* during his presidency was to set up a sovereign wealth fund to reduce the negative effects of oil price volatility on the economy. During his presidency, the GDP growth rate rose from 3% in 1997 to 8% in 2002 and more importantly, according to OECD report on the country risk classification, the risk of doing business in Iran decreased from 6 out of 7 in 1999 to 4 out of 7 in 2005, which could be seen by the next president as an opportunity to attract more foreigners to invest in this country.

c) Mahmoud Ahmadinejad

After Khatami, Mahmoud Ahmadinejad ruled the country for two consecutive terms (from 2005 to 2009 and 2009-2013). During his eight years of presidency, the price of oil had an increasing trend, reaching its highest level in 2012 at \$111.67,¹¹ and remained high (except in December 2008 when there was a sharp reduction in the oil price from \$97.26 to \$61.67). In order to convert these revenues into Iran's local currency and given the prohibition of paying dollars in exchange to Iran's oil, the government increased the volume of imports and to facilitate the imports, he reduced the tariffs and other obstacles. Therefore, over a period of eight years (2005-2013) Chinese commodities flooded Iran's markets¹² and on the other hand, the government lifted the subsidies of inputs for local producers and farmers during the first stage of Subsidy Reform Plan. These policies taken by government have caused an increase in costs of domestic producers.

While Ahmadinejad's government earned 275 thousands billion Toman (Iran's local currency) oil income, the highest in Iran's oil history, his government had the highest budget deficit since the Iranian revolution. The oil Stabilization Fund was closed by president Ahmadinejad in favour of a national development fund and the power was shifted from parliament to the president.

¹¹ BP Statistical Review of World Energy:

<http://www.bp.com/statisticalreview>

¹² Given the isolation of Iran and boycotting of Iran's oil by Western countries, one of the major importers of Iran's oil in recent years is China. The prohibition of paying dollars in exchange to Iran's oil makes this country to find another solution. There are only two solutions left for Iran. This country can either accept China local currency or can use a barter economy and import Chinese goods. The government decided to use the second solution and thus started the import of Chinese goods. The main feature of these goods is their price. Since Chinese goods are cheaper than those made by Iran, this encourages people to buy more of Chinese goods.

The result of his economic policies was a sharp reduction of GDP growth rate from 5% in 2005 to -6% in 2013. The final point which is worth to mention is that the risk of doing business in Iran increased from 4 in 2005 to 7 in 2013 (on a scale of 7).

As can be found from the information mentioned above, despite the existence of oil dependency in budgets of previous governments, these rents were more wisely used by other presidents than Ahmadinejad and were seen as an opportunity to boost the economy.

The important lesson from this section is the important role played by oil rents in Iran's economy which can be seen both as a threat and opportunity.

In the following section, we use a time-series data for a 46 year period from 1965 to 2011 to detect the presence or not of a resource curse in Iran.

Section 3

Data and Empirical Analysis

Although the previous studies about the natural resource curse show that the negative effects of natural resource abundance on economic growth are much stronger in developing rather than developed countries, and also present the negative effects of the natural resource abundance such as corruption, civil war and a reduction of incentive to accumulate human capital, etc., they do not focus on the specific effects of natural resource revenues on economic growth through their effects on government revenues and terms of trade.

Furthermore, the political structure and also the situation of Iran in terms of human rights cause most of the papers in the context of this country to pay attention to corruption and the effects of oil revenues on the quality of institutions and less on government revenues, investment, the development of private sector and other aspects of economy.

This motivates me to narrow down the study of the effects of natural resource abundance on Iran's economy by focusing on government revenues, which represents a proxy of oil dependency, and the terms of trade. My contribution to the existing literature will thus be a more specialized study of the resource curse, centered on the effects of oil dependency of government revenues and terms of trade in the case of Iran. While previous studies relied on cross-section and panel-data, this study uses only time-series data and the model specification has to be adapted accordingly.

In the following subsections, first, I present a brief description of the data, their limitations and their sources. Second, I introduce the empirical model and finally, I explain the estimation results that are obtained through regression analysis.

3.1. Data Description

The data used in this paper are obtained from the World Bank, OPEC, Central Bank of Iran (CBI), U.S. Department of Commerce: Bureau of Economic Analysis, data market database and an exchange with Professor Farzanegan. Table 1 below shows a description of the variables, their sources and the name of variables used in the econometric model.

Table1. Description of Data

The Variable Description	Data Source	Variable Name
Growth rate of real GDP per capita	World Bank and OPEC*	Δgdp_t
Growth rate of Real Investment Expenditure Per Capita	Exchange with prof. Farzanegan	Δinv_t
Growth rate of Real Education Expenditure Per Capita	Exchange with prof. Farzanegan	Δedu_t
Growth rate of Real Military Expenditure Per Capita	Exchange with prof. Farzanegan	Δmil_t
War Years with Iraq		War_t
Terms of Trade	Data Market*	Δtot_t
Ratio of Oil Revenues to Government Revenues	Central bank of Iran*	$doilrev_t$

*for further information and details on data sources, please refer to bibliography.

The data on GDP in current US dollar are extracted from the World Bank data base and are divided by US GDP deflator to get GDP in real terms, then the real GDP is divided by population whose data are from OPEC Annual Statistical Bulletin to obtain real GDP per capita. I performed the same calculation to measure other variables: real investment expenditure per capita, real education expenditure per capita, and real military expenditure per capita.

It is important to mention that since the education and investment data were unavailable for a few years from 2009 to 2011; the growth rates of these two variables from 2006 to 2009 have been used to estimate the missing data.

The oil dependency of the economy is measured by the ratio of oil revenues to government revenues (oil rev/government rev) and by terms of trade.

The last point to mention about the data is that the unavailability of the data on casualties during the Iran- Iraq war to measure the intensity of the war led us to use an annual dummy variable that takes a value of 0 for the years that Iran was not involved in war and 1 otherwise.

3.2. The Empirical Model

As Sachs and Warner (2001) mention in their paper, natural resource abundant countries tend to have a higher input price level that makes the manufacturing sector unable to compete in international markets. Other factors mentioned in their paper which cause resource abundance to be a curse rather than a blessing are the crowding out of entrepreneurial activities and poor governments. They use a cross-country set of data and the growth rate of GDP per capita is measured for a 20 year time period from 1970 to 1990. The main difference between this seminal paper and my work is that I use only time-series data for a single country. Since some macroeconomic variables such as GDP and investment expenditure are known to be non-stationary, the model suggested by Sachs and Warner (2001) had to be expressed in first difference form while the original variables are measured in logarithmic form.

$$\Delta \text{gdp}_t = \alpha_0 + \alpha_1 \Delta \text{gdp}_{t-1} + \alpha_2 \Delta \text{inv}_t + \alpha_3 \Delta \text{edu}_t + \alpha_4 \Delta \text{mil}_t + \alpha_5 \text{war}_t + \alpha_6 \Delta \text{tot}_t + \alpha_7 \text{doilrev}_t + \varepsilon_t \quad (1)$$

Δ is the first difference operator that is applied to the variables that are expressed in the logarithmic form; thus the variables are measured in terms of their growth rate. For instance,

$\Delta \text{gdp}_t = \ln \text{ real per capita GDP}_t - \ln \text{ real per capita GDP}_{t-1}$. The variable oil revenue is not submitted to the logarithmic transformation since it is expressed in terms of percentage. The symbol d indicates the first difference of a non logarithmic variable.

In addition to the independent variables explained in the data description table, the lagged value of the dependent variable (Δgdp_{t-1}) is introduced because of possible dynamic adjustment over time. The expected value of the coefficient is between 0 and 1 and it is an indicator of the speed of adjustment. The error term ε_t is added and is assumed to have a normal distribution with mean 0 and variance σ^2 .

The ratio of oil revenues to total government revenues and the terms of trade are the two variables used to study the presence of a resource curse in Iran. In the absence of a resource curse, the increase of the share of oil revenues in total government revenues should make a positive contribution to GDP because oil rent is used by government rather than the usual taxes that have dead weight. Also in the absence of the resource curse, we expect the increase in the terms of trade to make a positive contribution to GDP. For example, Farzanegan et al. (2011) state that the sign of this variable is expected to be positive. Given the recent political situation of Iran in the international arena and the intensified economic sanctions, particularly the boycott of the oil and energy sector by Iran's major trading partners such as Japan, India and European countries, lead us to believe that the expected sign of the coefficient for this variable may turn out to be zero or even negative.¹³

The positive effect of investment on economic growth is a well known phenomenon. Investment is one of the largest components of GDP and defined as a purchase of capital goods that are not bought for consumption but are to be used in the future to increase production. The

¹³ Terms of Trade are the value of export relative to the value of import. On one hand, a group of previous studies pay attention to the importance of terms of trade on economic growth and show how the improvement of this factor leads to economic growth. On the other hand, many studies illustrate the negative effect of being a primary good exporter on terms of trade and thus on economic growth. For example, a paper by Sala-i-Martin (1997) shows a negative correlation between being a primary good exporter and the growth rate. Mendoza (1997) shows the negative and robust effect of terms of trade volatility on economic growth. Given the main component of Iran's export is oil, the recent sanctions and restrictions have made this country's main revenues to become more volatile which in turn has a negative effect on economic growth. In other words, the volatility of oil export makes us to expect a negative sign.

best instances of capital goods are new technology, machines and buildings which lead to an increase in future production; as a result, it is expected to have a positive effect on GDP.

Another important independent variable in the model is education and its effect on economic growth. It is usually acknowledged that the augmented human capital leads to a higher productivity and thus to a higher economic growth rate and development. Therefore, a positive sign is expected for this variable.

The other independent variable in our regression model is the military expenditure. It measures how the stability and security of the country can affect the economic growth. Thus, we expect this factor to have a positive effect on the dependent variable. Generally, the more secure and stable the country is, the more opportunities and attractions exist for investors for doing business in that country hence high economic growth would be expected.

Last, we measure the effect of war on the economy and consequently on GDP growth rate. This effect is evident and there are a large number of published papers that have been devoted to the effects of this variable. War and also internal conflicts cause the destruction of opportunities which in turn leads to an adverse effect on economy. The best evidence of this claim is the economic situation of countries such as Iraq, Afghanistan and Nigeria where the years of war and debates have made those countries unable to use their potentials in a growth-led way. Thus a negative sign is expected for the war dummy variable.

Table 2 shows the hypothesized effects of the mentioned variables, Table 3 provides summary statistics of the variables in the empirical analysis and Table 4 presents the simple correlations among the different variables.

Appendix A provides a graphical representation of all variables of equation (1) and their trend from 1965 to 2011.

Table 2.Hypothesized Effects of Independent Variables

Independent Variable	Expected Sign
Lag of Dependent Variable(Δgdp_{t-1})	+
Growth rate of Real Investment Expenditure Per Capita(Δinv_t)	+
Growth rate of Real Government Spending on Education Per Capita (Δedu_t)	+
Growth rate of Real Military Expenditure Per Capita (Δmil_t)	+
war_t	-
Terms of Trade (Δtot_t)	+
Oil Revenues/Total Government Revenues ($doilrev_t$)	+

Table 3.Summary Statistics of the Variables (1965-2011)

Variable	obs	mean	std.dev.	min	max
Δgdp_t	46	.0356723	.1787966	-.5945334	.4242172
Δgdp_{t-1}	45	.0321708	.1792149	-.5945334	.4242172
Δinv_t	46	.0458943	.2381378	-.6868634	.501483
Δedu_t	46	.0237451	.261149	-.7206089	.8716879
Δmil_t	46	.044823	.3358563	-.7347353	1.298677
war_t	47	.1914894	.3977271	0	1
Δtot_t	46	.0322432	.301332	-1.014901	.801212
$doilrev_t$	45	-.0003962	.1488618	-.504706	.557974

Table 4. Correlation Matrix

	Δgdp_t	Δgdp_{t-1}	Δinv_t	Δmil_t	Δedu_t	war_t	Δtot_t	$doilrev_t$
Δgdp_t	1.0000							
Δgdp_{t-1}	0.3456* 0.0200	1.0000						
Δinv_t	0.8619* 0.0000	0.4819* 0.0008	1.0000					
Δmil_t	0.6987* 0.0000	0.3947* 0.0073	0.6584* 0.0000	1.0000				
Δedu_t	0.6762* 0.0000	0.3409* 0.0219	0.5965* 0.0000	0.6406* 0.0000	1.0000			
war_t	-0.2359 0.1144	-0.1640 0.2817	-0.2384 0.1105	-0.0801 0.5967	-0.1926 0.1998	1.0000		
Δtot_t	-0.0190 0.9003	0.2587 1.0000	0.0149 0.9218	0.0998 0.5092	0.1488 0.3237	-0.2960* 0.0458	1.0000	
$doilrev_t$	0.1681 0.2696	-0.1201 0.4318	0.2169 0.1524	0.1951 0.1989	0.1950 0.1991	-0.0895 0.5586	-0.1982 0.1918	1.0000

Before discussing the estimation results, I will present some diagnostic tests that are applied to search for possible model specification errors.

To investigate for the presence of autocorrelation, I use the Durbin–Watson test.¹⁴ As I will present in table 5, there is no symptom of autocorrelation in the residuals since the d statistic of this test is 2.095, a value close to 2.00.

To have reliable OLS estimators, the assumption of homoscedasticity should hold. If this assumption is violated then the estimated coefficients are still unbiased but are not BLUE and their variance is not the lowest. In other words, the standard errors are biased which in turn lead to a biased inference. So, there is a possibility for the results of the test to be wrong. The Breusch–Pagan test has been used to check for this problem. According to the results presented in table 5, the chi square statistic is equal to 0.41 and thus we fail to reject the null hypothesis which assumes the existence of constant variance.

¹⁴ In the presence of lagged dependent variable, it is more proper to use the Durbin–h test but as we will see later on, the coefficient of lagged dependent variable is not significant. So, we use the standard Durbin–Watson test.

Table 5. Results of regressing the growth rate of real GDP per capita on independent variables

	(1)
	Δgdp_t
Δgdp_{t-1}	-0.13 (0.0869)
Δinv_t	0.511*** (0.0821)
Δedu_t	0.146* (0.0667)
Δmil_t	0.0981 (0.0563)
War_t	-0.0316 (0.0348)
Δtot_t	-0.0506 (0.0472)
$doilrev_t$	-0.116 (0.0931)
_cons	0.0158 (0.0152)

N	45
R-sq	0.818
adj. R-sq	0.784
rmse	0.0841
Durbin–Watson	2.095
heteroscedasticity	0.41

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

To make sure I have all variables that are needed to explain the dependent variable, the growth rate of real GDP per capita, I test for possible omitted variable bias by using the Ramsey Reset test. From the result of this test, i.e. $rmse=0.0841$, I conclude that the OLS estimation does not show omitted variable bias. Again, the result of this test is presented in table 5.

Another important assumption is the absence of multicollinearity of the independent variables. In other words, one independent variable should not be a linear combination of other variables. The near multicollinearity is a possibility with macroeconomic time-series data. The presence of such a problem leads the standard error to be inflated. Therefore, I use the variance inflation factor (VIF) command to examine for the existence of this problem. As it can be seen from the result presented in table 6, none of the independent variables has a VIF value greater than 10, the standard criterion, which implies the absence of multicollinearity.

Table 6. The VIF Table

Variable	VIF	1/VIF
Δgdp_{t-1}	4.42	.412694
Δinv_t	2.27	.441059
Δedu_t	1.51	.663090
Δmil_t	1.93	.517952
War_t	1.29	.776846
Δtot_t	1.23	.811106
$doilrev_t$	1.19	.837497
Mean VIF	1.69	

The next diagnostic test is to detect whether the residuals follow a normal distribution. If this assumption is violated then, the validity of all tests (p, t and f) is questionable. I use the Shapiro–Wilk test to check for this problem. The null hypothesis of this test is that the residuals are normally distributed. As it can be seen from the results presented in the table 7, the p-value is

greater than 0.05 which indicates the null hypothesis cannot be rejected. Finally, the R-squared value, which is 0.81, shows that a significant portion of changes in the dependent variable, real GDP per capita growth rate, can be explained by changes of the independent variables in our regression.

Table 7. Shapiro–Wilk W Test for Normal Distribution

Variable	Obs	Z	Prob>z
E	45	-2.405	0.99192

After all of these diagnostic tests and making sure the model is well specified, we can use the OLS estimation results to analyze the presence of the natural resource curse. According to the results from the estimated regression, we can check whether Iran is a victim of resource curse or not and also examine the effect of other economic factors on the growth rate of GDP.

3.3. The Results of the Econometric Model

Following Sachs and Warner (2001), the estimation of the model has been carried out using Ordinary Least Square (OLS). The regression results are presented in table 5.

According to table 5, the estimated coefficient for the lagged value of the dependent variable is not statistically significant from zero while we were expecting a positive sign. This indicates that there is a little delay between the change of independent variable and the induced change of the dependent variable.

Table 5 shows that the coefficients for investment and education are significant at least at 5% level and robust. In addition, their signs are consistent with what is expected. This implies that as the growth rate of expenditure on investment and education per capita increases by one percent, the growth rate of real GDP per capita increases by 0.511 and 0.146, respectively.

The coefficient for the military expenditure is significant at least at 10% level and has the expected sign. This coefficient indicates that as the growth rate of expenditure on military increases by one percent, the growth rate of real GDP per capita increases by 0.098. This shows the important effect of stability and security of the country on economic growth.

The war dummy has the expected negative sign but is not statistically significant. One possible explanation for the insignificance of the war variable is that despite its destructive effects on different aspects of the country and the economy, and also is estimated that almost half a million soldiers and civilians were killed during those years, the efforts made by the state during the war period through increased spending which reached at its highest level at almost 27% in 1981 may have reduced the negative effects of war on the daily life of people.

The other two variables that represent the contribution of oil revenues to the economy, the ratio of oil revenues to government revenues and the terms of trade, are not statistically significant.

The negative and statistically insignificant result of terms of trade implies the existence of resource curse in Iran. As I mentioned above, while a number of papers show that terms of trade have a positive and significant effect on the economy growth rate, another group of papers show the negative effect of terms of trade volatility on growth rate of GDP. Our finding is consistent with the second group of papers. Since Iran's economy is highly dependent on oil revenues, any swings in volume of oil export or in the price of oil can cause volatility and a negative effect on economic growth through its effect on terms of trade.

One possible explanation of the insignificant results for the ratio of oil revenues to government revenues is the quality of the data. It is important to mention that the quality and the reliability of the data obtained from CBI have been questioned by researchers. In Iran, the statistical data come from monitoring sites administered by the CBI, which provides data on the national accounts and other important macroeconomic aspects of the economy.

The government and other responsible organizations for publishing the data are unwilling to publicize the real data since it shows the results of their mismanagement. Especially in recent years, the government manipulated the real data to underestimate the effects of the tightened sanctions which are caused by their mis-policies. For instance, Hanke (2013) uses the changes in

the exchange rate to estimate the real inflation rate in Iran. He shows that the real inflation rate of Iran is about 110% while the officials of Iran claim that this rate is less than 40%.

Accordingly, the manipulation of the data can be used to explain the non-significant result of the ratio of oil revenues to total government revenues. It is notable that this non-significance cannot reduce the importance of the fact that the economy of Iran is highly dependent on oil revenues and this dependency has made the country vulnerable.¹⁵

¹⁵ The best proof of this dependency and vulnerability of Iran's economy can be seen in the policies taken from Western countries in approach to Iran's nuclear program. The main sanction that brought back Iranian officials to negotiation table was the sanction against Iran's oil and its revenues which made the economic situation worse than before and also generated the social unrest.

Section 4

Conclusion

In this paper, I tried to show whether the Iran's economy is affected by the abundance of natural resource revenues or not. In other words, I study the resource curse in the case of Iran. I used a time series data set for a 46 year period from 1965 to 2011 to analyse this effect. After checking for possible model specification errors and problems, I estimate the model using Ordinary Least Square (OLS). The results indicate that Iran resource abundance has not led to high income per capita. As Sacks and Warner (2001) mention in their paper, rent seeking, corruption, crowding out the entrepreneurial and innovative activities are the main elements that can be used to explain the curse. Among these factors, the high dependency on oil revenues, consequently the vulnerability to the oil price volatility and oil export quantity swings on one hand, and on the other hand, the separation of the state from its people and thus the non-accountability of the state to its citizens both before and after the revolution play an important role in forming the natural resource curse. The massive rents derived from oil and gas are concentrated at the state level and act as an independent resource of revenues which result in non-accountability of government to its citizens. We also show how an increase of growth rate of investment, military and education expenditure have a positive effect on growth rate of GDP. The results indicate that using oil revenues to support investment is a positive way to contribute to higher income of Iran people.

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Appendix A: Figures

Figure 1.Trend of Real GDP Per Capita of Iran (1965-2011) (USD)

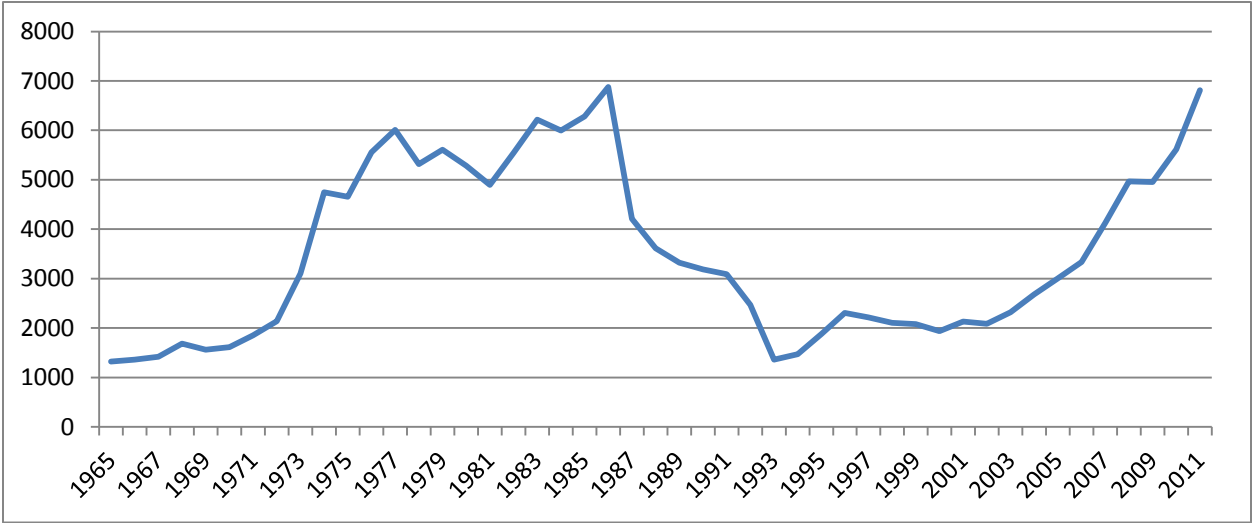


Figure 2. Trend of Oil Revenues Share in Total Government Revenues in Iran (%)

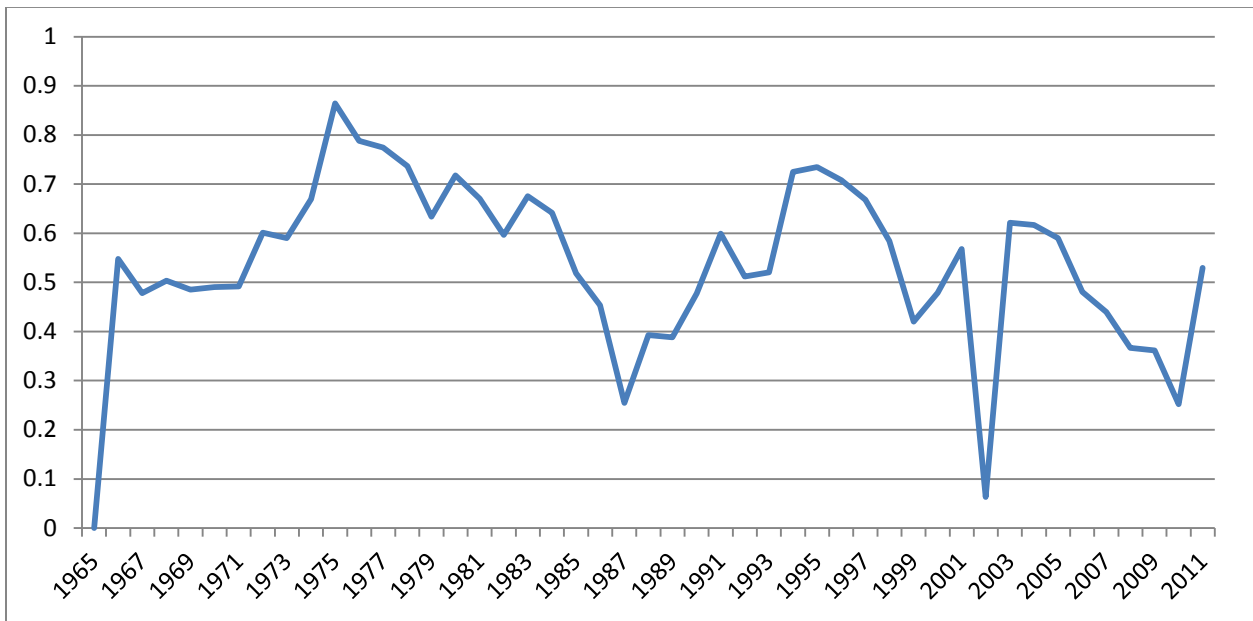


Figure 3. Trend of Real Investment Expenditure Per Capita (1965-2011) (USD)

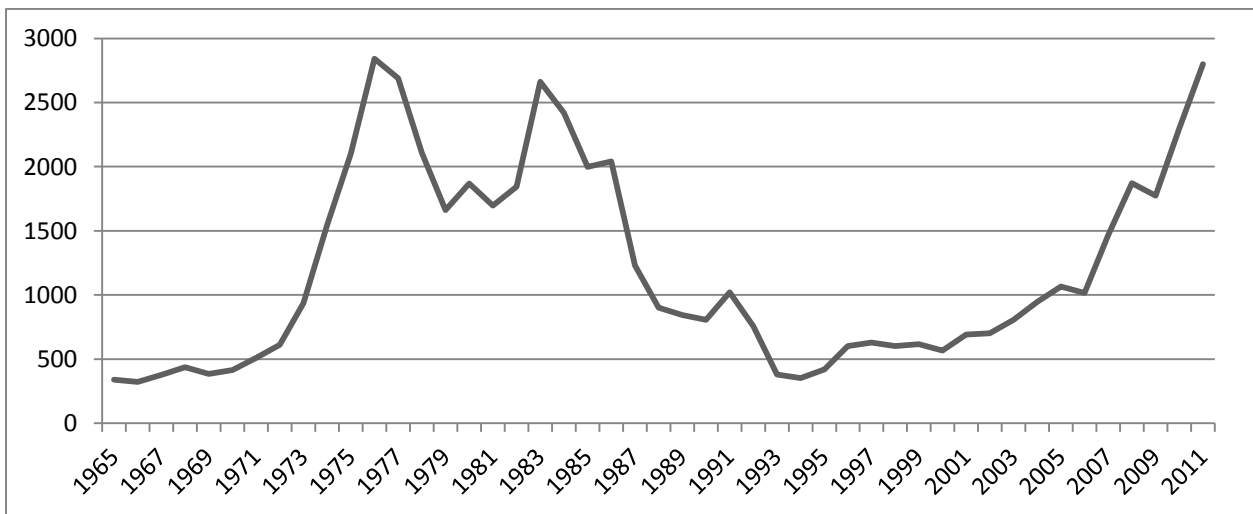


Figure 4. Trend of Real Military Expenditure Per Capita (1965-2011) (USD)

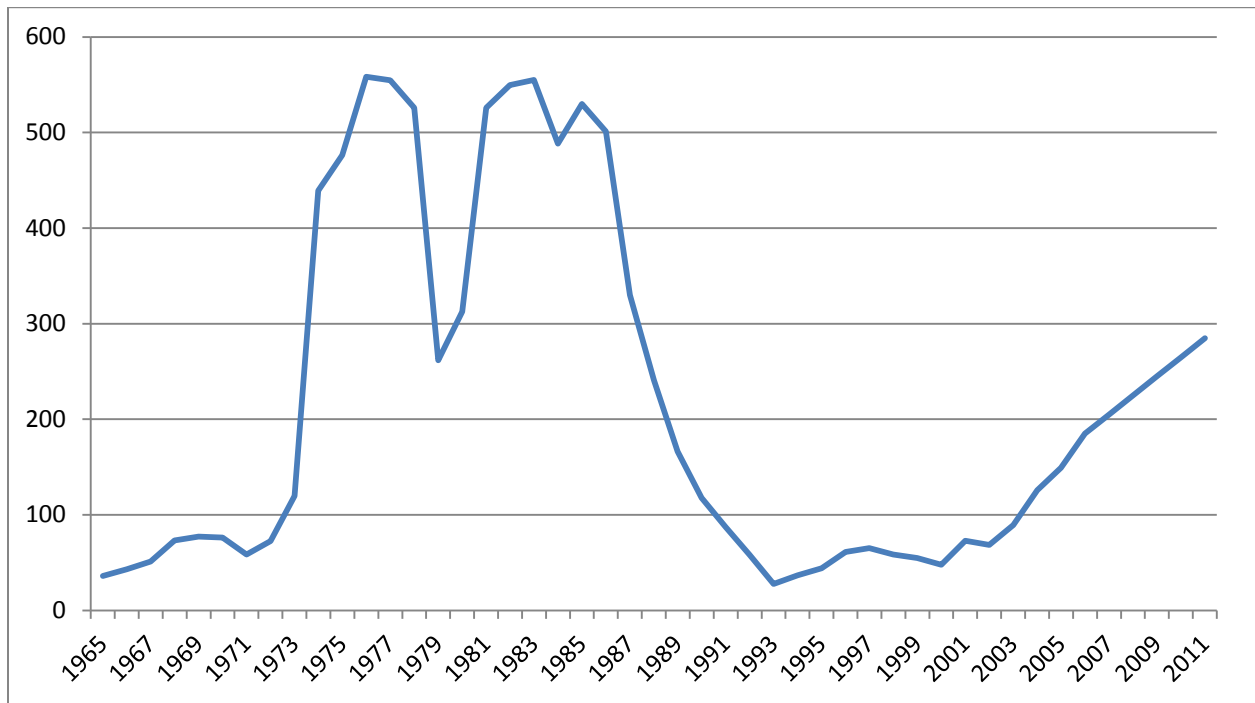


Figure 5. Trend of Real Education Expenditure Per Capita (1965-2011) (USD)

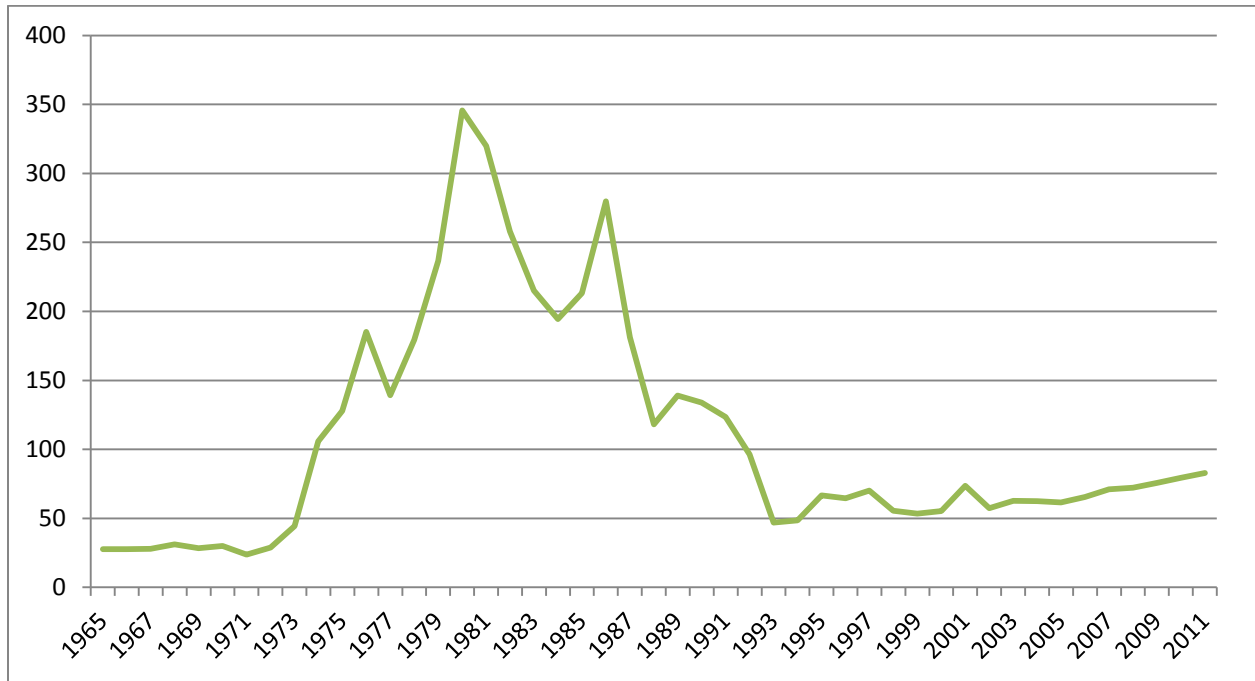


Figure 6. Terms of Trade (1965-2011)

