AMERICAN UNIVERSITY OF BEIRUT

CRUDE OIL PRICE FLUCTUATIONS: IMPACT ON THE WORLD ECONOMY

by
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AN ABSTRACT OF THE THESIS OF

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Since the 1970s, the world has experienced several oil price changes with cruel impact on global macroeconomic factors. The first oil price shocks in 1973 provoked the attention of many and the ambiguous relation between oil prices and economic activity encouraged several people to study its trends, causes and short term and long term consequences. Are oil prices linked to the law of the market, to political events, to speculation or future expectations?

Everybody reached the conclusion that oil price fluctuations stimulated inflation and generated recessions but each one got it differently.

In this thesis, we will test the relationship between crude oil price fluctuations and several macroeconomic factors from 1970 to 2009. In addition, an estimation of the impact of oil price shocks on the world economy is done. Chapter 1 is a general introduction about the energy industry particularly oil, and a brief description about the different chapters. Chapter 2 described the major events that happened from the 1970s until 2010 and that affected oil prices hence the macroeconomic performance i.e. Yom Kippur war, Iranian Revolution, Gulf war, Asian Financial Crisis, the sequence of Hurricanes, 2008 Great Recession. Chapter 3 is a discussion of previous studies related to this subject. It helps us identify better the nature of the relation between oil and macroeconomic factors from different point of views. In chapter 4, through the Granger causality test applied on 15 countries, we will analyze how crude oil price fluctuations affect them individually then to analyze the effect of oil price shocks on the global economy, an estimation of these shocks on the world economy is done. It focuses on two oil shocks: The Oil price shocks of 1973 and1985.

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To my family

CHAPTER 1

INTRODUCTION

Traditionally, economic concerns related to the energy industry and oil particularly were categorized as "microeconomic" and insignificant for macroeconomic analysis. However due to the first oil price shock in 1973, following Yom Kippur war the whole concept was modified. Despite its negative repercussions on the world economy, it should be seen as a great opportunity to broaden the horizons of economics.

Studying the impact of crude oil price fluctuations on the world macroeconomic factors has been and still is of great interest and concern among many people specially economists. They are trying to understand the trend, causes and consequences of these fluctuations.

Since the 1970s, oil has had a major part in shaping the nation's development and economic growth. Given the importance of crude oil and the attention its prices have been given in journals, in our daily lives and in several studies; I devoted my thesis to study the impact of crude oil price fluctuations on the world economy taking into consideration the following macroeconomic factors such as growth rate, exchange rate, inflation rate, and unemployment rate etc… In what is mentioned above, it is discussed that oil price fluctuations have an effect on the economy and can therefore lead to a recession, inflation or even expansion. On the other hand, Bernanke et al, (1997) stated that changes in oil prices are not the main cause of recession or other changes in the economy. It's the central banks' decision to increase interest rate to fight against inflation due to a raise in oil prices what dragged the economy into recession.

The aim of this paper is to find a logical relationship between historical events, theoretical analysis and empirical results related to crude oil price fluctuations and their impact on the world economy since the 1970's.Chapter 1 of the thesis is a general overview that introduces energy industry particularly oil, and also includes a brief description about the different chapters. Chapter 2 describes the major events that affected oil prices from 1973 until 2009. It begins with the 1973 oil crisis when the OAPEC countries announced their oil embargo on the US and its allies, rolling on to the Iranian revolution, the Iranian-Iraqi war, the OPEC controlling the oil prices, 1980's oil glut, the Gulf war, the Asian Financial crisis, the September 11 attacks, the Venezuelan strike, the Iraqi war, the sequence of Hurricanes and finally the 2008 Great Recession. All these events caused oil price fluctuations but to what extend these fluctuations affected the world economy; the analysis will be discussed in the following chapters. Chapter 3 is a literature review summing up some of the important concepts and theories in these different events and the attention they were given by numerous professionals. In the first part of chapter 4 the Granger causality test is applied on 15 countries to analyze if crude oil price fluctuations are affecting the countries' GDP or otherwise. In a second part, we analyze the effect of oil price shocks on the global economy; an estimation of these shocks on the world economy is done. It focuses on two oil shocks: The Oil price shocks of 1973 and1985. Chapter 5 is an overall conclusion of the thesis

CHAPTER 2

OIL PRICE FLUCTUATIONS AND HISTORICAL EVENTS: AN ONVERVIEW

Crude oil prices fluctuate like any other commodity in phases of shortages and surpluses to reach a balance between consumption and production whose changes are due to many factors such world economic growth, OPEC supplies, supply and demand alterations… This cycle can extend many years depending on the several changes that its supply and demand face.

The US petroleum and natural gas industry has been greatly controlled in the 20th century. After the World War II the oil prices were about $26.64 per barrel. If there wasn't any control over its price, the US oil price would have hit $28.68 similarly to the world price. The OPEC limited the crude oil prices between $22 and $28 per barrel. After the consecutive wars and conflicts in the Middle East, the prices surpassed $24 per barrel, OPEC didn't have the same ability of production i.e. controlling supply the way it wanted it so it removed the price band in 2005 and couldn't adjust the price of oil so it let it float. This same phenomenon happened in the 70s when the OPEC couldn't affect the oil prices.

Major events that affected crude oil prices:

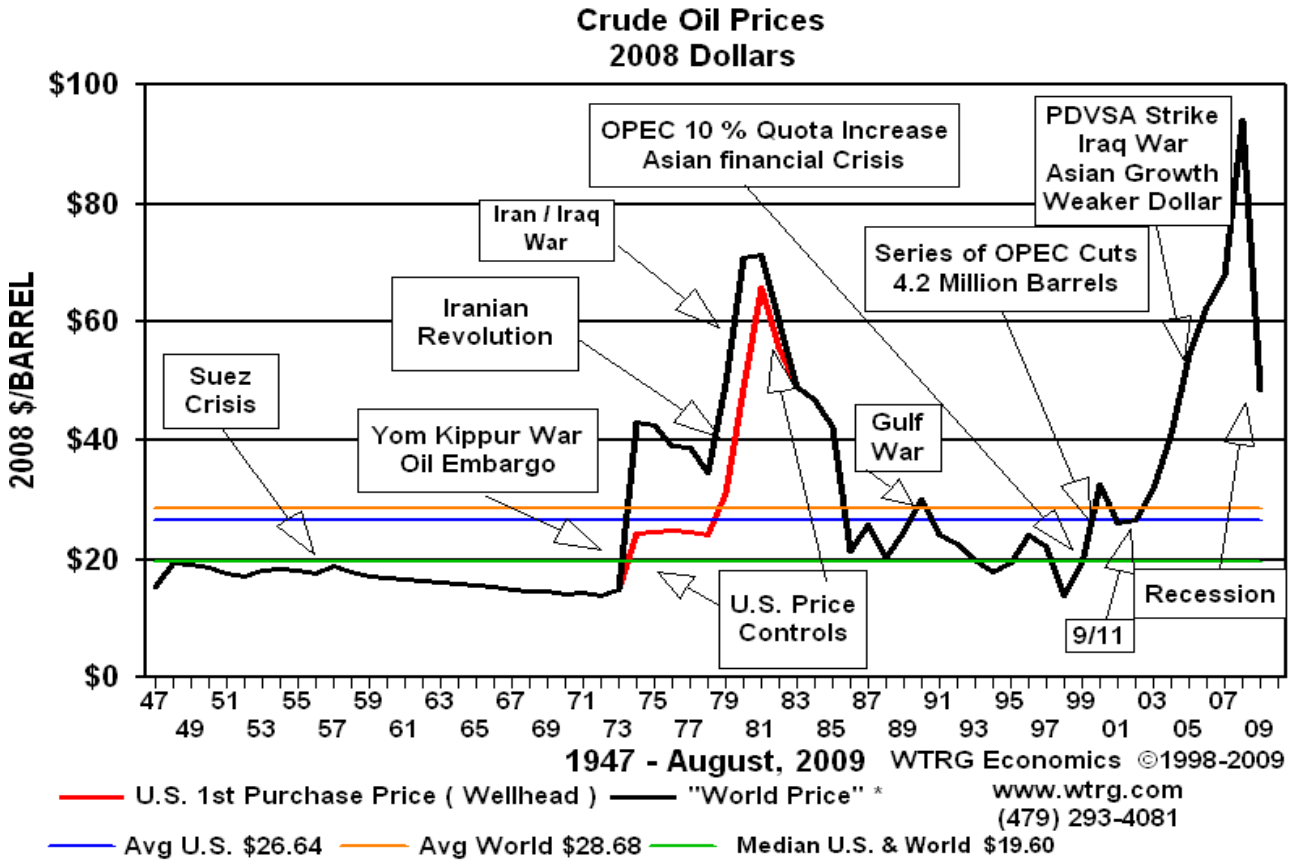

Figure 1: Major historical events affecting crude oil prices from 1937 until 2008

Source: www.wtrg.com/oilprice1947.gif

2.1. Post World War II events

After World War II, we will move to an era where Texas Railroad Commission[1] and the Seven Sisters[2] of petroleum industry's influence over oil production and prices declined due to the rise of the OPEC.

[1] It was the United States' oldest agency that controls the petroleum industry. It was established in Texas in 1891

From 1948 until the end of 1960's crude oil prices were between $2.50 and $3.00. In real value it's another story, crude oil prices vary between $17 and $19. In the period 1958-1970, the prices were stabilized around $3.00 per barrel but in real value it declined from $19 to $14 per barrel. In the years 1971-1972, to regulate the inflationary situation the crude oil prices were decreased causing depreciation in the US dollar.

The Organization of the Petroleum Exporting Countries (OPEC) was founded in 1960 with the founder members being Iran, Venezuela, Iraq, Kuwait, and Saudi Arabia then other members joined the group such as Algeria, Angola, Ecuador, Libya, Nigeria, Qatar, and United Arab Emirates in 1971. Indonesia, a former member left the cartel because it became an importer of oil.

It took the OPEC almost 10 years for it to improve and have an influence on the global market.

From these influences, the OPEC members held a study on Railroad Commission of Texas in order to analyze ways of influencing prices through the supply channel.

After the establishment of the OPEC until the year 1972 the founder members has experienced a 40 percent decrease in the purchasing power of the barrel of oil but an increase in the demand for crude oil during the after war period.

It was in March 1971 that OPEC took the price control over the other crude oil industries (Texas Railroad commission and Seven Sisters). In other words, OPEC is the new cartel that influences the crude oil prices worldwide instead of the United States of America

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[2] It refers to seven oil companies organized as a cartel that formed the "Consortium for Iran" and were taking over oil production, refining, and distribution in the 20th century. Its influence declined with the development of OPEC

specifically Texas, Oklahoma and Louisiana states especially after the war; OPEC had the full power to influence the crude oil prices.

2.2.Yom Kippur War - 1973 Oil Crisis

The 1973 Arab-Israeli War[3] started on October 6, 1973 until October 26 of the same month, between Israel and an alliance of Arab states supporting Egypt and Syria. The war coincided with Yom Kippur, the holiest day of the Jewish calendar and Ramadan, the holiest month in the Islamic calendar. It debuted by a surprise attack on Israel by the Egyptian and Syrian armed forces who took advantages of this Israeli religious occasion in which the security of the militaries would be provisionally absent. The two armies were fully equipped and numerous. Many Arab states were financing the war or even sending armies from the Arab side such as Kuwait, Saudi Arabia, Libya, Tunisia, Sudan and Morocco. Seeing all these countries involved in the attack, we could say that this war was on an international level implicitly involving the two poles, the United States and many western countries and Russia, each one supplying weapons to one side.

The war started when Egypt attacked the Suez Canal and Syria attacked Golan Heights; both threatening Israel. However, Israel reinforced itself by counter-attacking in the Sinai and occupying respectively the two Egyptian and Syrian territories in the Six-day war. After 24 to 48 hours from intensive attacks on Israel, the tendency is reversed in the favor of the Israeli forces that finished by pushing back the Syrians armed forces out of the Golan Heights in 2 weeks and moved forward the Suez Canal to the Egyptian

[3] Also known as Yom Kippur war, Ramadan warm the Fourth Arab-Israeli war

territories to progress toward the capital Cairo. Then the United Nations sent their troupes to the fighting scene and ordered the cease-fire. This drastic change in the situation to the benefit of Israel was due to the American's supply of weapons and moral support such as intelligence and information.

In this episode of the Arab-Israeli conflict lies a reputation of Israel's invincibility especially that the psychological impact of the early days of the war were in favor of the Arab countries. The changes that followed, led to the normalization of relations between Israel and Egypt, to peace negotiations which led to the David Camp Accords. The most important consequence was the "oil price shock of 1973" known as the first great event affecting the economy since the Great Depression in 1929. This shock originated when the OPEC including Egypt, Syria and Tunisia now known as the OAPEC, announced an oil embargo on the United States and all the other countries supporting Israel in the conflict. Although these countries decreased the production of oil by 5 million barrels per day, other countries were able to increase it by 1 million barrel. This cut down in the production of oil represented a fair loss of 4 million barrels per day. This situation remained until March 1974 and corresponded to 7 percent of the complimentary world production.

Although the OPEC was in control of crude oil prices over the United States, this influence was removed during this critical period, the Arab Oil Embargo. This remarkable flexibility of prices to supply the shortages became evident especially when the prices augmented by 400 percent in six months. In 1972, the price of crude was $3 per barrel; by the end of 1974 to 1978, the crude oil price quadrupled and was ranging

between $12.21 per barrel and $13.55 per barrel. Then to regulate for inflation, the crude oil prices started to decrease.

2.3.Crisis in Iran/Iraq – 1979/1980

2.3.1. *Iranian Revolution – 1979*

We'll start with the 1979 Iranian revolution also known as the Islamic Revolution where the Islamic republic under the Khomeini took place defeating Iran's kingdom under Shah Mohammad Reza Pahlavi in the revolution lead by Khomeini. Protests against the Shah started in early 1978 and many strikes followed it, terrifying the country. After many major events in Iran specially the revolution and the public referendum voting for it as an Islamic republic, Ayatollah Khomeini became the "supreme leader" of the country in December 1979.

The Iranian Revolution marked the second oil crisis in history after 1973. After the massive protest against the Shah in favor of the Khomeini who gained control in the country in early 1979, some protests affected harshly the Iranian oil sector too. Although the new regime under Khomeini carried on with oil exports, it was still irregular and with a reduced amount imposing an increase in the prices. To compensate this decline in oil production, Saudi Arabia and other OPEC members boosted the supply side; this decreased the loss to about 4 percent and caused high profits to all the OPEC members. Nevertheless, a prevalent terror arose, pushing the prices higher than they are anticipated in regular situations.

The effect of this oil price increase on the United States caused a phase of deregulation of oil prices in which oil importation decreased severely and US oil production increased strongly.

2.3.2. Iran-Iraq War - 1980

The Iran-Iraq war (also called the Imposed War, Holy Defense in Iraq and Saddam's Qadisiyah in Iraq) started in 1980 and lasted until 1988 where Iraq attacked by air and land Iran due to border conflicts, political differences and religious divisions. Saddam Hussein, the president of Iraq and the leader of the Ba'ath party, was terrified by the new leadership in Iran that might menace Iraq's Sunni/Shia's balance and would take advantage of Iraq's geographical importance and openness, attacked the Iranian territories without further notice to benefit from the revolution's disorder . Iraq's objective was to replace Iran in the "dominant Persian Gulf state". Although Iraq was first responsible of the attack, Iran was able to resist and confront the Iraqi militaries and regain its devastated territories in 1982. And then for the rest of the war, Iran was on the offensive side. The war caused many losses financially, economically and specially in human lives.

The effect on the crude oil prices was drastic during this war. In 1980, after Iraq's attack on Iran, Iran's oil supply almost stopped and Iraq as well decreased its oil production. After 1980, the crude oil prices decreased for the six-year of war and ended with a 46 percent price decline in 1986. This was mainly due to the decrease in demand and an increase in production which lead to the loss of harmony within the different

OPEC members. For instance, oil exporters such as the following countries Venezuela, Nigeria and Mexico increased their production.

The 1979-1980 events in Iran and Iraq caused another shock in crude oil prices that led to their increase. The Iranian revolution caused a loss of 2 to 2.5 million barrels per day of oil supply within a period of 8 month from November 1978 until June 1979. The production reached a point where it almost stopped. We can say that this event was the major one after World War II that lead to the highest prices of oil since then. Nevertheless the impact on oil prices was limited since it had been for a short period of time. And then later after a while, the production increased to 4 million barrels per day.

Two month after the Iraqi attack on Iran, in November the joint supply of both countries was 6.5 million barrels per day less than the previous year; in other words, it was only 1 million barrel per day. Accordingly, crude oil supply was 10 percent less than what it was in 1979 internationally. These 2 major events in the 80s led to an increase in the prices of crude oil to more than their double; they moved from $14 per barrel in 1978 to $35 in 1981. Many years later, Iran was able to reach in its oil production two thirds of what was produced at Pahlavi times whereas Iraq's production stayed around a million barrel.

2.4.US controlling oil prices

Following the different incidents from 1973 until the 1980s, there was a fast increase in crude oil prices that would have been prevented if there was no US policy after the 1973 oil crisis. Due to the oil embargo, the US set a price control on locally produced oil

to protect domestic production. Results showed that consumers were paying 50 percent higher on the imported oil than the local produced oil and consequently the US producers were getting less than the world market price. The policy applied by the US government was to subsidize oil prices in favor of local consumers.

Because the 1973 oil crisis caused a recession worldwide, its impact on the US economy particularly was less crucial due to the government's support that helped the consumer witness lower prices compared to the rest of the world.

If the US policy didn't exist and there was no price control, the production of oil would have been higher. And the sequence would have been the following:

Higher production of oil → higher petroleum prices → lower consumption → imports of the US lower during 1979-1980 → impact of the price increase due to the Iranian and Iraqi supply disruption not considerable.

2.5.1980's oil surplus

The 1970's Oil crisis led to a 1980's "oil glut" which means an excess of crude oil due to a decrease in demand for consumption[4] and an overproduction of oil. Crude oil prices reached their peak in 1980 with is $35 per barrel equivalent to $92 per barrel today. Later, in 1986 the prices decreased sharply to $10.

[4] It was due mainly to OPEC's policy for raising prices

The surplus started in the early 1980s due to a recession in industrial countries that followed the 1970's crises. Real value[5] of oil price decreased from $78.2 in 1981 until $26.8 per barrel in 1986.

The word "glut" might be misleading because it was an impermanent surplus mainly that caused a decrease in the prices but still they were above the levels previously reached during the crisis.

And this "glut" led to a six years decrease in oil prices that ended with an overall 46 percent decrease in 1986.

[5] It means it is corrected for inflation as opposed to nominal value which is the price expressed in today's value

2.6.OPEC unsuccessful in controlling crude oil prices

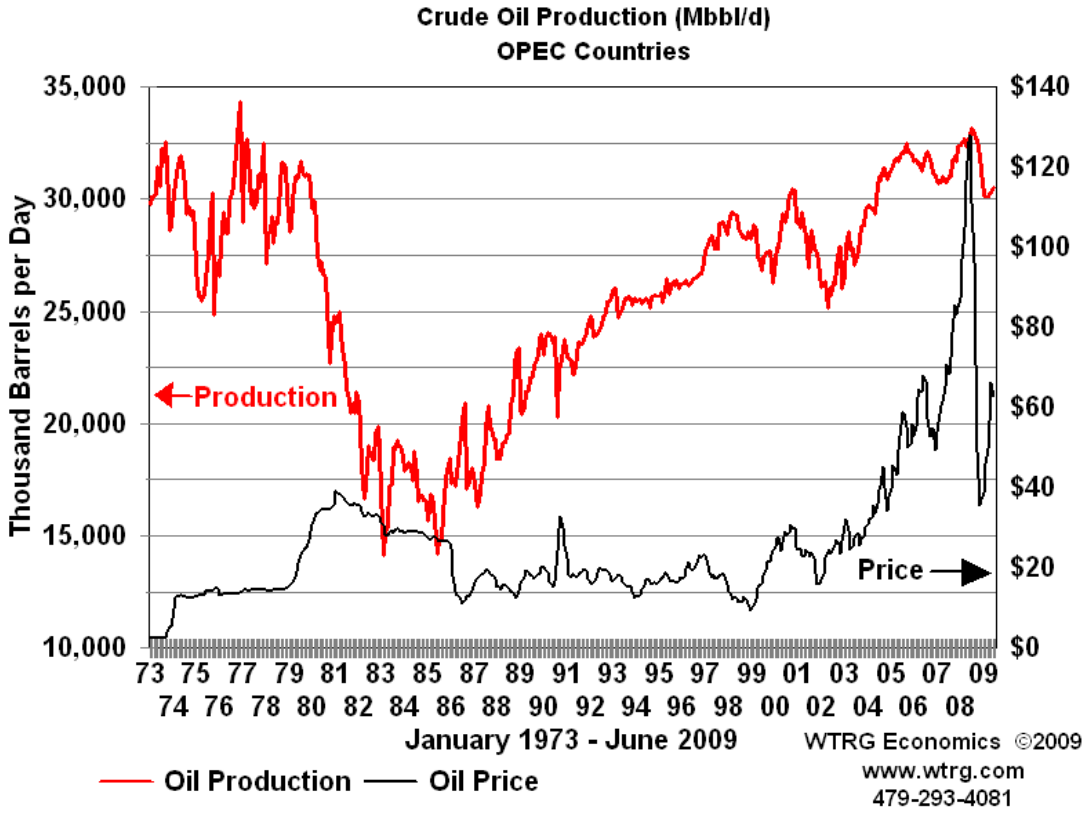


Figure 2: Crude Oil Production, OPEC Countries

Source: www.wtrg.com/oil_graph/PAPRPOP.gif

OPEC was hardly able to control crude oil prices. Though it was called a "cartel", it failed to accomplish its functions as homogenous organizations coordinating prices of oil.

At that time, Saudi Arabia had an important influence on the OPEC from the fact that it was able to increase the production of oil to compensate the effect of the drop in prices on its own revenue. Saudi Arabia had the spare capacity to do so and although this enforcement mechanism was mainly Saudi's Arabia, OPEC used it to remove the negative impact of oil surplus.

In 1979-1980, following the surplus of oil and the sharp increase in their prices, the Minister if oil in Saudi Arabia constantly notified the different OPEC members that increasing the prices of oil would cause a sharp decrease in its demand; but nobody took his advice into consideration until they faced the problem.

When the different events happened, the decrease in demand was due to two reasons mainly:

First, the worldwide recession that followed the different crisis and the increase in crude oil prices. Second, the consumers were vulnerable to the increase in oil prices: they changed their homes installation in order to consume less oil, buy efficient cars that saves energy…

But the worldwide recession was impermanent unlike the different reactions resulting from the consumers to reduce consumption of oil that were permanent and save energy. Therefore, even if there was a reduction of crude oil prices, the demand side won't be affected much.

Also, in the same time, the non-OPEC production increased to 10 million barrels per day between 1980 and 1986 leading to a decrease in the demand of OPEC's production.

Between 1982 and 1985, OPEC members decided to regulate the oil prices by setting a limit to their production. But this effort failed because many of the members didn't act in accordance with the quotas and they produced above it. Throughout this period, Saudi Arabia played as a "swing producer" in order to regulate the open decrease in prices. But later it associated the oil prices to the spot market for crude oil. And then in early 1986 it raised its production.

In mid-1986, crude oil prices freefall below $10 per barrel. Despite that fact, Saudi Arabia's revenue stayed almost the same but with superior volumes balancing the lower prices.

In late-1986, an agreement was set between the OPEC members to aim $18 per barrel but it failed in 1987 and prices stayed fragile.

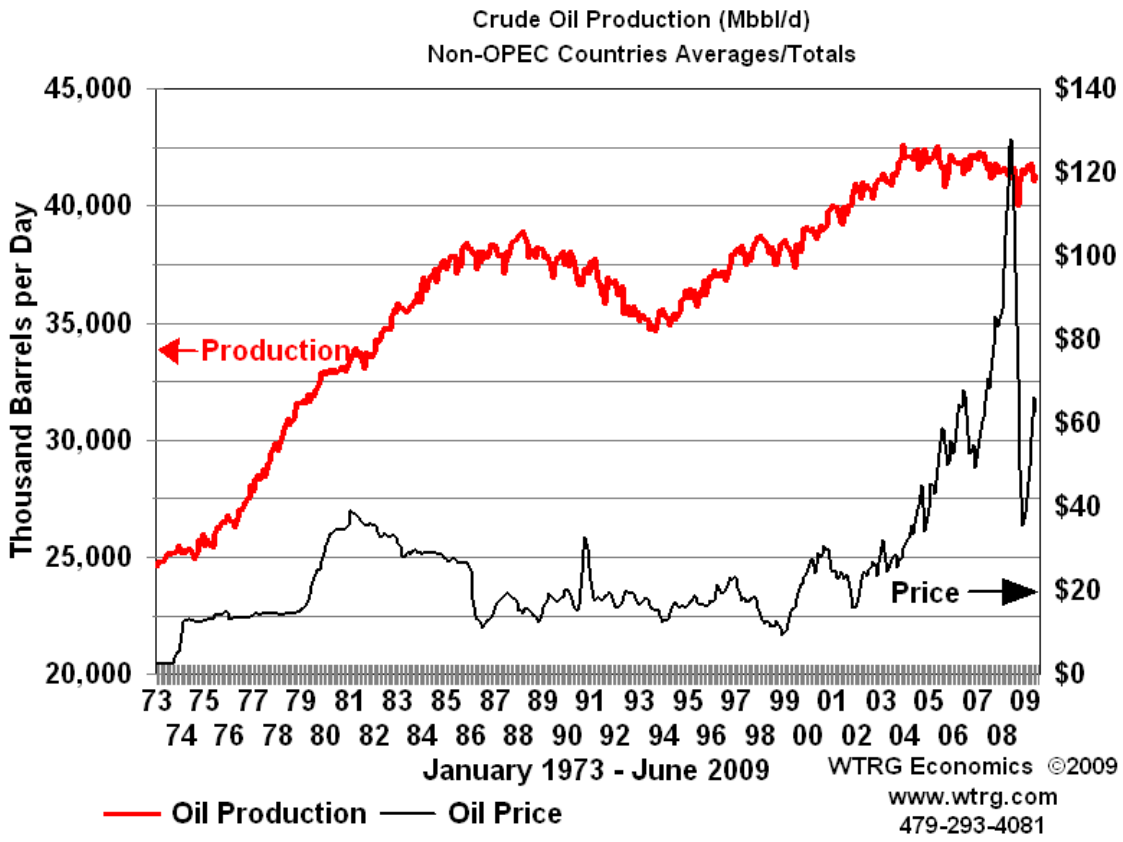


Figure 3: Non-OPEC Production and Crude Oil Prices

Source: www.wtrg.com/oil_graph/PAPRPNT.gif

2.7.Gulf war – August, 1990

Another event that affected the crude oil price was the invasion of Kuwait by Iraqi military forces in August 2, 1990. Iraq blamed Kuwait of stealing Iraqi oil by "directional

drilling". Only within few days of severe battles, the state of Kuwait was eradicated and Saddam Hussein declared that it was "the 19th province of Iraq".

The invasion of Kuwait led to the Persian Gulf War characterized by the alliance of 34 nations against Iraq with the approval of the United Nations. This alliance also known as the "coalition of the Gulf War" had the purpose of driving the Iraqi forces out of Kuwait and liberating it consequently. Mainly, the military forces were from the United States, Egypt, United Kingdom and Saudi Arabia. The combats were not only from the ground but also aerial and ended with the ultimate success of the alliance, and the liberation of Kuwait.

The main reasons behind the Iraqi attack on Kuwait were the following:

After the Iraqi attack on Iran, Iraq finds itself indebted to Saudi Arabia and Kuwait. Also it was under the pressure to pay what it owes them. In addition, Iraq blamed Kuwait on exceeding the OPEC quotas, therefore pushing the prices of oil down and harming the Iraqi economy consequently. The disastrous effect on Iraqi economy was when crude oil prices plummeted and the Iraqi government illustrated it as an economic armed battle worsened by Kuwait "slant-drilling". The relation between the two countries was tensioned when Iraq declared that Kuwait's territories are Iraqi's.

Due to this war, the crude oil prices increased and the production decreased because of the vagueness related to the invasion of Kuwait and the Gulf War in general. The Middle East's view towards the incident in general and Saddam Hussein's act invading Kuwait was worse than his act invading Iran. Subsequently, with the liberation of Kuwait, crude

oil prices started to decline progressively until 1994, where real prices reached their lowest level since 1973. Then the prices started to go up.

During this period, the United States economy and Asian Pacific region were growing. The period between 1990 and 1997 witnessed an increase in the world oil demand up to 6.2 million barrels per day. The crude oil prices fully recovered around 1997. In parallel, the decrease in Russia's supply also facilitated the prices' adjustment. This drop in its production was more than 5 million barrels per day between 1990 and 1996.

During this period of stability, the OPEC succeeded in controlling the crude oil prices despite the technical errors such as changing the quota timing or some common problems to keep the supply regulation between the different members. But this success didn't last for long since the Asian Financial crisis debuted.

2.8.Asian Financial Crisis - 1997

The Asian Financial crisis started in 1997 and caused a terror from a collapse in the economies worldwide due to the spread of this shock. It first debuted in Thailand because of the government's decision to let the Thai Baht float. It was their last resort after several efforts to fight the financial crisis in the real estate. In addition, the country was severely indebted and went bankrupt. With the diffusion of the crisis, it hits Southeastern Asia and Japan that saw their currencies crashing, their stock markets losing value and their debts increasing. Generally, all the countries confirmed the existence of a financial crisis but weren't able to determine its origins or extent. The affected countries were mainly Thailand, Indonesia and South Korea; though many other countries were hit, but

the effect of the crisis was less intense on them i.e. Hong Kong, Laos, Philippine, Malaysia…

In the beginning, OPEC took too lightly and underestimated the effect of the economic crisis in Asia; but then it realizes that the rise in the crude oil prices stopped in 1997 and 1998.

In 1997, OPEC raised the quota around 10 percent (equivalent to 2.5 million barrels per day). The economic expansion in Asia stopped its progress especially in 1998. The crude oil demand decreased in the Asian Pacific regions for the first time since 1982. The high supply of oil, the decrease in demand and the uncertainty about the future caused a sharp drop in the crude oil prices. As a reaction to what is happening, OPEC first puts a quotas of 1.25 million in early 1997 and another one of 1.335 million barrel per day in late 1997. The prices were still decreasing in 1998. They began to adjust in early 1999 but OPEC decreased its supply once again by 1.719 million barrels. Although the production of crude oil decreased by 3 million barrels per days the prices didn't exceed $25 per barrel in 1999.

In 2000, with insignificant year 2000 problems[6], expanding economies worldwide particularly in the US, crude oil prices increased in this year and exceeded the pre 1981 years prices. Three OPEC quotas equivalent to 3.2 million barrels per day were unable to stop the price increases because their effects were too small. After a fourth quota increasing the previous ones by 500 000 barrels per day, the prices progressively started

[6] Which were related to changing the digits in computer programs

to drop. On the other hand, Russia, part of the non-OPEC suppliers, increased its production and was the main dominant of non-OPEC production expansion since 2000.

In 2001, the rise in the non-OPEC supply with the weak US economy caused a decrease in the crude oil prices. OPEC's reaction to this situation was to reduce its sequence of quotas cutting accordingly 3.5 million barrels by September 1, 2001.
If the September 11, 2001 events didn't exist, the situation would have been resolved in response to the OPEC's decision or even the tendency would have been reversed.

2.9.September 11 attacks - 2001

The September 11 attacks known also as the 9/11 were a succession of different harmonious suicidal attacks on the United States set by al-Qaeda on September 11, 2001.

On that date, few terrorists from the al-Qaeda organization hijacked commercial airplanes and crashed them in the World Trade Center in New York City. A third airline crashed in the Pentagon. The attack caused the death of about 3000 people and equal number of victims, the collapse of the two Twin tours and a worldwide fear from the repercussions of this catastrophe.

The United States' first response was the official declaration of "War on Terrorism". Consequently, the US invaded Afghanistan to remove the Taliban political movement. Also the United States and many other countries enforced anti-terrorism rules and regulations.

Along with the instantaneous effect of the 9/11, many industries closed for the rest of the week and declared huge losses in particular the airlines and insurance companies. Similarly, the New York Mercantile Exchange (known as NYMEX) closed for the rest of the week. The NYMEX is known as the world's biggest physical commodity futures exchange, situated in New York City specially that it's the main oil trading market that works as an major instrument in price "discovery" for it determines current and future prices. This market serves also as a reference to different units of oil industries. It keeps them updated about the immediate presented prices since NYMEX and other similar markets follow up with market changes and political developments that affect prices directly since they symbolize the overall evaluation of the market actors. The price discovery[7] function moved to the sport market. There was no clear appearance that the oil industry was significantly influenced by the closing of the NYMEX though all the operations were postponed for a week.

Though the instant result of the attacks on the oil industry was to raise prices, insignificant changes in the supply and demand sides drove the market to adjust and crude oil prices to alleviate within two weeks time. Then crude oil prices declined from $24.44 in august 2001 to $23.73 per barrel in September. For the rest of 2001, crude oil prices free fell. Also spot prices (in the US) standards west Texas Intermediate fell 35 percent in November because there was a decrease in demand due to a decrease in jet fuel consumption, a hot winter in North America and Europe. Then crude oil prices dropped one third of the price level that existed before the attacks.

[7] It is a process used to determine the price of a commodity or a security in the market according to the law of supply and demand or buyers and sellers

If we were in a normal situation, and a similar drop in prices happened, we would have had another turn of quota reduction but with the political situation that resulted from the 9/11 OPEC waited for until January 2002 before any further action.

OPEC members then decreased their quotas by 1.5 million barrels per day; then non-OPEC members supported them and joined them including Russia. With this policy, they reached the so chosen results having the prices moving into the $25 range in March, 2002. In mid-2002, the non-OPEC members were re-establishing their oil supply, but the prices kept on increasing.

Generally, looking at the economy as a complete entity, oil prices shocks can severely and negatively affect economic growth, GDP, inflation as we noticed from previous shocks such as in 1973 and 1989-1990. But as discussed in the 9/11 events, the price spike was short and had insignificant effects of the on the whole economy. In October 2001, the economy affected crude oil prices from the fact that there was a decrease in demand for oil causing a decrease in its prices consequently (and not the inverse situation).

As mentioned in Makinen G. (2002), “the 9/11 events appeared to have had only a transitory impact on petroleum markets” meaning that as soon as the terror from a cut in supply is removed, the market will be regulated. It was also proven that the 9/11 events and similar crisis not affecting the base of supply and demand in the energy market have only a transitory effect on those markets that will fade after a short period of time (as we saw above).

Unlike the oil price increase in the 1970s, since late 2001, oil prices increased sharply due to a reduction in the demand/supply balance in the market. The demand for oil was increasing with the worldwide economic growth while the supply side was destabilized by numerous events such as Iraq war, Russia's Yukos problem, Venezuela's political strike, Nigeria's strikes, the sequence of hurricanes in the Gulf of Mexico and the Middle East's instability.

2.10. PDVSA Strike – December 2002

Petróleos de Venezuela, S.A. written as PDVSA is the world's fifth largest oil exporter. It is owned by the Venezuelan government. It was founded when the Venezuelan oil industry was nationalized and it takes care of the following activities: exploration, production, refining and exporting oil and natural gas.

In December 2002, numerous managers and employees from the PDVSA dismissed workers and effectually halted the supply of oil for two month to put a pressure on Hugo Chavez, the president of Venezuela to anticipate the elections. As a response to this harmful behavior, the government took the initiative to fire 19,000 employees and resumed the oil supply with the remaining faithful employees to the actual Venezuelan government and to Chavez's policies. So mainly, the strike's aim was to hit oil shipment in order to remove Chavez from presidency as it was reported in the BBC news.

The strike caused considerable macroeconomic losses such as increasing unemployment rate by 5 percent and reaching a peak of 20% in March 2003. The organization then turned into a militia accepting the adherence of volunteers in order to protect the government.

The Venezuelan strike caused a loss of about 3 million barrels per day of crude oil supply in Venezuela and consequently a raise in the world price of crude oil. On the short run, the United States was the most affected country compared to the other importing ones since it used to import more than 50 percent of the Venezuelan crude oil and other products; and substituting the lost capacity was a difficult task. Eventually, the OPEC being an important supplier of crude oil was able to increase its production sufficiently to cover the losses caused by the Venezuelan strike. OPEC members such as Kuwait, Iran and Saudi Arabia have corresponding qualities in crude oil to the Venezuelan ones. The Middle East OPEC countries' crude oils are far to reach the United States in a short period of time which will cause a supply gap that can reach up to 40 days. Therefore, the inequality between the demand and supply sides in Venezuela caused by the cut in the Venezuelan oil production stay endured for many months forcing crude oil prices to increase.

With the rise of the strike, Venezuela couldn't return to the previous levels it used to produce and is producing around 900,000 barrels per day below its peak ability of 3.5 million barrels per day. OPEC once again raised quotas by 2.8 million barrels per day in the months of January and February 2003.

When the Venezuelan production started to adjust and return to its normal levels around March 19, 2003, the Iraq War began preventing the worldwide crude oil prices to stabilize. In the same time, inventories in the US and other Organization for Economic

Co-operation and Development[8] (OECD) stayed below average. The economic growth in the US coincides with the Asian growth leading to an increase in demand for crude oil at a rapid rate.

2.11. Iraq War – 2003

The Iraq War also known as "the Occupation of Iraq" started on March 20, 2003 when military forces from the United States and the United Kingdom invaded Iraq. The reasons behind this invasion were first, the assumption that Iraq possesses weapons of mass destruction (WMD) that threatens the region. The United Nations group in charge to verify the assumption has found no clear evidence regarding Iraq's weapon statement. Following the invasion, the US reached a conclusion although they found bits and pieces of unused chemical weapons; Iraq stopped its nuclear, chemical and biological plan since 1991 but is willing to restart it if the "Iraq sanctions[9]" increase. Second, US representatives blamed Saddam Hussein of hiding and protecting Al-Qaeda; but also no evidence were found regarding that matter. Other reasons causing the invasion are Iraq's financial aid to Palestinian suicidal, absence and mistreatment of human rights respect from the Iraqi government and finally the hope of spreading democracy in the Iraqi state.

The two terrible events, Venezuelan strike and Iraq war caused a decrease in production of crude oil linked to an increase in the OPEC production. OPEC has to cover the

[8] OECD is an international economic organization made of 31 countries. It believes in market economy and democracy. Its aim is to provide policies and problem solving ideas to reach development among its members

[9] They are financial and trade embargo imposed by the United Nations Security Council on Iraq. They were initiated in 1990 up until 2003 following the fall of Saddam Hussein. They were done to force Iraq to retreat from Kuwait, pay reparations and stop the production of any weapons of mass destruction.

universal increase in demand that caused deterioration of the excess in oil production. In mid-2002, there was surplus in the production of oil of 6 million barrels per day; a year later in mid-2003 this surplus is below 2 million. In the years 2004-2005, the additional capacity of oil production is below one million barrels per day which is not able to face supply disturbances from most OPEC suppliers.

The overall worldwide consumption of petroleum goods is more than 80 million barrels per day which means that we have an additional considerable risk premium to crude oil price and is basically accountable for the price increase to $40- $50 per barrel.

Other important causes leading to the present high prices are first, the weakening of the US dollar and the fast progressive expansionary Asian economies and their increasing demand on petroleum, the sequence of Hurricanes in 2005, and the Lebanon's conflict with Israel.

2.12. Weakening of the Dollar

Oil has always been traded by one currency, the US dollar. Using it as a single medium of exchange in trading oil globally decreases transaction costs. Throughout the latest years, while oil prices were increasing following the basic law of supply and demand in the market, the value of the dollar was weak compared to the currencies of the countries' trading partners especially the Euro areas. The dollar reached its maximum in mid-2001 then drop sharply by 46 percent against the euro since then and again it dropped by 21 percent since 2004.

A weakening in the dollar affects Europeans and other foreign oil consumers positively since it makes oil cheaper relatively to them causing an increase in demand for oil. Correspondingly, a weak dollar decreases the dollar-denominated supply from foreign producers. These two reasons[10] exercise an upward pressure on oil prices in addition to the factors discussed above also causing a rise in the prices. To examine the impact of a weakening dollar on oil prices we assume that in 2008, the US currency still has the same 2001 value against Euro; consequently, the oil would have been traded around $80 a barrel, in other words, about $21 less than its actual price. The largest part of the dollar's price effect happened at the end of the period. To adjust oil supply and demand, a decreasing dollar will take time to readjust crude oil prices specially that expectations can't be modified easily. Since oil is traded in spot market, factors that increase expectations of future prices also cause an increase in spot prices because market doesn't adjust quickly.

2.13. The 2005 sequence of Hurricanes

Several Hurricanes hit the season in 2005 and were registered as the most dynamic and the most devastating in history. The impact of these hurricanes was harmful causing many deaths and damages of about $130 billion. The five main hurricanes in 2005 which effect caused disastrous destructions are: Dennis, Emily, Rita, Wilma, and Katrina.

Three hurricanes that will be discussed, Katrina and Rita that were recorded in 2005 and Ivan recorded in 2004.

[10] Daniel Yergin, chairman of Cambridge Energy Research Associates, includes a third element by stating that some investors have used oil as a hedge against the dollar's decrease.

2.13.1. Hurricane Ivan – 2004

Hurricane Ivan was considered as the tenth most powerful Atlantic Hurricane recorded in history and also considered as the fourth major hurricane in 2004. It hits the strongest category power on the SSHS[11]. Ivan caused many disastrous damages in Grenada, Jamaica, part of Cuba, and few parts of the United States. In addition to the human deaths, the severe flooding, and the destruction of many houses, the hurricane Ivan blocked the nations' economies particularly the United States: It caused weak trade in Florida, several companies declared the decrease in their earnings caused by the storm and also small businesses such as car retailers, restaurants, and airlines announced a reduction in their earnings. Similarly, there has been disruption in oil supplies especially to the US, arrest of the profits and workers were asked to leave the rigs used in drilling for oil or gas in Gulf of Mexico, which used to provide the US with 25 percent of their oil and natural gas consumption.

2.13.2. Hurricane Katrina – 2005

Hurricane Katrina is considered to be the hurricane that caused the highest expenses and life losses in the history of the United States. It is also considered as the sixth strongest hurricane of all. Hurricane Katrina started in the Bahamas then hit Florida, Gulf of Mexico, Texas, New Orleans, Louisiana and Mississippi.

The economic impacts of hurricane Katrina were catastrophic resulting in $105 billion of expenses assigned to repair and reconstruct the region. Not to forget the economic losses

[11] It refers to Saffir Simpson Hurricane Scale that classifies Western tropical storms that surpassed the intensities of tropical depressions or storms.

caused by the important disruption of the oil supply and exports of other commodities such as grain to the US and the increased level of unemployment particularly in New Orleans.

Crude oil prices were severely affected since the Gulf area, a major oil producer, importer and refiner was harshly hit by the storm causing a disruption in oil supply.

In the rise of Katrina, power losses caused a cut in supply of oil and natural gas. The pipelines course that moves petroleum goods from their base to other places in East Coast was interrupted because power outages[12] closed the pumps that permitted the flow of materials. In addition, more than twenty oil platforms were lost, misplaced or ruined. It was also reported that the port that serves 16 percent of the country's supply of crude oil and natural gas, was also hit by the hurricane and will cause negative effects not only on the short run which amounts for losses of half billion dollars a day but also on the long run. The fear of having oil supply shortages due to the oil production drop by one third of the usual rate caused the price of oil to increase greatly. It was reported that there was existence of price gouging[13] not only on petroleum goods but also on their complementary goods (ex: bottled water, chewing gum…). In the US, to anticipate the price increase, consumers rushed to the gas stations to buy gasoline causing "queuing" and "favored customers".

[12] It is also known as power cut or power failure or blackout where there is short term or long term electric power in a region

[13] It means when there is an important increase in prices of goods in case of high demand on them. In some countries especially in the US, it is considered illegal.

The EPA[14] elevated the petroleum standards in order to decrease prices. Also to fight against the price increase and against negative economic consequences, the Strategic petroleum Reserve of the US used their emergency oil storage to prevent foreign economies from crashing after a decrease in consumer spending.

2.13.3. Hurricane Rita – 2005

Hurricane Rita was recorded as the "tropical cyclone" in the Gulf of Mexico and the fourth powerful Atlantic hurricane. Rita caused $11.3 billion losses in the US Gulf Coast in September 2005. Rita hit Sabine Pass, Texas, Johnsons Bayou and Louisiana and Texas coasts. The important presence of oil infrastructure in the Gulf of Mexico made from Rita and heavy catastrophe.

Nowadays, the United States doesn't have much of oil emergency capacity and the Gulf of Mexico supplies 2 million barrels per day which are the repercussions of Katrina's. Rita not only touched the intense area of offshore pipelines and oil platforms, but also regions with great refineries. Although the whole region is still paying hard Katrina's impact and the Gulf supply in oil hasn't recovered yet, Rita made the situation even worse with a weaker US economy but lesser effect on the oil industry, and a slight increase in price. The impact on GDP was very tragic since its growth decreased by 1% in a year and also the unemployment rate increased leaving 500,000 people unemployed. Many efforts were done to boost the economy in 2006 but many people thought that the high increase in energy prices and the increase in interest rates will cause a loss in the consumer's confidence and therefore a decrease in his demand leading the economy into

[14] It refers to the US Environmental Protection Agency in charge to protect human health and environment.

a recession in 2006. Although this happened but it came to reality in 2008 after Rita's effect in over a year.

In 2005, the hurricanes and the US refinery problems linked to the Hurricanes effect and to the switch from MTBE[15] as a chemical addition to ethanol have led to superior prices. Also other factors contributed to higher prices that are the intensity of petroleum inventories in the United States and other importing countries.

Before considering that additional capacity of crude oil prices is of great concern, inventory levels were a central instrument for short term price estimation. Even though this wasn't revealed, OPEC has been reliable for many years on a strategy that amounts to world inventory supervision. The main reason that caused it to decrease the oil supply in 2006 and in 2007 was its worry about expanding OECD inventories. They essentially stress on overall petroleum inventories that sum up all crude oil, gasoline, fuel and petroleum goods and are a better indicator of prices than checking oil inventories only.

2.14. Financial crisis 2007-2010

The recent financial crisis also known as the Great Recession was generated by a banking crisis in the United States due to the breakdown of important financial institutions, the financial aid of banks by state governments and international stock markets crash. The crisis also hit the housing market that endured. Because it had a disastrous effect worldwide, it was judged as the most terrible financial crisis since the Great Depression in 1929.

[15] It means Methyl tert-butyl ether. It is volatile, flammable, and colorless and cannot be mixed with water.

It led to the collapse of many important businesses, a decrease in the consumers' prosperity, and an important decline in the economic growth worldwide. In the United States, housing prices reached their maximum in early 2005, and then collapsed in 2006, causing a free fall of the real estate prices and harming consequently worldwide financial institutions and stock markets that endured from severe losses in 2008-2009. As a result, credits and international trade decreased entering the worldwide economy into a recession.

In July 2008, crude oil prices peaked at $147 per barrel after six years of expansions in the developing countries, and the past events described above. But in August 2008, crude oil prices plummeted as the OECD countries entered into a recession that became later visible as a severe financial crisis and that had dreadful impacts of the global economy. In an effort to control the drop in prices, the OPEC launched a series of quotas in its production leading the crude oil prices to stabilize around $40 per barrel

The world oil consumption decreased by 0.2 percent in 2008 and 0.4 percent in 2009. The free fall in demand is related to the fall in consumption in the industrialized countries. The decrease in demand in OECD countries is linked to the drop in demand in North America and Europe. Non-OECD demand for oil is estimated to increase disregarding the global crisis since it will be driven by the increase in demand in China, India and Arab oil-exporting countries. Oil demand in China and India will be linked to their growth rate whereas the oil demand in the Arab exporting countries will be depend on the effects of the global crisis.

From the supply side, following the financial crisis and the important drop in prices, OPEC countries began a series of quotas that showed effectiveness in January 2009 with a cumulative cut of $4.2 billion barrel per day. The cuts in production lead to anticipated decrease in worldwide output but estimated to improve in 2010. This crisis affected oil prices negatively through two major channels: First, as the financial crisis spread globally, several workers left their jobs in the commodities market to cover their debts. Second, once the worldwide economy was in the recession, there was a decrease in oil consumption that caused an anticipated decrease in oil prices.

CHAPTER 3

OIL PRICE FLUCTUATIONS AND IMPACT ON THE WORLD ECONOMY: LITERATURE REVIEW

In this chapter we will be using different authors' theoretical and empirical approaches on oil price shocks to assess the impact of crude oil price fluctuations on the macroeconomic aggregates. Mainly most of the papers discussed the fact that changes in crude oil prices trigger inflation or recession.

Holding everything else constant we will study variations in oil prices. Not only economic growth, inflation, changes in the dollar or in interest rates might intensify the impact of elevated oil prices but also prices are determined by global macroeconomic aggregates. It is important to identify fundamental shocks influencing the real price of oil. Kilian (2006) suggested four elements: oil supply shocks caused by political incidents in OPEC nations such as revolutions or wars, oil supply shocks caused by other factors associated to cartel activity or non-OPEC oil production, aggregate demand shocks which refer to shocks to the demand for industrial commodities and precautionary demand shocks associated to fears about future oil production and are precise to the petroleum market. The oil price shocks are not similar. There has always been an tendency to link important fluctuations in oil prices with the events in history such as the fluctuations in oil prices that followed the Yom Kippur War, the Iranian Revolution, the Persian Gulf War or the Iraq War. These events appear to affect the supply side of oil market; but also there were events that affected the demand side and are considered as exogenous demand shocks such as the plummet of crude oil prices following the Asian crisis. Hurricanes

Rita and Katrina are mainly seen as external shocks affecting negatively the demand side for crude oil and not the supply side. The decrease in US crude oil supply caused by the hurricanes in the Gulf of Mexico was insignificant if seen on an international level. The loss of the US refining ability was more significant since there has been a power cut. This shut down in refineries caused a decrease in the US demand for crude oil and consequently a decrease in the crude oil prices worldwide.

The 1973 events marked the end of crude oil prices' control held by US oil companies and in which OPEC took over the control. The US oil companies' aim was to maintain a low price by raising the supply side. Whereas, OPEC's aim especially in 1982 and in 1983-1985 was to decrease the supply of oil in order to stop the decrease in its price.

Crude oil production has been cruelly reduced by political events i.e. the wars or revolutions that occurred in the Middle East which are external factors with respect to global macroeconomic orders.

To evaluate the impact of demand and supply shocks on crude oil prices, we have to control crude oil supply shocks. Six main political events evaluated crude oil supply shocks to OPEC nations: Yom Kippur War (1973), Iranian Revolution (1978-1979), Iran-Iraq War (1980-1988), Gulf War (1990-1991), Venezuela Civil Strike (2002), and Iraq War (2003).

We can differentiate between the changes that happened in crude oil supply driven directly in response to the external events cited above. For example, during the presence of the Persian Gulf War, Saudi Arabia increased provisionally its oil production and

similarly, the Iraqi supply of oil increased after the Iranian Revolution. Alternatively, endogenous changes that happened in crude oil supply belong to the "propagation mechanism."

Global crude oil production is also another factor influencing real oil prices. It is influenced by oil supply shocks linked to political events, internal OPEC conflicts (i.e. 1970s and early 1980's), internal reactions in real oil price fluctuations in non-OPEC nations, and the impact of the Hurricanes Rita and Katrina on crude oil supply.

The global economic activity affected the supply side of oil but also the demand side in a direct way; therefore it has an impact of crude oil prices.

There is some subjective support that the global economic activity is linked to the global business cycle: In 1972-1974 and 1978-80 there was a global economic growth but in the mid-1970s and early 1980s the global economy entered into a recession then again in early 2000s a global economic growth led to the boost in the commodity markets.

The economic activity reached its maximum in October 1970 then entered into the depression in March 1972. After a fast recovery phase, it reached again another maximum in December 1973 again followed by a depression in February 1976. The real economic activity stayed weak during mid-1970s. Then again an important economic expansion happened in 1977 reaching its maximum level in July 1979. It is followed by a long period of economic stagnation then a recession until it reached a depression in August 1982 and another one even wider in July 1986. In March 1988, the real economic activity entered the period of recovery but remained stagnated until January 1990. It is

then succeeded by a recession that preceded the invasion of Kuwait and that lasted with few breaks until October 1999. Following the disastrous effects of the Asian Financial Crisis on the economy, there was an economic expansion that started in July 1998 and that lasted until November 2000. With the 9/11 attacks the global economy entered into a crisis that reached its depression peak in November 2001 then again a recovery period until it reached its maximum growth in December 2004.

Kilian (2006) discussed that supply shocks related to political events illustrated "negative shocks" while the others were "positive shocks". Interruptions in the production of oil led to a provisional decrease in global oil production then to an increase in production in the first year to offset the effect caused previously. These shocks caused also a decline in the global economic activity in the years to follow through the impact on the adjusted price of oil.

In the case of an oil supply expansion, global oil production increased in a significant way. In the case of an aggregate demand expansion temporary raised the global production of oils and remained for almost four year but they also caused an increase in the real oil prices.

From this perspective Kilian (2006) concluded that an increase in the demand of oil lifts prices of oil up in a significant way and similarly caused an increase in the economic activity. They didn't necessarily increase the global oil production and through the different tests undertaken, it was clear that there's a possible decrease in oil production after a while.

Looking backward to the different events that happened, Kilian (2006) analyzed the effect of the different shocks of crude oil prices:

Following the Iranian Revolution in 1979-1980, a sharp increase in crude oil prices resulted from the "superimposition" of an important increase in precautionary demand in 1979. The impact of the precautionary demand shocks reached its maximum before the occurrence of the Iran-Iraq war and started to decrease constantly in the 1980s. During this period, another political oil shock occurred (Iran-Iraq war) and served to intensify the effect on the crude oil prices on the short term. The collapse of the OPEC cartel in mid-1980s caused the price of oil to plummet and it was mainly due to the decrease in precautionary demand more than the increase in the oil production of Saudi Arabia.

The important increase in oil prices in 1990-1991 due to the invasion of Kuwait was mainly caused by precautionary demand shocks; even though oil supply shocks had also little effect on the price of crude oil but in the end of the war. The inconsistent decrease in the demand for oil during the Asian crisis in 1997-1998 and that caused a sharp drop in the price of oil was proposed to be caused by precautionary demand shock. It was proven in Kilian (2006) that this decrease in demand preceded the decrease in oil inventories in 1999-2000 and therefore was not caused by inventory adjustments. The main remarkable observation tested in Kilian (2006) was that the increase in the oil prices since 2002 was completely due to a rush in real economic activity that was initiated in 2001 but it wasn't specified which kind of shocks took place.

Stating the various examples above, it was clear that the different events that affect the crude oil prices even if they are initiated by oil supply shocks related to political events (wars or revolutions) were through the effect of precautionary demand for oil. This last channel caused a rapid yet significant effect on crude oil prices even if the oil production was not affected.

It could also intensify the impact of oil shocks on the production of oil preceding the future changes in crude oil supply.

After analyzing the different historical events, the shocks related to each one and the economic activity at each period, Kilian (2006) examined the reaction of the US macroeconomic performance (i.e. GDP rate and inflation rate) related to these events. This paper was able to demonstrate that although oil supply shocks have an important impact on crude oil prices but aggregate demand and precautionary demand for oil shocks (reflecting fear about the future of oil) were more significant; and their implications on the US economy were far more important. Understanding the US macroeconomic factors and how they were affected by oil shocks allowed us to understand the global macroeconomic factors and their response to the different shocks.

Following an interruption in oil production related to political events, real GDP rate decreased. There was evidence that although real GDP decreased in the first two quarters after the shock, the main decrease took place in the next year. Consequently, this can be explained by the fact that although political supply shocks had an important effect of real GDP, they didn't raise the crude oil prices in a significant way. Since the main decrease in real GDP was the following year and after experience from the first important shock in early 1970s that "bad shocks" were harmful to the economy, economic agents changed their behavior before any adjustment in the crude oil prices; therefore it can be concluded that the effect of political supply shocks in significant on the long run. Another transmission mechanism going from oil shocks to affect the GDP rate was through the interest rate channel and the interest rate response to these shocks.

On the other hand, an expansion of other oil supply increased real GDP growth in an important way upon the impact; it can therefore be concluded that other oil supply interruptions have a short run effect on real GDP. An expansion in the aggregate demand caused an increase in real GDP growth in the first year following by a decrease in the following year reaching a zero level; therefore aggregate demand expansions affected the short run real GDP while global aggregate demand increases caused a raise in the price level in the long run.

Kilian (2010) added that "speculative demand shocks defined as any demand shock that reflects forward looking behavior by traders played an important role in 1979, in 1986, in 1990/91, in 1997/2000 and in late 2008" (WTO report, 2010). These speculative demand shocks have an instantaneous effect on oil prices. In addition, the increase in real price of oil during 2003 and 2008 wasn't due to any of the causes mentioned above, but to the variations in the global business cycle triggered by unanticipated growth in emerging Asia over the OECD countries' growth. Also as the world economy fell in late 2008, so did the crude oil prices. These were caused by the anticipation of an extended global recession. The progressive recovery of oil prices in 2009 was partially credited to a change in the expectations and to an improvement in the demand for industrial commodities showing a slight return to growth in the global economy.

Barrel and Pomerantz (2004) studied the fluctuations of oil prices and their impact on the world economy especially output and inflation. It also discussed the disparities among the European countries. It was clear that the repercussion of oil price shocks on inflation and output depended basically on the attitude of the monetary policy in response to the shock. In addition this paper showed that the effect of oil price raise on output is

dependent on the level of oil production that has been decreasing in different countries in the last 20 years.

Each country and region has a different level of dependence on oil. Usually industrial countries rely more heavily on oil. For example, in 2003, 40 percent of OECD energy necessities came from oil whereas only 28 percent were for non-OECD countries. The results are expected since manufacturing and transport use the highest share of petroleum goods. Japan since 2001 has the highest need for oil receiving 50 percent of its energy needs from oil; but this has decreased from 60 percent since early 1980s. On the contrary, China is not very dependent on oil; in 2000 it consumed less than 20 percent of the country's energy consumption. As the country continues to develop its oil needs increase. Similarly other Asian countries pursed the same trend as China although they consume more than 30 percent of oil since 2000. With the exception of Japan, most of the OECD countries reveal stable levels of oil dependence. The United States and Europe depend 40 percent on oil from their energy uses. One of the main reasons why Europe countries decreased partially their dependency on oil was due to the second oil price shock in the late 1970s, the Iranian Revolution. They decreased in almost four years their energy use from over 45 percent to fewer than 40 percent in 1982. Whereas in the United States, the consumption of oil compared to the total energy use did not show signs of evident decrease until the early 1990s. From the developing countries, countries of Latin America continue to be dependent of oil for their needs in energy use. Almost 50 percent of the area's energy is from oil in 2000. The OECD countries decreased their share of oil in the late 1970s in response to the Iranian revolution and kept their consumption constant for 20 years. For the middle-income nations, South Americans are less efficient in energy

that their other equivalent OECD countries though they are developed and have evident industrial commercial transport and a huge number of means of transportation. This mixture of features considers large share of oil to meet the requirements. Many countries from Central and Eastern Europe are moderately less dependent on oil for their energy use than several developed nations because of their sustained dependence of coal[16] as a source of energy. For example, the Czech Republic uses more than 50 percent of coal for its energy use in 2000 and 20 percent share for oil that is still constant since the 1970s. s, Throughout the past 30 years, the consumption of petroleum products has almost increased by 40 percent from 57.4 million barrels per day in 1973 to 78.7 million barrels per day in 2003. Nevertheless, expansion in the demand for oil changed considerably over time and among the countries. Determined by important decrease in demand from Europe, oil demand in OECD countries increased about 0.5 percent per year until 1990s where it started to decrease. On the contrary developing countries in Asian Pacific countries noticed an expansion throughout the years particularly in China and India where it continues to grow at a rapid rate. Demand for oil in Latin America decrease in past few years due primarily for the cruel recession in Argentina. The most remarkable change in oil consumption happened between countries such as the ex-Soviet Union, China and other Asian countries especially with the growth of India and the transitional phase that the communist countries passed through when changing their economies from a centrally planned to market economies.

[16] It is the most abundant fossil fuel. It is the principal source of energy for the generation of electricity and heat globally.

Barrel and Pomerantz (2004) analyzed also the supply side. Global oil production increased almost around 1 percent per year. After 1973, OPEC oil supply increased by 0.2 percent per year, while non-OPEC supply increased by 1.9 percent per year. Following the 1970s and 1980s events, OPEC sharply decreased its oil production while non-OPEC especially ex-Soviet Union and Central America oil producers increased their production to meet the global demand for oil. In the 1990s, with the dissolution of the Soviet Union and the considerable increase in oil production in the Middle East, non-OPEC countries only increased their production by 0.5 percent annually before reaching the 2 percent increase by the end of the 1990s. In the mid-1980s, the real price of oil is below the maximum level that was reached in the 1970s and early 1980s. Following the second oil shock in the 1980s, prices of crude oil increased sharply but OPEC's supply compared to the world oil production decreased quickly from over 50 percent in 1973 to below 30 percent in 1985. In 1990s OPEC's supply for oil recovered after its decline in the 1980s, and produced around 40 percent of the world total oil supply. As for the non-OPEC members, the production of the ex-Soviet Union collapsed with the end of the communism in 1989 but recovered in 2003 and increased its supply up to 30 percent of those from OPEC; as for the supply of oil from Latin America it almost doubled from 1.8 million barrels per day in 1985 to 3.9 in 2003. Throughout the past 30 years, the aggregate supply and demand for oil were inversely proportional to the oil prices. Nevertheless, in the past years it turned out that the structural change in demand for oil that occurred changed the whole demand-supply concept related to oil prices fluctuations. According to Kaufmann (2003), since 2000s the supply of oil doesn't seem to be the main factor that affects oil prices nor does crude oil prices affect changes in demand for

oil; it is the lower industry stocks of crude oil especially in the US in addition to the strong demand for oil in Asia and the sharp geopolitical insecurity in the Middle East that have put pressure on oil prices.

Hunt, Isart and Laxton (2002) studied the impact of three oil price shocks of different duration to real GDP and inflation. First, the impermanent shock in which oil prices increased by 50 percent in the first year and then returned to normal in the following year. The second shock is a bit more constant from the fact that it caused a 50 percent increase in oil prices in the first two years then decreased at a balanced fixed rate to reach back its normal in six years. The third shock caused a durable 50 percent increase in oil prices. Definitely oil prices will affect each country differently; for example in their test it showed that the effect of oil price increase on the United States' inflation will be greater than on the United Kingdom.

Hunt, Isart and Laxton (2002) also proposed empirically that economic activity and oil prices are inversely related. However, an increase in oil prices will have a bigger effect on the economic activity than a decrease in them. Therefore, the employees' response would be different. They would respond to an increase in oil prices by pushing for a superior income to fight the decrease in their consumption whereas a decrease in the price of oil would increase their consumption and won't affect them negatively as much as the latter. The model proposes that negative oil price shocks put downward weight on inflation through the "expectations channel" that permit an easy monetary policy consequently expanding the economy. Inequality in real wages gives a significant justification of the experimental nonlinear relationship between oil prices and the macroeconomic aggregates. Similarly as mentioned in Hamilton (2000), another

reasonable explanation of this relationship is that the distribution of external factors of previously observed oil price fluctuations has been asymmetric and mostly related to oil supply cuts.

Barrel and Pomerantz (2004) suggested that if there was uncertainty about the future of oil price fluctuations and their effect on inflation, a rapid monetary policy response won't be effective. But also delaying the reaction to the increase in oil prices can cause a major possible risk which is the loss of credibility of the supposed policy and therefore have negative implications on inflation. Two cases were analyzed where the shock caused a 50 percent increase in oil prices for two years but then fell in the third year. A delay in monetary policy response differs from a country to another; but in general it has an expansionary effect on economic activity on the short term such as an increase in aggregate demand and in GDP but in the third year, there will be an important increase in the interest rate and decrease in GDP. While an important increase in interest rate can be positively seen in preventing inflation in these theoretical scenarios, it can however since by increasing interest rate, the monetary policy will be tightened, and it puts a downward pressure on economic growth and output.

Bernanke, Gentler and Watson (1997) examined three main oil price shocks: the oil embargo in 1973, the Iranian revolution and the Iraqi invasion of Kuwait, and their effect on output, price level and the funds rate in the period surrounding them mainly from 1972 to 1976, 1979 to 1983 and 1988 to 1992. Two scenarios were studied one having the federal funds endogenously determined separating the fraction of each recession from the related monetary policy response and the second one was exogenously determined in which oil prices are assumed to equal their historical values and no other

shocks exist. The first model showed that the recession caused after the oil embargo in 1974-1975 is not much related to oil price shocks as much as it's related to non-oil commodity prices that rose sharply before the recession triggering an important monetary policy response. As for the second model, in which the federal fund rate didn't react to any of the commodity prices nor oil price shocks, revealed no recession at all and demonstrated that endogenous monetary policy reacting to shocks in oil prices and commodity prices has a key role in the scenario. On the other hand, the period surrounding the Iranian revolution justified the conventional thinking that recession was triggered by the oil price shock. Nevertheless, if we excluded the monetary policy reaction, we would have gotten a slight slowdown in the economy and not an important recession. The period surrounding the invasion of Kuwait from 1988 to 1992 proved that without any monetary policy response to oil price shocks caused a higher course for output and prices than otherwise.

Jiménez-Rodríguez and Sánchez (2004) analyzed empirically the effect of oil price shocks on real GDP growth of different OECD countries. The analysis differentiated between increases and decreases in oil prices. It showed that an increase in prices caused a negative effect on output growth in all OECD countries with the exception of Japan. The most important effect on GDP occurred in the end year of the shock in all countries except France and Italy that were affected in the mid-year following the shock. After three years, the countries balanced themselves and the effect of the shock fully disappeared. A 100 percent increase in real oil prices caused a 5 percent decrease in GDP growth in the US and Germany due to the appreciation of the real exchange rate; similarly a 4 percent decrease in Italy, a 3 percent decrease in France

and an overall 2 percent decrease in GDP growth in the Euro Area occurred although their real exchange rates depreciated partially counterbalancing the effect of the shock. In Canada, only a 1 percent decrease followed the negative impact of the shock. Also the outcome of this analysis showed that an oil price shock caused inflation, increased the short term interest rates in all the countries except the US, Germany and the Euro Area and increased the long term interest rate with the exception of Germany. In addition, this oil price shock caused a decrease in real wages in these countries.

Barrel and Pomerantz (2004) studied through a large econometric model, NiGEM, the impact of an increase in oil prices on inflation and output on the different OECD countries. An increase in price causes inflation everywhere but particularly in the US because their lump sum taxes[17] are below European's. Similarly the oil intensity[18] of output in the US is 60 percent higher than Europe thus impact on prices bigger. As for the impact of higher prices on output, for all countries the long run output will drop; whereas the short run effect is greater in the US than in Europe due to the higher oil intensity and bigger inflation effect. The long run drop in output is due to the modification in terms of trade between the OECD and OPEC, the main suppliers of oil. Despite the fact that OPEC revenue adjusts quickly that early 1970s, OECD needs to produce further products for a certain consumption level and this modifies the saving investment balance thus decreases saving for the output levels in the steady state causing an increase in interest

[17] The lump sum tax is tax that is fixed no matter what changes. It is used for taxation of income or property or sales taxes… it is a regressive tax from the fact that it decreases as the amount of the source we're taxing increases.

[18] Oil intensity is defined as the primary oil consumed per unit of GDP

rates in the long run and hence a decrease in the output steady state level. The long run effect on output is the same for all countries.

Barrel and Pomerantz (2004) concluded through its analysis that a permanent oil price shock always causes a decrease in output on the long run since the OECD's term of trade change and their interest rate increase. It also added that the main worry should be about the central bank's reaction towards the shocks and the policy it will implement. The effect of an increase in oil prices on output in the short run can be counterbalanced by a monetary policy but only by causing higher inflation in the short run and an increase in prices in the long run. The impact's strength of oil shocks on output and inflation depend from their nature whether they are temporary or permanent. A permanent shock affects the equilibrium real interest rate and output. This shock causes an increase in the world real interest rate thus a decrease in output in a forward looking world. The impact on inflation in this case is smaller than in the case of a temporary shock. Analyzing shocks in oil prices without taking into consideration rational expectations of the future and misjudging people that they are "myopic" will lead to ambiguous and deceptive results since they won't be capable in differentiating between temporary and permanent shocks. The oil concentration of the products also has an effect on oil shocks and it decreased in a significant way over the past two decades. Consequently the impact of oil shocks on the economy is less important than what it was during the 1970s.

Kato (2005) analyzed the effect of an increase in oil prices on the world economy after 2002 following the recession caused by the September 11 attacks and the explosion of the communication technology bubble. During the recovery period, the prices of oil

rose sharply causing inflation worldwide since prices of final goods stayed the same. This paper studied the economy of four main countries consumers of oil.

In Japan, they saw their economy grow due to the growth of exports held by the US and China's increasing demands. Manufacturers mainly helped the Japanese economy recover. It is a business sector-led recovery. The companies were aiming lower costs to increase their earnings. The US recovery was initiated by decreasing interest rate to boost business, housing and consumption investments to reach an economic recovery. However, employment didn't improve much in the initial years. The US economic expansion led to an increase in demand for oil causing a rise in its price and consequently boosting gasoline prices and limiting consumption. No harmful effects resulted since income increased simultaneously. The Euro area didn't get its economic recovery until 2003 but still the gap between its economic growth and inflation was increasing in most of its countries i.e. Germany, France, and Ireland seeing their budget deficit increasing also. The economic recovery in Euro areas was slow mainly due to the appreciation of the Euro. The impact of an increase in oil prices was counterbalanced by the increase in Euro that caused a decrease in exports and made economic future expectations uncertain. China saw a rapid economic expansion especially in 2004 that made it increase its demand for oil. China moved from a net oil exporter in 1993 to a net oil importer and increased its imports throughout the years. China's main source of energy is coal. Although oil price were increasing sharply during that period causing an increase in China's cost, an increase in come was higher than the costs reducing the harmful impact of oil price increases.

Kato (2005) also related in a theoretical study the probable macroeconomic effects following an increase in oil prices. From this viewpoint, three factors were discussed. First, we'll have the terms of trade effect or the income transfer effect. An increase in oil prices doesn't necessarily cause a decrease in demand. Oil consumers will pay additional money to meet suppliers' prices. Consequently, there will be a transfer from demander's income to suppliers. Second, there will be a change in the distribution of income. A country heavily dependent on oil imports will have the similar effect of income transfer. Consequently, an oil price increase might worsen corporate earnings unless it is passed to consumers reflecting therefore a loss in the purchasing power. Finally, there will be an effect on supply instead of demand or income. In other words, if the company wants to keep its production technology unchanged, it should change the combinations of capital, labor, energy and other production factors to reduce costs. Therefore when there's an increase in oil prices, for this company to maximize its profit keeping technology unchanged should reduce its production.

Comparing the economic situation between the 1970s and 2000s, Kato (2005) observed that the effect of an increase in oil prices in reduced in 2000s. For example, in the 1970s, the US economy stayed tight for a long period with high inflation and low growth rates. These differences are mainly due to five macroeconomic factors. First, the exchange rate altered considerably in a way such as the Japanese yen and the Euro values increased against the dollar lowering accordingly the income transfer effect following the increase in oil prices. Second, the economic growth changed counterbalancing the income transfer effect on the increase in oil prices by increasing income. Third, inflation situation changed. In other words, the increase in oil price in the 1970s appeared among global

inflation. In 2000s, it's more difficult for inflation to increase even if oil prices are increasing since monetary policy actions are easier to be initiated. Fourth, despite the fact that short term interest rate increased in the US and other countries, the long term interest rate remained stable at a low rate increasing consequently economic growth and offsetting the oil price increase. Finally, labor market changed. In the 1970s labor market was inflexible affecting companies' flexible input of production factors and restrained companies from dissolving costs. However, in 2000s, even with an increase in oil prices, labor market is flexible allowing costs increase to be absorbed by controlling wages.

The International Energy Agency[19] (2004) also analyzed theoretically the global economic performance in case of an increase in oil prices. Accordingly, an increase in oil prices lead to a transfer of income from consuming countries to producing countries by shifting the terms of trade. The degree's effect of crude oil price increase is dependent of the cost of oil in national income, the country's dependence on imported oil, its ability to decrease oil consumption and shift to other factors of production and to gas price response to the oil price increase. Usually the higher and the longer oil price increase, the greater in the macroeconomic impact. An increase in oil price affects positively real national income of oil exporting countries since they get higher export revenue; despite the fact that this extra profit made is offset by a decrease in demand for oil due to the

[19] The International Energy Agency is an intergovernmental organization founded to support OECD countries after the 1973 oil crisis. It was devoted to respond to oil supply interruption, provide information about the global oil market and the petroleum industry and help as an adviser to its member states and non-members nations such as China, India and Russia.

economic recession experienced by trading partners. In the same time, an increase in oil prices lead to inflation, increase factors of production cost and decreased investment in oil importing countries. Because government expenditure is inflexible, there will be a decrease in tax revenues and an increase in the budget deficit leading to an increase in interest rates. Similarly an increase in oil price puts a higher pressure on nominal wages causing a reduction in demand hence an increase in short term unemployment. An oil price increase also affects balance of trade among countries hence their exchange rates. In oil importing countries there will be deterioration on the balance of payment causing depreciation in the exchange rate. Consequently, imports will be costly and exports costless causing a decrease in real national income. If the government doesn't take monetary policy measures, the dollar will tend to appreciate as oil exporting countries demand for dollar- denominated international reserve assets increase. This monetary policy reaction to increase in inflation rate and unemployment rate, and decrease in real output level affects the economy on the long run. This government policy doesn't omit the negative impacts described above but it reduces them. Wrong policies can deteriorate the situation. Tight monetary and fiscal policies to pressure inflation could worsen the recessionary income and unemployment effects. Alternatively, easy monetary and fiscal policies might postpone the decrease in real income caused by the increase in oil prices, encourage inflationary pressures and deteriorate effect of higher prices in the long term. IEA (2004) analyzed the 1973/1974 and 1979/1980 events. It was visible that an increase in oil prices following these two shocks caused a decrease in economic growth in the majority of oil importing countries in the two years following the price increase especially in the US, Euro Area and Pacific. On the other hand, oil exporting countries

viewed their economy grow enhanced by the increase in oil prices but this profit was less than the oil exporting countries' loss therefore the net effect is always negative. Following a major oil price increase including that of 1999-2000, the world economic growth has always decreased because demand of importing countries fall lower than that of exporting countries causing the net global demand to decrease in the short run.

IEA (2004) measured the impact of OECD countries then on developing and transition economies. Starting with OECD countries, they stay liable to an increase in oil prices regardless of the decrease in the region's net oil imports and a decrease in oil intensity since the first shock in 1973. However the region stays greatly dependent on oil imports to meet its needs around 56 percent in 2002. From the OECD countries only Canada, Denmark, Mexico, Norway and the United Kingdom are net exporters of oil. Through empirical tests, IEA (2004) came to the conclusion that an increase in oil prices affects OECD's economic performance on the short run keeping the long run effect limited. The effect on GDP growth rate occurs in the first two years because the term of trades is deteriorating, pushing income down hence weakening domestic consumption and investment. In the third year, these losses caused by the increase in oil prices will start to decrease as global trade in other goods and services recovers. The impact of an increase in oil prices was more important on inflation rate than on GDP growth rate. The effect can remain for five years. The OECD's trade balance deteriorates in the short run as increase in oil prices causes an increase in the cost of oil imports and in inflation. Usually the impact on OECD countries' economic performance differs from a country to another depending on the level to which they import oil. Euro areas that are greatly dependent on oil imports are affected by an increase in oil prices mostly in the short run

and causing therefore an increase in unemployment rate. Japan is moderately less reliant on oil therefore it has lower oil intensity that counterbalances its total dependence on imported oil. The decrease in GDP in both Europe and Japan would increase budget deficits in both regions. The United States suffer less than the Euro area and Japan because its local production gathers around 40 percent of its oil needs. Unemployment in those countries is of great worry since it would affect mainly the short term. For OECD countries exporters of oil, effect on GDP is positive in the first year but in the second and third years, GDP decreases affecting most countries even exporters because there will be a considerable decrease in exports of non-oil related goods and services to oil-importing countries. Measuring the impact on developing and transition economies after an increase in oil prices proved that countries in debt and under developed are severely affected. For example, Sub-Saharan African countries that have weak economies and are more oil intensive have an important decrease in their GDP. As for Asian countries that import oil, they face a decrease in their output following deterioration in their current account balance during the following year of the increase in price. Countries such as the Philippines, India and China would suffer the most. Philippines GDP would decrease by 1.6 percent the following year as for India, it will decrease by 1 percent and China's GDP would decrease by 0.8 percent. Asian countries would face a decrease in their current account balance and a large increase in inflation in the first year basing their supposition that an increase in global oil price would increase domestic prices. Latin America is less affected by the oil price increase than Asian since its net oil imports are lower; however its economic growth would decrease a bit. Developing countries in Asia and Africa that are highly dependent on oil imports witness their economies suffer. IEA (2004) reached

the conclusion that the impact of an increase in oil prices on developing countries and transition economies is less than for the OECD countries since as a group they include many oil exporters. As for OPEC countries, main exporters of oil, when there is an increase in oil price, their net trade balance would increase causing an increase in their GDP. But Venezuela is the least to benefit from this increase unlike Iraq and Nigeria which gain the most since their economies are mainly based on oil. On the long run, OPEC oil revenues and GDP would decrease because higher prices won't offset lower production. An increase in oil prices is caused by OPEC's policy to cut production. In addition to the fact that OPEC's share of global oil supply declined from 40 percent in 1999 to 38 percent in 2003, if this policy continues in the future, OPEC won't be able to respond to the increasing global demand of oil. According to intensive research done by the IEA, they came up to the conclusion that in 2010, OPEC's market share would recover and reach 40 percent and in 2030 it will increase to 54 percent. The results in this paper showed that an increase in oil prices was and will still have a negative effect on the OECD and non-OECD nations. Even OPEC and other exporting nations will be affected negatively since the increase in oil prices will give them extra-earnings in the first two years only but then the effect will be offset by the declined economic activity in the importing countries. To determine the loss of global net GDP, we should determine the extra oil earnings of the oil exporting countries including OPEC. The higher the marginal propensity to save their earnings in oil exporting nations, the higher the preliminary loss of GDP will be. Oil exporting countries might benefit from this increase in oil prices to restore reserves and decrease foreign and domestic debt. Therefore the undesirable effect on worldwide economic growth will be brutal. Not only increased oil prices cause a

decrease in economic activity, in corporate revenues and increase inflation, they also cause harmful consequences on financial markets such as a decrease in exchange rates and in government financing.

CHAPTER 4

OIL PRICE FLUCTUATIONS AND IMPACT ON THE WORLD ECONOMY: EMPIRICAL ANALYSIS

In this chapter, to test if crude oil price fluctuations affect the world economy, we will try to analyze the behavior and variability of several dependent macroeconomic variables in each country by regressing it on one regressor that is the oil prices on a 40 years period from 1970 to 2009.

Fifteen countries are chosen to be tested, they are classified as follows:

- Six countries that are members of the OPEC cartel; they are the following: Algeria, Iran, Kuwait, Nigeria, Saudi Arabia, and Venezuela.
- Six countries that are part of OECD countries:

  - Germany, Spain and the United Kingdom as part of the European Union

  - United States of America and Japan, two of the largest economies in the world.

  - Mexico, an upper middle income economy being part of the OECD whereas the above OECD countries are of High Income Economies.
- Finally, the most important three advanced emerging markets: China, India and Russia.

One of the main concepts being the core of time series procedure is that of stationarity that validates the results of classical regression analysis i.e. having the mean fluctuating

around a constant long-run mean, having a finite variance that is time-invariant; and having a theoretical correlogram that diminishes as the lag length increases.

Each of the variables will be tested for the order of integration to check the number of unit roots. In this paper the Augmented Dickey Fuller (ADF) test is used to test for unit root. The non stationary variables will be adjusted depending on the unit root in difference. Then after making sure that the variables are all stationary, we will use the Granger causality test to test if oil price fluctuations cause changes in the macroeconomic factors of each of the countries cited above or otherwise.

4.1. OPEC countries

4.1.1. Algeria

From the Granger Causality test, an increase in oil prices affects mainly energy production in Algeria in a negative way which is logical since this country being an OPEC member relies heavily on oil exports and the energy sector is the base of the Algerian economy. But this effect will be outweighed by trade surplus, an increase in profit from oil exports and an increase in foreign exchange reserves. However, unemployment rate is still high in Algeria but its causes aren't due to oil price fluctuations. As for the other variables, the test showed that there is not significant effect of crude oil price fluctuations on any of them.

4.1.2 Iran

Iran highly depends on its petroleum industry and the Iranian oil reserves are nowadays the fourth in the world. Therefore a decrease in the world energy imports as we notice from the Granger causality test will affect the Iranian economy negatively and this might cause changes in oil prices. Similarly a cut in energy production that might be due to an event such as the Iranian revolution or the Iran-Iraq war will affect crude oil prices negatively. The relationship between the two variables is significant at a 10 percent level reflecting that a decrease in energy production by 1 unit will cause an increase of oil prices by 1.2 percent.

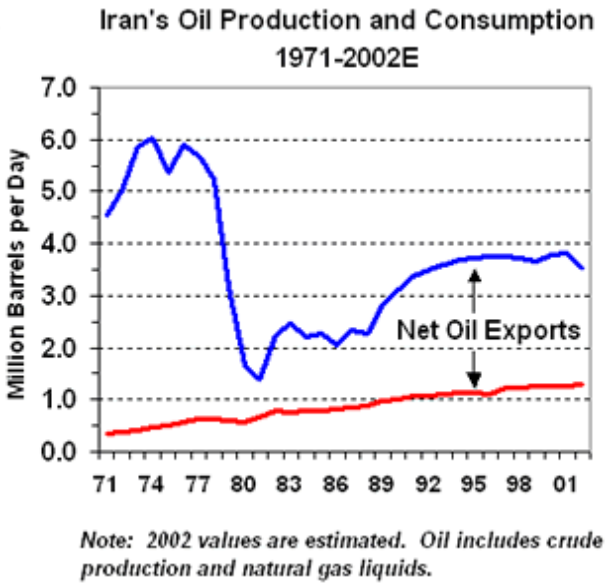


Figure 4: Iran's Oil Production and Consumption 1971-2002

Source: www.globalsecurity.org/military/world/iran

Noticing also from the graph above, oil production in Iran decreases in times of political events (war) whereas its consumption remains almost stable. Therefore net oil

exports will decrease as a consequence in case of war and will affect Iran's economy hence its GDP negatively since Iran highly depends on petroleum industry. Not only will the Iranian economy be affected but the world economy too as Flower (2010) stated:

> Oil prices are extremely volatile. Unlike conventional demand and supply fluctuations, oil responds quickly to risk factors like war or war like situations even if the supply is steady. Iran's position in the oil world- Iran is a large player in the oil business being the fourth largest producer of oil in the world. When Iran does something, the world takes notice.

4.1.3 Kuwait

Kuwait being the fifth richest country in the world holds around 10 percent of the world's crude oil reserves. Granger causality test shows that inflation in the state of Kuwait will cause crude oil prices to increase and therefore boost the Kuwaiti economy. Similarly the test shows that an increase in crude oil prices will affect positively the country's GDP and enhances the money supply; this confirms the latter results. According to the granger causality test, a change in oil prices also affects energy production and otherwise. This can be explained in two ways: first, an oil supply shocks might cause a decrease in energy production and could consequently cause crude oil prices to rise, or an increase in oil prices, will cause the world oil consumption to decrease and therefore cause a decrease in energy production. However, the Granger causality test shows that when changes in oil prices causes changes in energy production it is more significant (at the 5 percent level) than in the other way around (at the 10 percent level).

The relationship between oil prices and Kuwait's GDP is positive noting that any harmful effect on oil prices will harm Kuwait's economy.

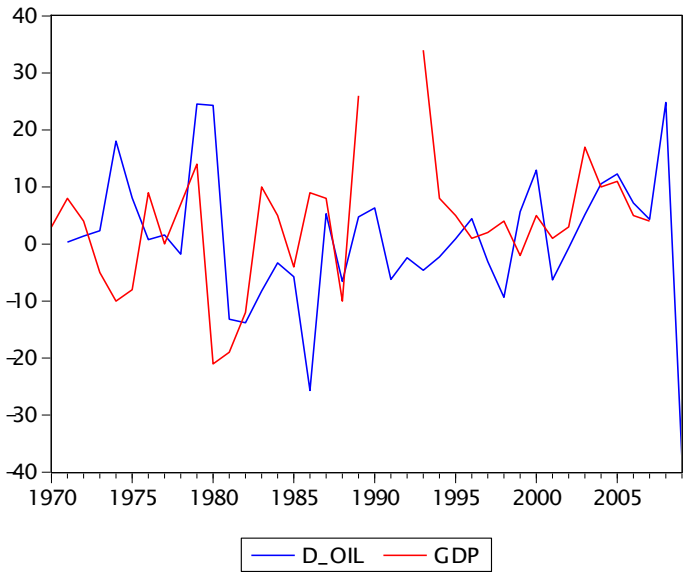


Figure 5: oil price fluctuations and impact on GDP in Kuwait

Kuwait's main trading partners are the United States, India, South Korea, Singapore, China, Euro area, Saudi Arabia and Japan being the largest customer of Kuwaiti oil.

Therefore any crisis affecting these countries will affect Kuwait's economy negatively.

4.1.4. Nigeria

Nigeria being the third largest economy is Africa and the twelfth largest petroleum supplier is an emerging market and the petroleum industry plays an important part in the Nigerian economy. There is a positive relationship between oil prices and Nigeria's GDP showing that an increase in oil prices by 1 unit will cause an increase in GDP by 18.3 percent. Nigeria is an important world producer of oil therefore oil exports count a lot for the country's economy. Because of this considerable contribution, the economy's base of Nigeria is oil therefore any change in oil will cause drastic changes in

Nigeria's economy. Any drastic decline in global oil prices will record a huge deficit in Nigeria's economy; even the country's public services will face severe consequences regarding the nation's political stability. Although the Granger causality test doesn't show significant results in what is affecting the other whether it's the oil prices changes or the macroeconomic factors changes, however in reality Nigeria's economical stability is highly related to crude oil prices stability. Therefore oil is considered to be a blessing but in the same time a curse for the Republic of Nigeria that was given a recent attention in the 1990's after years of a corrupted military regime and political and economical instability.

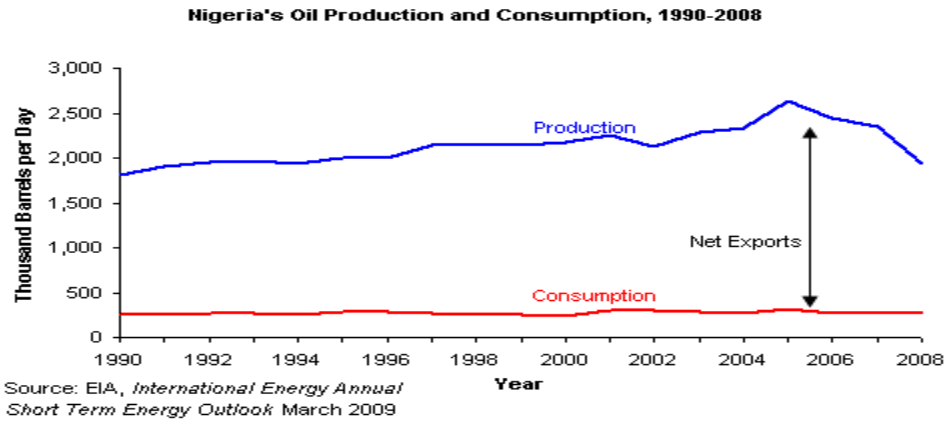


Figure 6: Nigeria's Oil Production and Consumption 1990-2008

4.1.5. Saudi Arabia

Saudi Arabia is the world leading oil producer having the largest oil reserves. The country depends on oil export that accounts for 90 percent of its total exports and 75 percent of the government earning. The Granger causality test confirms the fact that oil price fluctuations affect the nation's economy in a significant way. An increase in oil prices will cause an increase in Saudi Arabia's GDP by almost 24 percent. Also this test

shows a significant relation between oil prices and the money supply from one side, and energy production and oil prices on the other side. The results confirm previous studies done by other people: Energy production in Saudi Arabia has a significant impact on oil prices but not on world inflation. We can cite the major role Saudi Arabia played in 1999 OPEC's campaign to increase oil prices since the Gulf War by controlling oil production. However, shocks in Saudi's production have tight effect on the world inflation; it's true that Saudi Arabia doesn't affect world prices directly but it can highly affect oil prices through oil price shocks and impact the world inflation.

In addition, an increase in oil prices will cause an increase in money supply since the government will earn more revenue. Aleisa (2001) stated that any alteration in government expenditure will affect Saudi Arabia's economic activity positively in case of an increase in oil prices hence increase in the revenue, and negatively otherwise. And government expenditure will affect consequently the money supply. From here, we can conclude that the Granger causality results are confirmed.

4.1.6. Venezuela

Venezuela's economy highly depends on the petroleum industry that counts around 1/3 of its GDP and 80 percent of its government earning. The Granger causality test shows that changes in oil prices granger cause changes in GDP at a 10 percent significance level. There is a positive relation between these two factors. An increase in oil prices by 1 unit causes an increase in Venezuela's GDP by 2.5 percent. The test doesn't show direct impact on oil price fluctuations on the other macroeconomic factors. However analyzing the trend of each of the factors separately shows a relationship between each other. As we notice from the graph of below, the PDVSA strike caused a

decrease in oil production that caused a decrease in Venezuela's GDP, causing an increase in inflation and unemployment. Similarly from the graph we notice that a decrease in oil prices due to the Asian financial crisis caused a decrease in Venezuela's oil production hence its GDP and increase finally unemployment. Its true inflation was decreasing at that time but it is 2 years after the crisis that it reached its minimum.

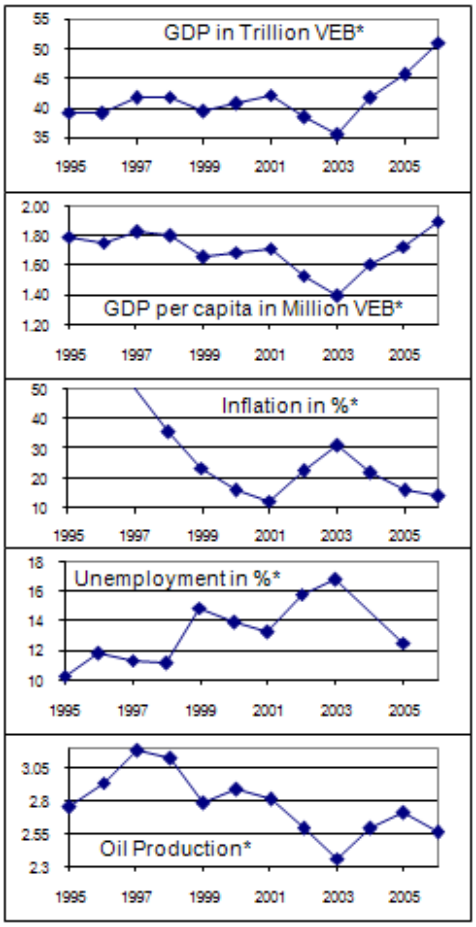


Figure 7: Venezuela's economic indicators

Source: WDI/World Bank.

4.2. OECD countries

4.2.1. European Union

Overall, European Union countries have the highest world oil imports. Their

imports reach almost 18 million barrels of oil daily. Nevertheless, American's foreign oil consumption is way higher than the European countries.

4.2.1.1. Germany

Germany's oil imports accounts for less than a quarter of global fuel delivery to the United States. Although Germany is one of the chief leaders in procuring substitute energy sources such as wind and solar power, the country stays highly dependent on oil imports. Germany being a major world exporter relies on oil to produce major luxury automotive brands such as Mercedes-Benz, Volkswagen, BMW, Audi and Porsche.

Spiegel, a Dutch newspaper, highlighted that an increase in oil prices is not only an international problem but it highly affects Germany since it faces a particular situation that is that crude oil prices are related to natural gas prices, and an increase in oil will cause the increase of the other. Therefore when the two unpleasant events happen together, the impact will be twice on German manufacturers causing a 10 percent decrease in the sales for precision-engineered products as fuel prices go up.

The Granger causality test confirms the above mentioned information since it shows that changes in oil prices granger cause inflation in Germany. An increase in oil prices by 1 unit causes an increase in inflation by 0.86 percent. Similarly an increase in oil prices by 1 unit granger cause a slight decrease in exchange rate by 0.12 percent and a decrease in interest rate by 2.2 percent at a 5 percent level. The results are logical since we know that theoretically a depreciation of the exchange rate would cause a decrease in imports and an increase in exports and there will be an income transfer from importing countries to

exporting countries through a change in the terms of trade. Germany being an oil exporter country will be worse off in case of an increase in oil prices.

4.2.1.2. Spain

The main energy source in Spain was and continues to be oil; however it has decreased in significance since the 1970s. The consumption of oil in Spain increased sharply between 1973 and 1979 and then it started to decrease in 1985 to reach almost half of the 1970s amount[20]. Part of oil consumption was replaced by coal and natural gas consumption.

The Granger causality test shows that changes in oil prices will granger cause changes in GDP. An increase in oil price by 1 unit will cause a decrease in Spain's GDP by 2.1 percent. The test also shows that changes in oil prices granger cause changes in the exchange rate. An increase in oil prices will cause a decrease of the exchange rate by 0.25 percent. The test doesn't show any other significant cause between oil prices and the macroeconomic factors.

4.2.1.3. United Kingdom

The Granger causality test shows that a change in oil prices will affect the United Kingdom's GDP. An increase in oil prices by 1 unit will cause a decrease in the country's GDP by 4.9 percent. This is natural in an importing country since an increase in oil price will make it worse off.

[20] In the 1970s, the consumption of oil in Spain reached 50 million tons but since the 1985 it declined to 39 million tons.

However, the test shows that changes in the United Kingdom's exchange rate, GDP, unemployment rate and current account affect oil price slightly; but to what extent this is significant no other relation is clear since it is known that the United Kingdom is a consumer of oil. One possible explanation of how oil prices can be affected by the United Kingdom is that the country mainly imports oil for consumption in cold weather to use it for heat or for transportation. If the economic activity in the country is growing this explains that the production, transportation and consumption of goods and services are increasing and since they require energy and oil consumption therefore there will be an increase in their demand consequently causing an increase in their prices.

However the UK is only one consumer compared to the world economy, therefore the impact on oil prices won't be significant. Another possible explanation of how oil prices would be affected by UK's economy: if the UK's economy is booming, the citizen will be better off therefore they will give more time for leisure since their disposable income is increased; this will lead to an increase in demand for transport since they would like to travel long distances or go on trips. This will cause an increase in the cost of transportation and therefore an increase in the demand for oil causing an increase in its price (according to the law of demand and supply).

4.2.2. Largest economies in the world

4.2.2.1. The United States of America

The United States is the world's largest consumer of petroleum. Therefore any changes in oil prices will affect oil imports in the US as we can see from the Granger

causality test. An increase in oil prices by 1 unit will cause a decrease in energy imports by almost 4 percent. The Granger causality test doesn't show significant results between oil price fluctuations and impact of the macroeconomic factors. It can be noticed that changes in money supply granger cause changes in oil prices; however it's not clear to what extent it cause oil price fluctuations. Looking at the graph below, we can clearly see that changes in the US GDP are affected by crude oil price fluctuations throughout time. Any increase in oil prices linked to political events causes a decrease in US GDP. Kilian (2006) was also able to prove that the United States growth rate is related to oil prices; therefore an increase in oil prices will lower the growth rate but in the next quarter. It was clear in the analysis that oil supply shocks linked to political events harshly affect the US GDP. Kilian (2006) also proved that oil supply cuts not only cause a rise in oil prices but also push inflation up in the US.

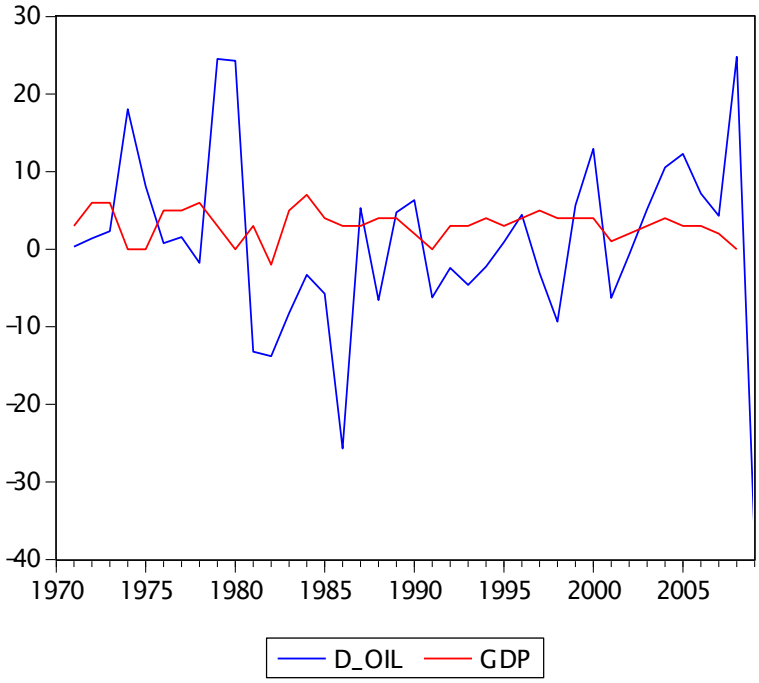


Figure 8: Oil price fluctuations and impact on the US' GDP

4.2.2.2. Japan

Japan is the second largest economy in the world after the United States in terms of GDP.

Japan mainly exports transportation tools, motor vehicles, electronics, electrical machinery and chemicals; however since Japan lacks energy sources it mainly has to import them. It also imports from China, US, the European Union, Saudi Arabia, UAE, Australia, South Korea and Indonesia the following: machinery and equipment, beef, chemicals, textiles, fossil fuels and raw materials for its industries.

After the World War II, Japan has seen a rapid industrial activity that pushed it to increase its energy consumption. In 1976, Japan's consumption of energy was higher than

its population rate. The Granger causality test shows that changes in energy imports in Japan granger cause changes in oil prices. This could be true at a certain point in time since Japan's consumption in 1976 was almost 6 percent of the world's energy supply however its population rate was only 3 percent of the world population. So a cut in Japan's imports could definitely affect oil prices. The test also shows that changes in oil prices affect the money supply in Japan. There is a negative relationship between the two variables. An increase in oil prices will cause a decrease in money supply. Also the relationship between the money supply and the exchange rate is positive. Therefore a decrease in the money supply will cause a decrease in the exchange rate in other words its appreciation. The appreciation of the exchange rate in Japan will cause a decrease in exports which might cause a current account deficit that will prevent Japan from importing oil.

However another scenario was discussed by Jackson (2006) that since Japan like Germany is highly dependent on foreign oil imports. Therefore when OPEC increased oil prices German inflation was only 7 per cent but Japan's inflation rate increased to 25 per cent.

4.2.3. Upper Middle Income: Mexico

Mexico's economy is the eleventh largest in the world. Mexico was in 2006 the sixth largest oil supplier in the world however its oil production dropped rapidly.

From the Granger causality test, there is clear evidence that changes in oil prices affect the Mexican current account, fuel exports and GDP. An increase in oil prices causes an increase in Mexico's GDP by 14.5 percent, a significant decrease in fuel exports because consuming countries will cut their demand and an increase in the current account which will make the country better off. However these results seem to contradict with other analysis done.

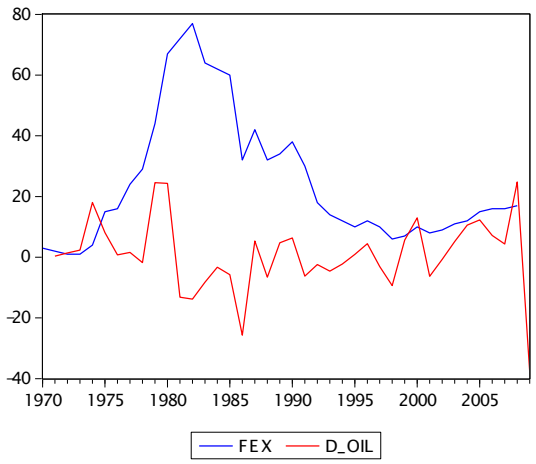


Figure 9: Oil Price Fluctuations and Impact on Mexico's Fuel Exports

From the graph above we notice that fuel exports harshly decreased in 1993 in Mexico. Similarly crude oil production decreased. However this decrease in exports wasn't due mainly to increase in oil prices but to an increase in local consumption and a lower total production.

4.3. Advanced Emerging Countries:

4.3.1. China

China is an emerging economy that moved away from the centrally planned economy (like the Soviet Union's). Since its independence in the 1978, China's economical growth has been increasing rapidly and in particular crude oil consumption. In addition, as we stated in the previous chapter, one of the main reasons for crude oil price increase was the China's growth. China is now the largest oil consumer after the U.S. My results confirm the previous statements since in the granger causality test there is clear evidence that Chinese energy imports granger cause changes in oil prices. An increase in Chinese energy imports by 1 unit cause an increase in oil prices by almost 11 percent. Also Money supply changes granger cause oil price changes. An increase in the Chinese money supply will cause an increase in oil prices by 0.00024 percent. Although this increase is insignificant but it can contribute indirectly to an increase in oil prices since an increase in money supply cause a depreciation of the currency and therefore will cause an increase exports. In addition, China has also the largest coal reserves in the world but because of the increased pollution caused by burning coal for power, it is imposed on China to export petroleum from abroad. However the Chinese government prefers not to buy oil on open market because it will have to abide to changes in oil prices; the solution that China is seeking is acquiring its oil from countries that have oil fields but are deficient in capital and technology for exploitation such as Sudan, Iran and Russia.

The granger causality test doesn't show significant effects caused by oil price fluctuations on the Chinese economy. This confirms an article published in BBC news stating that: With the oil price increase globally, China's population is not worse off since the government is paying subsidies and putting upper price limits on the prices consumers pay for oil products. In addition, the government reimburses oil firms for selling their products less than the market price. It's true this policy helps from one side but it will affect the Chinese economy negatively from another side such as increasing inflation rate.

4.3.2. India

When India followed an open economy in the 1990s its economy experienced a rapid growth. India discovered oil reserves in Bombay High which it is using for local consumption. However, its oil imports are increasing making it one of the largest consumers of crude oil. Similar to China, one of the main reasons for crude oil price increase was India's growth.

The Granger causality test shows that changes in exchange rate granger cause changes in oil prices. There is no evidence that the reciprocal effect is significant. However an article written in BBC states that an increase in oil prices in India causes the increase of the rupee against the dollar meaning the appreciation of their currency which will cause an increase in exports. But despite the oil price increase India is not largely affected since the government pays financially supports petrol and diesel. The subsidies might drag the Indian economy in inflation later on.

4.3.3. Russia

In the 1990s, most of the post-Soviet countries were harshly hit by the economic crisis more than the other European countries that were hit by recent Great Recession.

However, Russia's economy has been growing fast lately with the increase in oil prices, the increase in foreign investment, the political stability that the country has been finally facing and the increase in the local demand. In 2007, statistics showed that Russia's GDP is of $2.076 trillion (in terms of PPP) which made her the sixth largest economy in the world. Oil sector in Russia counts for almost 80 percent of its exports. However these exports decreased since 2003, with the increased internal demand. Russia is also known as one of the largest natural gas reserves in the world, and the eighth largest oil reserves. It is the second larger exporter of oil after Saudi Arabia. Russia's oilfield is passing through a transition phase that might change its destiny forever. It is improving with time and is becoming the centre of interest of the United States as a substitute supplier of the Middle East with all their political imbalances.

The Granger causality test shows that change in oil prices in Russia will affect energy production and the inflation rate at a 10 percent significance level.
There is no information concerning how energy production is affected in Russia however, the impact on inflation is confirmed from the coming report:

According to OECD assessment report (2006), Russia will become a major power in the future, in addition to other factors affecting oil prices; the appreciation of the rubble can cause their increase too. Similarly, economic performance can be affected by

oil prices. An increase in oil prices will cause in Russia economic growth since Russia is a major exporter of oil will increase wages, cause an appreciation of the Ruble against other foreign currencies and will cause an economic stability in the country but also this might lead to inflation.

My results with the Granger causality test doesn't show a significant impact on how oil prices will affect the economy in Russia, bas as we notice nowadays, Russia\s economy is booming. An increase in oil prices will also cause an increase in trading revenues which will increase the current account surpluses in the country. However more money in circulation will lead to higher inflation rate since the greater the money is in circulation, the more suppliers will be willing to increase prices to match higher demand of goods and hence inflation will rise.

4.4. Effect of oil price shocks on the World Economy: Forecasting three oil shocks 1973-1985 and 1990

After analyzing how crude oil prices affected the economies of each country separately, in this part we will analyze how crude oil price fluctuations have an impact on the world economy. Although it is unanimously agreed that oil price shocks may have severe adverse effects on the global economy, quantifying this effect is not easy. The global economy is proxied using the aggregate GDP of the high income OECD countries (Source: 2009 WDI)

This section aims at making a contribution towards the estimation of oil price shocks on the world economy. It focuses on two oil shocks: The Oil price shocks of 1973 and1985.

Methodology

In order to test the impact of an oil price shock on the World economy, an interrupted time series approach is applied.

It is necessary to identify the length of the price shock first which is from the point it started to increase until it reached its normal level again.

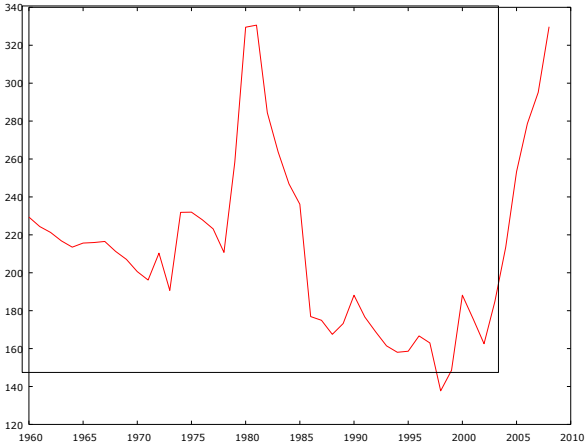


Figure 10: Oil Price Fluctuations 1960-2010

The above figure suggests that reasonable assumption regarding the length for the 1970s oil crises are 1973-1985. The beginning of each oil crisis can be clearly identified with political events which are the Arab embargo of 1973, Iran/Iraq crisis and the invasion of Kuwait by Iraq.

The ending of each crisis can be thought of as the time when pre-crisis real gas price levels are restored again. In the first and second oil crisis this is the case in 1985 and in the first Gulf war in 1991.

How does the interrupted time series approach work? In the case of the 1970s oil crises, a simple ARIMA (p,d,q) forecast is made based on the observations prior to 1973 for the period between 1973 and 1985.

The Auto-Regressive Integrated Moving Average model known as ARIMA model is the most general class of models for forecasting a time series which can be stationarized by transformations such as differencing and logging. Lags of the differenced series appearing in the forecasting equation are called "auto-regressive" terms (AR), lags of the forecast errors are called "moving average" terms (MA), and a time series which needs to be differenced to be made stationary is said to be an "integrated" version of a stationary series (I).

ARIMA model is classified as ARIMA (p,d,q) where:

AR (p) = autoregressive

I (d) = integrated

MA (q) = moving average

The letters in parenthesis denote the number of the process' order.

It is expected that the forecast values are higher than the actual. The difference between forecast and actual value can be interpreted as foregone economic activity due to the oil crises. The same logic applies to the 1990 First Gulf war (Figure 11). The dataset is annual from 1960-2008.

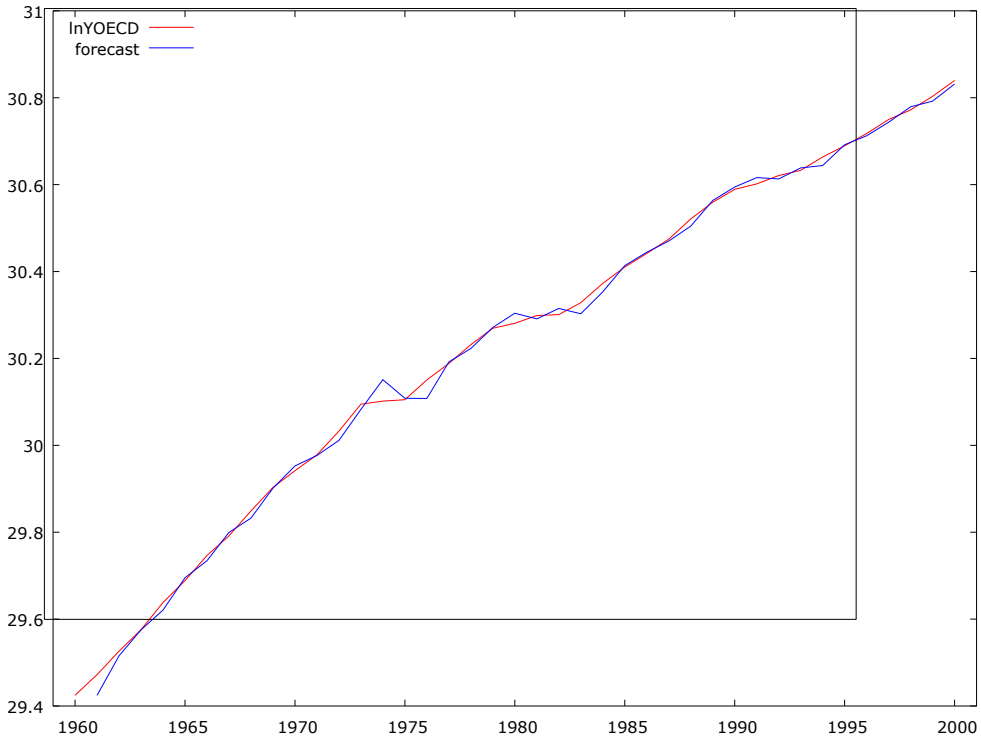


Figure 11: Forecasting OECD's GDP from 1960-2000

Empirical Results

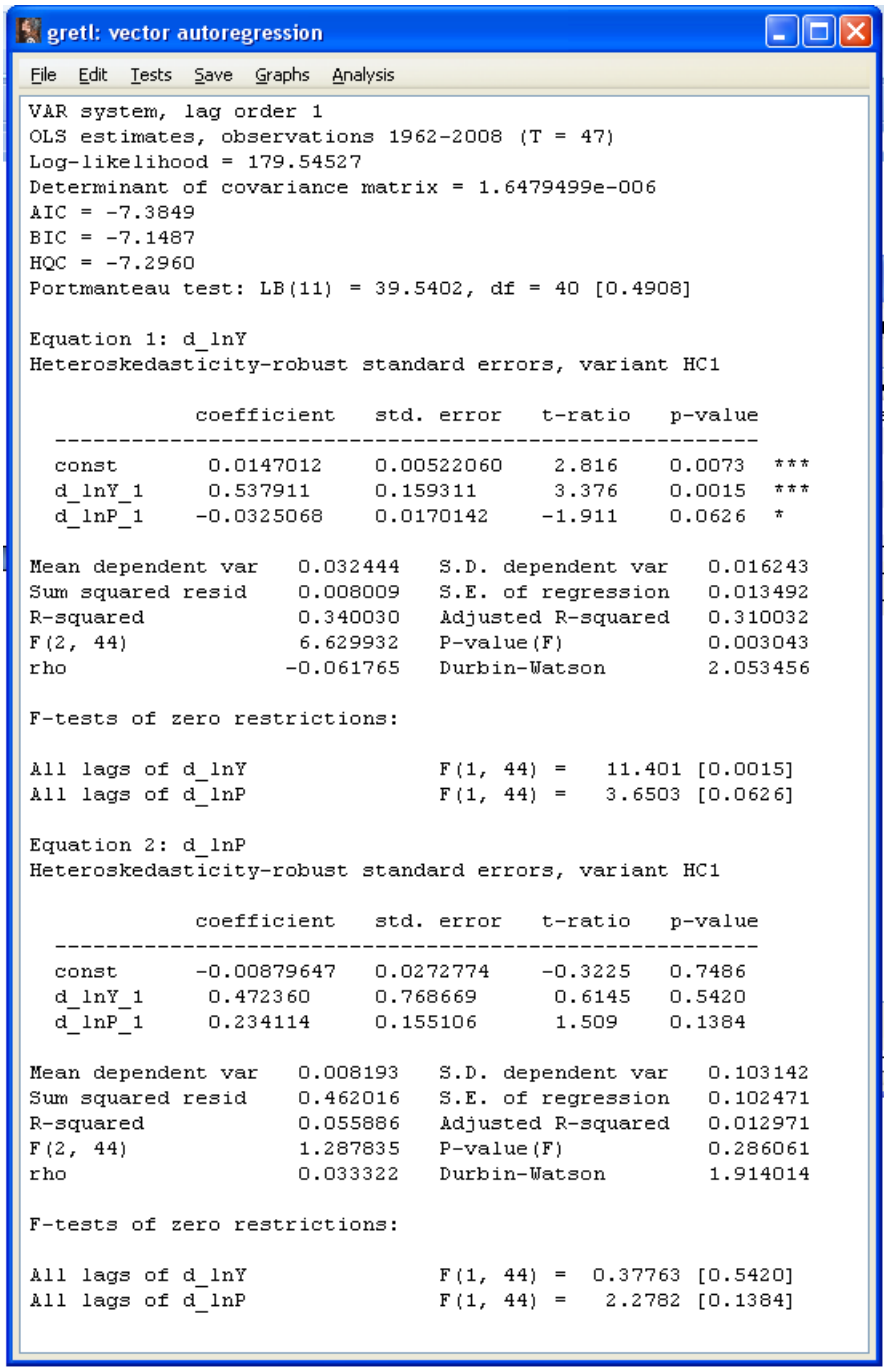
Empirical results showed that Oil Prices matter for World GDP. Oil price shocks delayed GDP growth. In a first step it is useful to show that the world economy in fact is adversely affected by higher oil prices. For this purpose, a simple Granger causality test is run. The Granger causality test as described in previous sections is a technique that determines if one time series is helpful in forecasting another.

Specifically, it is run:

$$d\ln Y_t = \beta_0 + \beta_1 d\ln Y_{t-1} + \beta_2 d\ln P_{t-1} + \varepsilon_t \qquad (1)$$

$$d\ln P_t = \beta_0 + \beta_1 d\ln P_{t-1} + \beta_2 d\ln Y_{t-1} + \varepsilon_t \qquad (2)$$

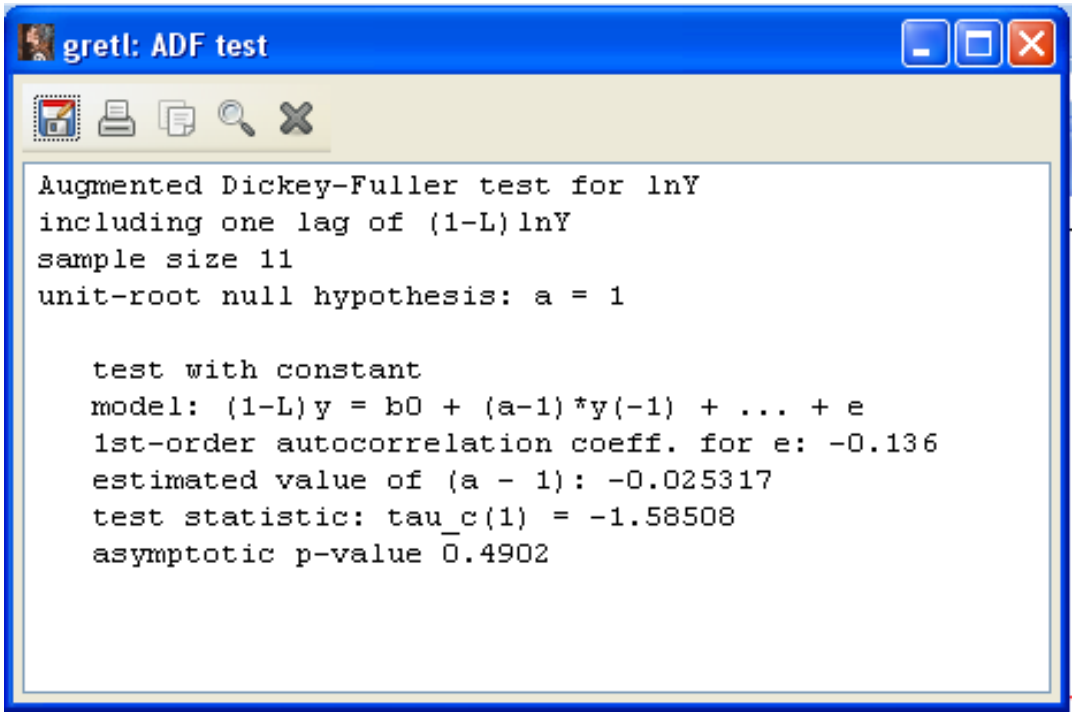
Table1: vector autoregression




```
VAR system, lag order 1
OLS estimates, observations 1962-2008 (T = 47)
Log-likelihood = 179.54527
Determinant of covariance matrix = 1.6479499e-006
AIC = -7.3849
BIC = -7.1487
HQC = -7.2960
Portmanteau test: LB(11) = 39.5402, df = 40 [0.4908]

Equation 1: d_lnY
Heteroskedasticity-robust standard errors, variant HC1

             coefficient   std. error   t-ratio   p-value
  ---------------------------------------------------------
  const       0.0147012    0.00522060    2.816    0.0073   ***
  d_lnY_1     0.537911     0.159311      3.376    0.0015   ***
  d_lnP_1    -0.0325068    0.0170142    -1.911    0.0626   *

Mean dependent var   0.032444   S.D. dependent var   0.016243
Sum squared resid    0.008009   S.E. of regression   0.013492
R-squared            0.340030   Adjusted R-squared   0.310032
F(2, 44)             6.629932   P-value(F)           0.003043
rho                 -0.061765   Durbin-Watson        2.053456

F-tests of zero restrictions:

All lags of d_lnY               F(1, 44) =   11.401 [0.0015]
All lags of d_lnP               F(1, 44) =   3.6503 [0.0626]

Equation 2: d_lnP
Heteroskedasticity-robust standard errors, variant HC1

             coefficient   std. error   t-ratio   p-value
  ---------------------------------------------------------
  const      -0.00879647   0.0272774    -0.3225   0.7486
  d_lnY_1     0.472360     0.768669      0.6145   0.5420
  d_lnP_1     0.234114     0.155106      1.509    0.1384

Mean dependent var   0.008193   S.D. dependent var   0.103142
Sum squared resid    0.462016   S.E. of regression   0.102471
R-squared            0.055886   Adjusted R-squared   0.012971
F(2, 44)             1.287835   P-value(F)           0.286061
rho                  0.033322   Durbin-Watson        1.914014

F-tests of zero restrictions:

All lags of d_lnY               F(1, 44) =  0.37763 [0.5420]
All lags of d_lnP               F(1, 44) =   2.2782 [0.1384]
```

The results suggest that there is weak Granger causality from lagged oil prices to world GDP but no Granger causality whatsoever the other way around.

Table 2: ADF Test



Looking at the augmented Dickey Fuller test, we can clearly see that we fail to reject Ho since the p-value is greater than 0.05. The test shows the presence of unit root.

To confirm the presence of unit root, we also analyze the correlogram.

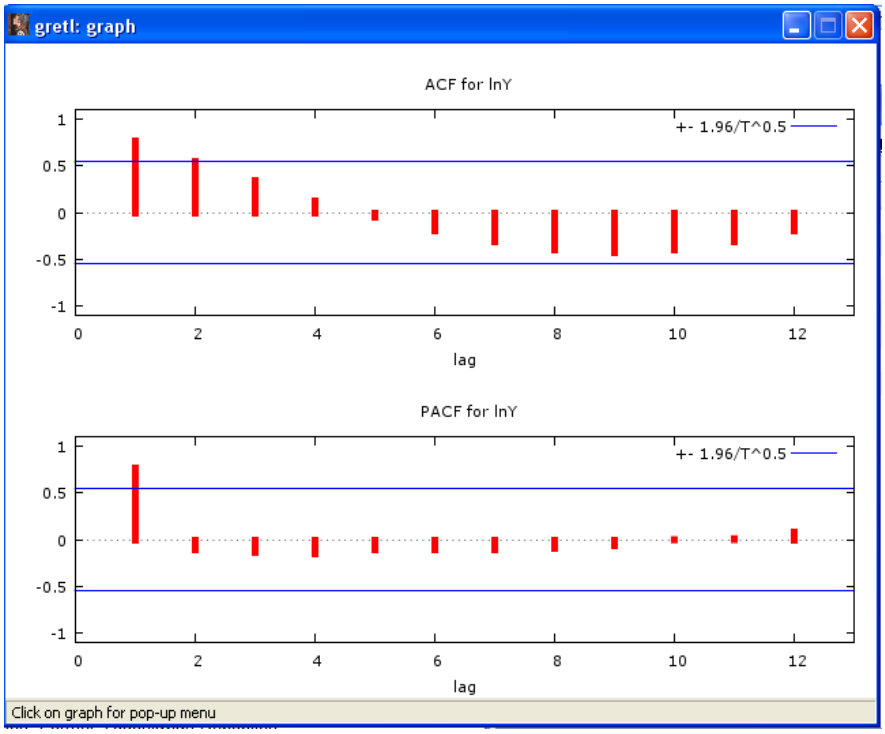
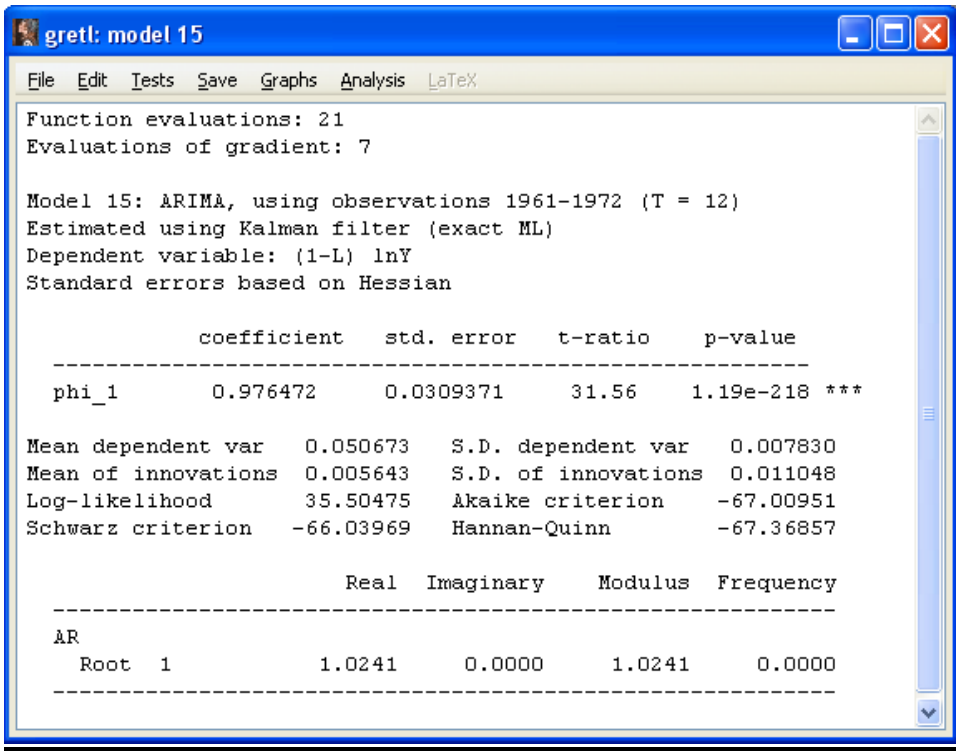


Figure 12: Correlogram World GDP (1960-1972)

Similarly, the combination of a tailing-off ACF and a cutting-off PACF typical for an AR process is illustrated above. The first spike of the ACF and PACF are indicative for a unit root).

We identify the 1960-1972 time series of World GDP as an ARIMA (1, 1, and 0) process because the time series has a unit root (d=1). The model is the differenced first order autoregressive model. If the errors of the random walk model are autocorrelated, possibly the problem can be solved by adding one lag of the dependent variable to the prediction equation.

The Estimation Results of the ARIMA (1,1,0)



Looking at the p-value, we see that it is very significant. Therefore, we can conclude that the variables are now stationary.

Similarly, the Residual test confirms the appropriateness of the model:

By looking at the p-value, we notice that they are all insignificant at a 5 percent significance level. Again, we clearly can conclude that the variables are stationary and we can start the forecast.

gretl: correlogram

Residual autocorrelation function

LAG	ACF	PACF	Q-stat.	[p-value]
1	-0.0808	-0.0808	0.0997	[0.752]
2	-0.0368	-0.0436	0.1224	[0.941]
3	0.0591	0.0530	0.1877	[0.980]
4	-0.0551	-0.0479	0.2513	[0.993]
5	0.0130	0.0091	0.2554	[0.998]
6	-0.2051	-0.2132	1.4334	[0.964]
7	0.0669	0.0434	1.5840	[0.979]
8	-0.0554	-0.0737	1.7130	[0.989]
9	-0.3004	-0.2974	6.7673	[0.661]
10	-0.0792	-0.1880	7.2942	[0.697]
11	0.1737	0.1529	12.3633	[0.337]

The data set is from 1960-1985

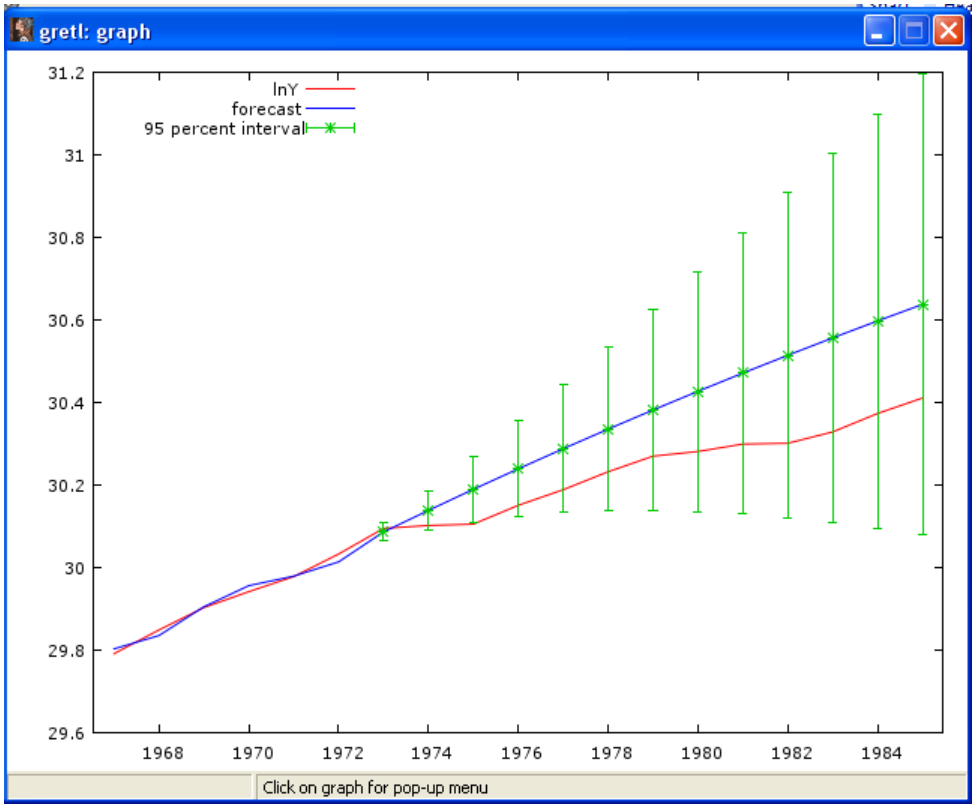


Figure 13: The Forecast Plot 1960-1985

To answer the question how much did the oil crises cost the world economy?

The total foregone world income over 12 years (1973-1985) is estimated at 27.2 trillion USD (const 2000$).

We notice that the World GDP could have been 16 percent higher in 1985 if there were no oil shocks.

The annual foregone growth rate is on average more than 1 percent.

Assuming there were almost 840 million people in 1985 (source: 2009 WDI), the per capita income could have been some 34,000 USD higher (const 2000 USD) in case the 1973 oil shock and the 1980s second oil shock didn't occur at that time.

One could also think of these costs as an implicit "tax" of the oil crisis of almost 3,000 dollars per year.

CHAPTER V

CONCLUSION

Since the 1970s, oil price shocks proved to be important factors that lead to oil price fluctuations and cause consequently drastic effects on the world macroeconomic factors. However these shocks affect each country differently depending whether the country is an exporter or an importer of oil. If the country was an importer, the degree of the impact will depend whether the country is highly dependent on oil or not. Generally it was proven that an increase in oil prices due to political events caused a global recession and triggered inflation. However empirical results showed that an increase in oil prices will increase profits in OPEC countries such as Algeria, Kuwait, Nigeria, Iran, Venezuela and Saudi Arabia. In addition, Saudi Arabia can influence global oil prices significantly without dragging the world into inflation since it's a leading oil producer. On the other hand, OECD countries such as Germany will be severely affected by oil price increases because prices of other goods will be affected consequently. Large economies such as the United States and Japan can themselves influence oil prices since they are major importers of oil and reciprocally they will be affected by an increase in oil prices and will have to face an increase in inflation. As for Mexico, an upper middle income country will have an increase in its GDP when oil price increase however it will face a decrease in its exports. As for the emerging countries China and India, they won't be affected by oil price increases because the government protects the economy by paying subsidies. China, in addition, doesn't buy oil from open market transaction; it acquires its own oil from its contribution to countries that lack capital and technology in his domain in return of oil.

Finally, Russia, as oil price increase, its GDP will increase on the short term but on the long term, they will be worse off because of the decrease in global demand and the appreciation of its currency will lead the country to inflation.

Summing up all these economies, in a next step, I analyzed the crude oil price fluctuations and their impact on the world economy that is proxied using the aggregate GDP of the high income OECD countries. The estimation of oil price shocks on the world economy is done by focusing on two oil shocks: The Oil price shocks of 1973 and1985. The results showed that the total foregone world income over 12 years (1973-1985) is estimated at 27.2 trillion USD (const 2000$). Therefore world GDP could have been 16 percent higher in 1985 if there was no oil shocks in the 1073 and 1985.

Appendix

Table 1: Algeria

Pairwise Granger Causality Tests

Date: 05/29/10 Time: 15:18

Sample: 1970 2009

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
D_INF does not Granger Cause D_OIL	37	0.36857	0.5478
D_OIL does not Granger Cause D_INF		2.13223	0.1534
D_EXR does not Granger Cause D_OIL	38	0.01094	0.9173
D_OIL does not Granger Cause D_EXR		0.05098	0.8227
D_EPR does not Granger Cause D_OIL	35	3.32667	0.0775
D_OIL does not Granger Cause D_EPR		5.92704	0.0207
CA does not Granger Cause D_OIL	14	26.0703	0.0003
D_OIL does not Granger Cause CA		0.03738	0.8502
EIM does not Granger Cause D_OIL	36	2.20237	0.1473
D_OIL does not Granger Cause EIM		0.45420	0.5050
FEX does not Granger Cause D_OIL	34	3.03466	0.0914
D_OIL does not Granger Cause FEX		0.01387	0.9070
GDP does not Granger Cause D_OIL	37	0.98952	0.3269
D_OIL does not Granger Cause GDP		0.00759	0.9311
INT does not Granger Cause D_OIL	14	0.81443	0.3861
D_OIL does not Granger Cause INT		0.00098	0.9755

Table 2: Iran

Pairwise Granger Causality Tests

Date: 05/29/10 Time: 17:06

Sample: 1970 2009

Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
CA does not Granger Cause D_OIL	24	2.11834	0.1603
D_OIL does not Granger Cause CA		1.65432	0.2124
DD_EIM does not Granger Cause D_OIL	34	8.84904	0.0056
D_OIL does not Granger Cause DD_EIM		1.39066	0.2473
DD_EXR does not Granger Cause D_OIL	37	0.16302	0.6889
D_OIL does not Granger Cause DD_EXR		0.43114	0.5159
FEX does not Granger Cause D_OIL	15	0.91752	0.3570
D_OIL does not Granger Cause FEX		0.41069	0.5337
GDP does not Granger Cause D_OIL	36	0.10114	0.7525
D_OIL does not Granger Cause GDP		0.47697	0.4946
INF does not Granger Cause D_OIL	37	0.07643	0.7839
D_OIL does not Granger Cause INF		0.78871	0.3807
EPR does not Granger Cause D_OIL	36	8.90402	0.0053
D_OIL does not Granger Cause EPR		2.57047	0.1184

Table 3: Kuwait

Pairwise Granger Causality Tests
Date: 05/29/10 Time: 17:58
Sample: 1970 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
D_CA does not Granger Cause D_OIL	32	0.31025	0.5818
D_OIL does not Granger Cause D_CA		0.19278	0.6639
D_EPR does not Granger Cause D_OIL	35	3.59081	0.0672
D_OIL does not Granger Cause D_EPR		6.33850	0.0170
DD_M2 does not Granger Cause D_OIL	32	0.05644	0.8139
D_OIL does not Granger Cause DD_M2		11.5986	0.0020
EIM does not Granger Cause D_OIL	36	1.60291	0.2144
D_OIL does not Granger Cause EIM		0.00108	0.9740
GDP does not Granger Cause D_OIL	32	4.15201	0.0508
D_OIL does not Granger Cause GDP		7.14746	0.0122
INF does not Granger Cause D_OIL	35	3.76971	0.0610
D_OIL does not Granger Cause INF		1.43206	0.2402
INT does not Granger Cause D_OIL	24	2.32179	0.1425
D_OIL does not Granger Cause INT		4.57101	0.0444

Table 4: Nigeria

Pairwise Granger Causality Tests
Date: 05/29/10 Time: 19:21
Sample: 1970 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
D_CA does not Granger Cause D_OIL	30	0.13682	0.7143
D_OIL does not Granger Cause D_CA		0.59925	0.4456
EIM does not Granger Cause D_OIL	36	3.24044	0.0810
D_OIL does not Granger Cause EIM		2.29466	0.1393
D_EPR does not Granger Cause D_OIL	35	1.50340	0.2291
D_OIL does not Granger Cause D_EPR		1.50137	0.2294
D_EXR does not Granger Cause D_OIL	37	0.57112	0.4550
D_OIL does not Granger Cause D_EXR		1.70341	0.2006
D_GDP does not Granger Cause D_OIL	37	0.10171	0.7517
D_OIL does not Granger Cause D_GDP		1.36041	0.2516
D_INF does not Granger Cause D_OIL	37	1.01436	0.3210

D_OIL does not Granger Cause D_INF		0.11565	0.7359
INT does not Granger Cause D_OIL	37	0.94798	0.3371
D_OIL does not Granger Cause INT		1.34339	0.2545

Table 5A: Saudi Arabia

Pairwise Granger Causality Tests
Date: 05/29/10 Time: 21:08
Sample: 1970 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
CA does not Granger Cause OIL	37	6.77031	0.0136
OIL does not Granger Cause CA		3.14717	0.0850
EIM does not Granger Cause OIL	36	3.13515	0.0859
OIL does not Granger Cause EIM		7.13771	0.0116
EXR does not Granger Cause OIL	39	3.55333	0.0675
OIL does not Granger Cause EXR		1.95953	0.1701
EPR does not Granger Cause OIL	36	3.48797	0.0707
OIL does not Granger Cause EPR		4.59333	0.0396
FEX does not Granger Cause OIL	31	0.15176	0.6998
OIL does not Granger Cause FEX		0.69148	0.4127
GDP does not Granger Cause OIL	38	2.47103	0.1250
OIL does not Granger Cause GDP		3.70432	0.0624
INF does not Granger Cause OIL	38	0.51074	0.4796
OIL does not Granger Cause INF		0.70474	0.4069
M2 does not Granger Cause OIL	38	2.47776	0.1245
OIL does not Granger Cause M2		14.8736	0.0005

Table 5B: Saudi Arabia and oil price shocks

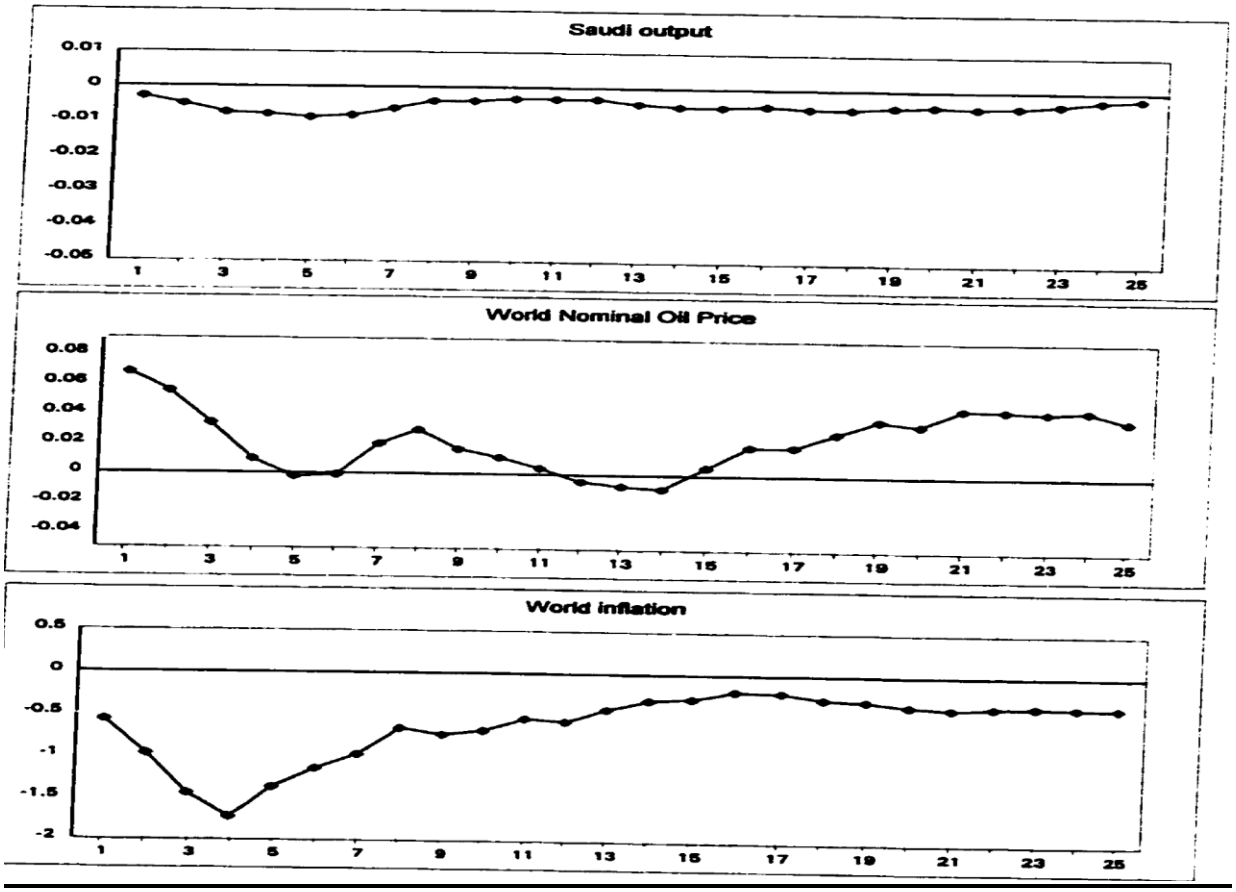


Table 5C: Saudi Arabia production shock

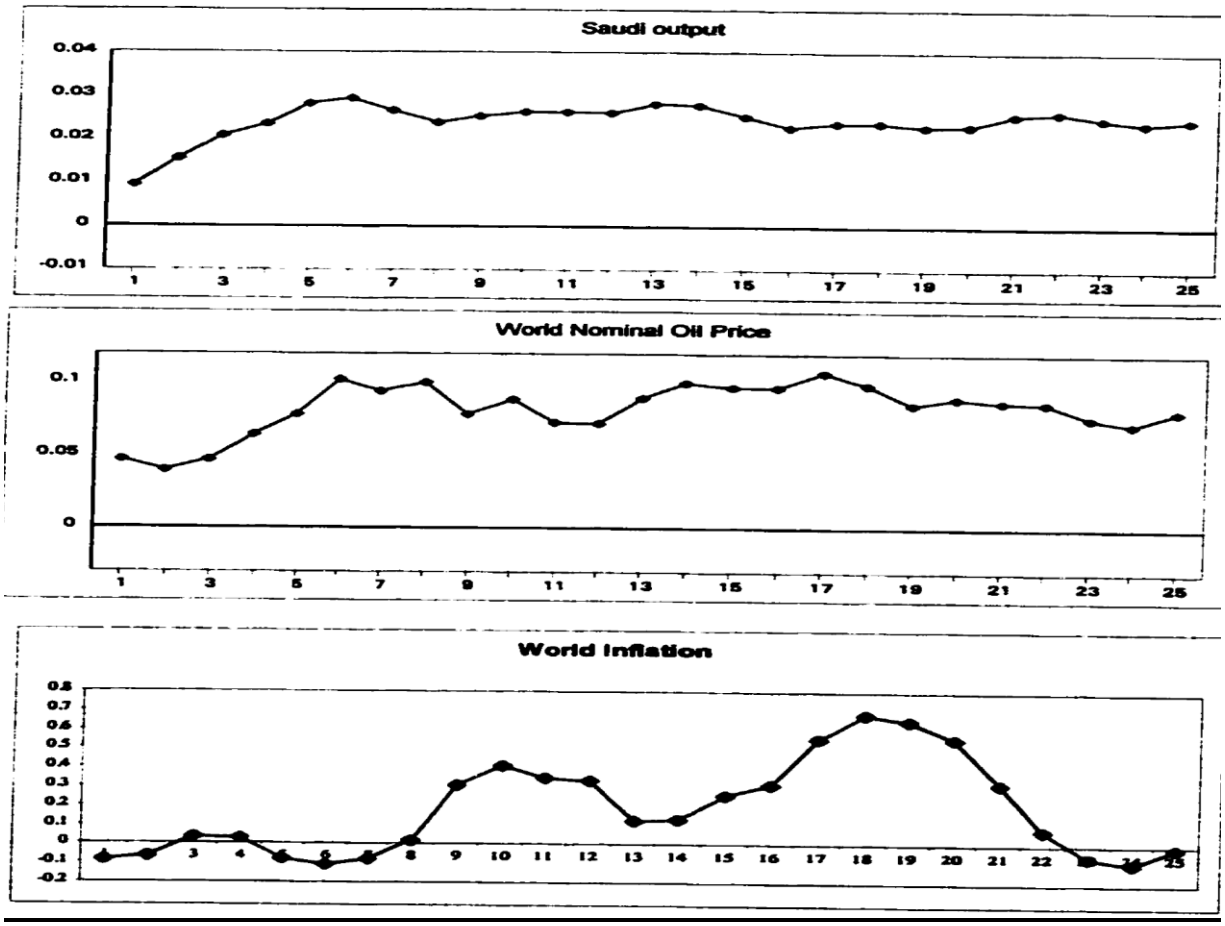


Table 6: Venezuela

Pairwise Granger Causality Tests
Date: 05/30/10 Time: 09:27
Sample: 1970 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DD_CA does not Granger Cause D_OIL	36	0.42974	0.5167
D_OIL does not Granger Cause DD_CA		3.28562	0.0790
EIM does not Granger Cause D_OIL	36	1.83627	0.1846
D_OIL does not Granger Cause EIM		0.99930	0.3248
D_EXR does not Granger Cause D_OIL	38	0.71285	0.4042
D_OIL does not Granger Cause D_EXR		0.29626	0.5897
D_FEX does not Granger Cause D_OIL	35	2.56825	0.1189
D_OIL does not Granger Cause D_FEX		0.01075	0.9181

GDP does not Granger Cause D_OIL	37	0.51808	0.4766
D_OIL does not Granger Cause GDP		3.15318	0.0847
D_INF does not Granger Cause D_OIL	37	0.41656	0.5230
D_OIL does not Granger Cause D_INF		0.89674	0.3503
D_EPR does not Granger Cause D_OIL	35	0.00757	0.9312
D_OIL does not Granger Cause D_EPR		0.24129	0.6266
INT does not Granger Cause D_OIL	24	0.33061	0.5714
D_OIL does not Granger Cause INT		2.09671	0.1624

Table 7: Germany

Pairwise Granger Causality Tests
Date: 05/30/10 Time: 10:48
Sample: 1970 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
D_INT does not Granger Cause D_OIL	23	2.57904	0.1240
D_OIL does not Granger Cause D_INT		10.6873	0.0038
D_FEX does not Granger Cause D_OIL	37	0.48938	0.4890
D_OIL does not Granger Cause D_FEX		5.21304	0.0288
D_EPR does not Granger Cause D_OIL	36	0.35815	0.5536
D_OIL does not Granger Cause D_EPR		0.00170	0.9674
D_CA does not Granger Cause D_OIL	36	2.53467	0.1209
D_OIL does not Granger Cause D_CA		0.16989	0.6829
EIM does not Granger Cause D_OIL	36	2.17818	0.1495
D_OIL does not Granger Cause EIM		1.10435	0.3009
EXR does not Granger Cause D_OIL	38	1.40207	0.2444
D_OIL does not Granger Cause EXR		0.07654	0.7837
GDP does not Granger Cause D_OIL	37	1.08761	0.3044
D_OIL does not Granger Cause GDP		0.01811	0.8937
INF does not Granger Cause D_OIL	16	0.59685	0.4536
D_OIL does not Granger Cause INF		5.66084	0.0334
UNP does not Granger Cause D_OIL	17	1.48838	0.2426
D_OIL does not Granger Cause UNP		0.04725	0.8311

Table 8: Spain

Pairwise Granger Causality Tests
Date: 05/30/10 Time: 14:17
Sample: 1970 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
D_INT does not Granger Cause D_OIL	23	1.58801	0.2221
D_OIL does not Granger Cause D_INT		0.00908	0.9251
D_INF does not Granger Cause D_OIL	37	0.07124	0.7912
D_OIL does not Granger Cause D_INF		2.01292	0.1651
D_GDP does not Granger Cause D_OIL	36	0.51982	0.4760
D_OIL does not Granger Cause D_GDP		4.68119	0.0378
D_FEX does not Granger Cause D_OIL	36	2.57278	0.1182
D_OIL does not Granger Cause D_FEX		0.01091	0.9174
D_EXR does not Granger Cause D_OIL	38	1.43690	0.2387
D_OIL does not Granger Cause D_EXR		5.10576	0.0302
D_EPR does not Granger Cause D_OIL	36	0.33122	0.5688
D_OIL does not Granger Cause D_EPR		0.08639	0.7707
D_EIM does not Granger Cause D_OIL	36	2.07004	0.1596
D_OIL does not Granger Cause D_EIM		0.33701	0.5655
D_CA does not Granger Cause D_OIL	32	3.41730	0.0747
D_OIL does not Granger Cause D_CA		0.03723	0.8483
D_UNP does not Granger Cause D_OIL	27	2.78955	0.1079
D_OIL does not Granger Cause D_UNP		0.01415	0.9063

Table 9: United Kingdom

Pairwise Granger Causality Tests
Date: 05/30/10 Time: 17:51
Sample: 1970 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
D_EIM does not Granger Cause D_OIL	36	1.22437	0.2765
D_OIL does not Granger Cause D_EIM		0.51367	0.4786
D_EPR does not Granger Cause D_OIL	36	0.24733	0.6223
D_OIL does not Granger Cause D_EPR		0.02322	0.8798
D_EXR does not Granger Cause D_OIL	38	16.4154	0.0003
D_OIL does not Granger Cause D_EXR		0.26422	0.6105
D_FEX does not Granger Cause D_OIL	37	1.69311	0.2019
D_OIL does not Granger Cause D_FEX		1.02926	0.3175
CA does not Granger Cause D_OIL	37	3.35172	0.0759
D_OIL does not Granger Cause CA		1.80758	0.1877

GDP does not Granger Cause D_OIL	37	4.43197	0.0427
D_OIL does not Granger Cause GDP		9.24086	0.0045
INF does not Granger Cause D_OIL	37	1.01311	0.3213
D_OIL does not Granger Cause INF		2.32628	0.1365
INT does not Granger Cause D_OIL	37	0.40838	0.5271
D_OIL does not Granger Cause INT		0.90081	0.3493
UNP does not Granger Cause D_OIL	25	11.3154	0.0028
D_OIL does not Granger Cause UNP		0.03331	0.8569

Table 10: United States of America

Pairwise Granger Causality Tests
Date: 05/30/10 Time: 18:41
Sample: 1970 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
D_INT does not Granger Cause D_OIL	36	0.28455	0.5973
D_OIL does not Granger Cause D_INT		2.22894	0.1449
D_FEX does not Granger Cause D_OIL	37	4.17582	0.0488
D_OIL does not Granger Cause D_FEX		7.15181	0.0114
D_EPR does not Granger Cause D_OIL	36	0.00488	0.9447
D_OIL does not Granger Cause D_EPR		0.12609	0.7248
D_EIM does not Granger Cause D_OIL	36	1.67260	0.2049
D_OIL does not Granger Cause D_EIM		4.83331	0.0350
D_CA does not Granger Cause D_OIL	37	0.38408	0.5396
D_OIL does not Granger Cause D_CA		2.61211	0.1153
D_UNP does not Granger Cause D_OIL	27	0.01661	0.8985
D_OIL does not Granger Cause D_UNP		2.74279	0.1107
DD_M2 does not Granger Cause D_OIL	36	4.78903	0.0358
D_OIL does not Granger Cause DD_M2		2.36370	0.1337
GDP does not Granger Cause D_OIL	37	1.37508	0.2491
D_OIL does not Granger Cause GDP		1.78062	0.1909
INF does not Granger Cause D_OIL	37	0.78422	0.3821
D_OIL does not Granger Cause INF		0.74786	0.3932

Table 11: Japan

Pairwise Granger Causality Tests
Date: 05/30/10 Time: 23:06
Sample: 1970 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
D_M2 does not Granger Cause D_OIL	37	0.32377	0.5731
D_OIL does not Granger Cause D_M2		3.35885	0.0756
D_INT does not Granger Cause D_OIL	36	0.40012	0.5314
D_OIL does not Granger Cause D_INT		0.43595	0.5137
D_EPR does not Granger Cause D_OIL	36	2.74945	0.1068
D_OIL does not Granger Cause D_EPR		0.04943	0.8254
CA does not Granger Cause D_OIL	31	3.64266	0.0666
D_OIL does not Granger Cause CA		0.14203	0.7091
D_EIM does not Granger Cause D_OIL	36	3.74183	0.0617
D_OIL does not Granger Cause D_EIM		0.50073	0.4841
D_UNP does not Granger Cause D_OIL	27	0.18890	0.6677
D_OIL does not Granger Cause D_UNP		1.59429	0.2188
EXR does not Granger Cause D_OIL	38	5.6E-05	0.9941
D_OIL does not Granger Cause EXR		1.06260	0.3097
FEX does not Granger Cause D_OIL	37	0.01435	0.9054
D_OIL does not Granger Cause FEX		0.22369	0.6393
GDP does not Granger Cause D_OIL	37	0.00667	0.9354
D_OIL does not Granger Cause GDP		0.00123	0.9722
INF does not Granger Cause D_OIL	37	0.02046	0.8871
D_OIL does not Granger Cause INF		0.09638	0.7581

Table 12: Mexico

Pairwise Granger Causality Tests
Date: 05/31/10 Time: 15:09
Sample: 1970 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
D_UNP does not Granger Cause D_OIL	16	0.56330	0.4663
D_OIL does not Granger Cause D_UNP		0.19577	0.6654
DD_EIM does not Granger Cause D_OIL	34	0.09165	0.7641

D_OIL does not Granger Cause DD_EIM		0.55437	0.4621
DD_EPR does not Granger Cause D_OIL	34	1.02413	0.3194
D_OIL does not Granger Cause DD_EPR		0.90733	0.3482
D_CA does not Granger Cause D_OIL	28	0.49383	0.4887
D_OIL does not Granger Cause D_CA		3.15229	0.0880
D_EXR does not Granger Cause D_OIL	38	0.66674	0.4197
D_OIL does not Granger Cause D_EXR		0.32246	0.5738
D_FEX does not Granger Cause D_OIL	37	3.03568	0.0905
D_OIL does not Granger Cause D_FEX		3.17911	0.0835
D_INF does not Granger Cause D_OIL	37	0.12000	0.7312
D_OIL does not Granger Cause D_INF		1.13974	0.2932
D_INT does not Granger Cause D_OIL	14	0.77053	0.3988
D_OIL does not Granger Cause D_INT		0.51408	0.4883
D_M2 does not Granger Cause D_OIL	37	2.14056	0.1526
D_OIL does not Granger Cause D_M2		0.30539	0.5841
GDP does not Granger Cause D_OIL	37	0.05517	0.8157
D_OIL does not Granger Cause GDP		4.41938	0.0430

Table 13: China

Pairwise Granger Causality Tests
Date: 05/31/10 Time: 16:19
Sample: 1970 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
DD_EPR does not Granger Cause D_OIL	34	0.36522	0.5500
D_OIL does not Granger Cause DD_EPR		0.66875	0.4197
DD_CA does not Granger Cause D_OIL	24	0.32470	0.5748
D_OIL does not Granger Cause DD_CA		1.12990	0.2999
D_EXR does not Granger Cause D_OIL	38	0.04205	0.8387
D_OIL does not Granger Cause D_EXR		4.18997	0.0482
D_M2 does not Granger Cause D_OIL	30	3.88413	0.0591
D_OIL does not Granger Cause D_M2		0.26899	0.6082
EIM does not Granger Cause D_OIL	36	3.06818	0.0891
D_OIL does not Granger Cause EIM		0.09017	0.7658
FEX does not Granger Cause D_OIL	24	12.3918	0.0020
D_OIL does not Granger Cause FEX		0.01597	0.9006
GDP does not Granger Cause D_OIL	37	0.00043	0.9836

D_OIL does not Granger Cause GDP		2.09727	0.1567
INF does not Granger Cause D_OIL	21	0.00241	0.9614
D_OIL does not Granger Cause INF		0.57055	0.4598
INT does not Granger Cause D_OIL	28	0.00070	0.9791
D_OIL does not Granger Cause INT		0.24578	0.6244
UNP does not Granger Cause D_OIL	28	1.47365	0.2361
D_OIL does not Granger Cause UNP		2.27701	0.1438

Table 14: India

Pairwise Granger Causality Tests
Date: 05/31/10 Time: 17:18
Sample: 1970 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
D_FEX does not Granger Cause D_OIL	37	0.30062	0.5871
D_OIL does not Granger Cause D_FEX		0.18264	0.6718
D_EXR does not Granger Cause D_OIL	38	7.90458	0.0080
D_OIL does not Granger Cause D_EXR		0.17228	0.6806
D_EPR does not Granger Cause D_OIL	35	0.40646	0.5283
D_OIL does not Granger Cause D_EPR		1.57973	0.2179
D_EIM does not Granger Cause D_OIL	35	1.34832	0.2542
D_OIL does not Granger Cause D_EIM		2.59939	0.1167
D_CA does not Granger Cause D_OIL	32	0.17265	0.6808
D_OIL does not Granger Cause D_CA		0.36943	0.5480
GDP does not Granger Cause D_OIL	37	0.00706	0.9335
D_OIL does not Granger Cause GDP		2.08468	0.1579
INF does not Granger Cause D_OIL	37	0.18592	0.6691
D_OIL does not Granger Cause INF		0.11327	0.7385
INT does not Granger Cause D_OIL	30	0.03117	0.8612
D_OIL does not Granger Cause INT		1.94305	0.1747

Table 15: Russia

Pairwise Granger Causality Tests
Date: 06/01/10 Time: 11:56
Sample: 1970 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.

DD_M2 does not Granger Cause D_OIL	13	7.40606	0.0215
D_OIL does not Granger Cause DD_M2		1.32765	0.2760
D_UNP does not Granger Cause D_OIL	15	0.18588	0.6740
D_OIL does not Granger Cause D_UNP		1.59028	0.2313
D_GDP does not Granger Cause D_OIL	17	0.00583	0.9402
D_OIL does not Granger Cause D_GDP		0.00355	0.9534
D_FEX does not Granger Cause D_OIL	11	0.15040	0.7083
D_OIL does not Granger Cause D_FEX		0.38858	0.5504
D_EXR does not Granger Cause D_OIL	15	0.12423	0.7306
D_OIL does not Granger Cause D_EXR		0.66822	0.4296
D_EIM does not Granger Cause D_OIL	16	1.36032	0.2644
D_OIL does not Granger Cause D_EIM		0.80514	0.3859
D_CA does not Granger Cause D_OIL	13	0.32153	0.5832
D_OIL does not Granger Cause D_CA		0.32608	0.5806
EPR does not Granger Cause D_OIL	17	0.01346	0.9093
D_OIL does not Granger Cause EPR		3.36337	0.0880
INF does not Granger Cause D_OIL	15	0.34498	0.5679
D_OIL does not Granger Cause INF		3.23916	0.0971
INT does not Granger Cause D_OIL	13	0.86613	0.3739
D_OIL does not Granger Cause INT		0.56173	0.4708

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