



ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΩΣ

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The interconnection between 2000s energy crisis and the global financial crisis. The role of NOCs and IOCs as part of the global recession

By

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Declaration

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List Of Figures

- Figure 1: Prices of crude oil between 1861 and 2010. Prices not corrected for inflation
- Figure 2: Global oil production between 1965 and 2010
- Figure 3: Crude oil prices in terms of US\$ 1946-2020
- Figure 4: Oil production after the first Persian Gulf War
- Figure 5: The general causes of energy problems in developing countries
- Figure 6: Non-OECD liquid fuels consumption and GDP between 2001-2018
- Figure 7: OPEC spare production capacity and WTI crude oil prices from 2003-2018
- Figure 8: Oil Prices and Exchange Rates from 2002 to 2008
- Figure 9: World Crude Oil prices from 1999 to 2017
- Figure 10: The evolution of the Chinese economy
- Figure 11: NOCs and IOCs global hydrocarbon reserves
- Figure 12: NOCs contribution to governments budget
- Figure 13: Trends of NOCs role and influence
- Figure 14: IOC and NOC reserves and geographic reach
- Figure 15: NOC's various operational models
- Figure 16: Global upstream oil and gas capital expenditures by firm type
- Figure 17: Global upstream oil and gas capital expenditures
- Figure 18: Annual inflation rate and IEA Upstream Investment Cost Index
- Figure 19: Annual rise in oil output according to company type
- Figure 20: Super-majors' net income compared to the average IEA crude oil import price
- Figure 21: Share Price Performance (October 2002 index = 100)
- Figure 22: Strategies for resolving the energy issue in emerging nations

List Of Tables

Table 1: Summary of significant postwar events

Table 2: Regression results between 2006-2014

Table 3: List of NOCs in chronological order

Table 4: Comparison of IOCs and NOCs

Table 5: Emerging Major Oil Company Types

Table 6: Investment plans for 50 of the world's biggest oil and gas companies

Table 7: Investment in the oil and gas sector (nominal dollars)

Table of Contents

1: Introduction	8
1.1: Aim of Thesis.....	8
1.2: Methodology.....	8
1.3: The structure of Thesis.....	8
1.4: Contribution of Thesis.....	9
2: What is an energy crisis	10
2.1: Introduction.....	10
2.2: The role of oil and the meaning of oil crisis.....	10
2.3: Three main Oil Shocks.....	11
2.4: Correlation of energy crises in the 2000s and the 1970s	15
2.5: Other minor Oil Shocks.....	15
2.6: Conclusions.....	18
3: The causes that led to the 2000s energy crisis	19
3.1: Introduction.....	19
3.2: General causes of energy problems.....	19
3.3: Causes leading to 2000s energy crisis.....	21
3.4: End of Crisis and the Great Recession.....	28
3.5: Conclusions.....	29
4: The effects of energy crisis on global economy	30
4.1: Introduction.....	30
4.2: Common effects of an oil price rises.....	30
4.3: The effects of 2000's energy crisis.....	31
4.4: Country case study of the 2000s oil crisis.....	32
4.5: Conclusions.....	36
5: The role of NOCs and IOCs in the 2000s energy crisis	37
5.1: Introduction.....	37
5.2: Terminology and a brief history of NOC and IOC.....	37

5.3: NOCs vs. IOCs: Differences and collaborations.....	44
5.4: Economic performance of NOCs and IOCs during the 2000s energy crisis...47	
Conclusions.....	54
6: Future Implications and Policy Recommendations.....	55
6.1: Introduction.....	55
6.2: Future Implications.....	55
6.3: Policy Recommendations.....	57
6.4: Conclusions.....	60
7: Conclusions.....	61
References.....	63

1. Introduction

1.1 Aim of Thesis

The scope of this dissertation is to analyze the connection of 2000s energy crisis with the global financial crisis of 2008. Also, it will examine the role of National Oil Companies (NOCs) and International Oil Companies (IOCs) as far as the global recession is concerned. In order to get a comprehensive evaluation of the above relation, firstly, there will be a historical background review of the most important energy crises until nowadays, with the intension to underline the basic characteristics of each oil crisis. Particularly, the analysis will be focused on the main causes that led to the 2000s energy crisis and its effects on global economy during that time. Furthermore, the research will examine how the NOCs and IOCs affected the turbulent oil market in the mid-2000s, by reviewing the movements of some major key players of the oil sector.

1.2 Methodology

In order to accomplish this thesis and to achieve the stated objective, it is followed the methodology of literature review and research from scientific articles related to the interconnection of 2000s energy crisis and the financial crisis. In addition, the current thesis is going to be elaborated under the prism of International Macroeconomic Theory, following by the geopolitical analysis among nations as well as the international relations.

1.3 The structure of Thesis

The structure of this thesis is consisted of 7 chapters. The first Chapter studies the aim, the methodology, the structure and the contribution of the thesis. In the second Chapter it is presented the meaning of an energy crisis by examining the three main oil crises. A reference is also made regarding the correlation between 2000s and 1970s energy crises and some other minor energy crises that affected the world oil industry. The third Chapter examines the general causes of energy problems, the major reasons that led to the 2000s energy crisis and its connection with the Great Recession. In the fourth Chapter, we refer to the effects of an energy crisis on global economy and the macroeconomic effects of oil price shocks in the 2000s by underling country cases study of the 2000s oil crisis. The fifth Chapter discusses the role of NOCs and IOCs in the 2000s energy crisis and the contribution of main key players of oil sector in the energy crisis. In the sixth Chapter, this research is going to examine the future implications of a peak oil prices to the global economy and nation's development, explore some

crucial measures to reduce oil dependency and eventually reduce the implications of an oil shock. Finally, the last Chapter includes the conclusions and an overview of the main key points of the thesis.

1.4 Contribution of Thesis

The primary purpose of this research is to contribute to the understanding of the characteristics and the effects of an energy crisis, especially the one in 2000s, through the examination of some major oil countries such as US, China, Russia and Saudi Arabia. Moreover, it will be underlined the vital importance of alternative measures in order to reduce the oil dependency and promote a more energy efficient model for the countries globally. Finally, this thesis is going to be about the analysis of macroeconomic factors regarding the economies of nations affected by the oil crises and the future implications if another oil price shock is going to happen.

2. What is an energy crisis

2.1 Introduction

In this chapter we examine what an energy crisis is by reviewing the main historical events until nowadays. Specifically, we refer to the oil shocks and the oil's growing importance since the beginning of 18th century. We examine the events and the reasons that lead to an oil price peak or decline. Furthermore, we analyze the three main oil crises that affected the world market, making a first assessment of the causes and consequences to the national economies that were involved. For deeper understanding, we examine the correlation between 2000s and 1970s energy crises. Also, it is mentioned other minor crises that led to oil prices fluctuations. The study of the oil shocks attempts to show the reasons behind it, such as political, financial, geopolitical conflicts and imbalances between the production or supply among nations. Lastly, we emphasize the crucial role of policymakers and their decisive approach as a way to handle and minimize the effects of the oil crisis.

2.2 The role of oil and the meaning of oil crisis

In the beginning of the pre-industrial civilizations, man depended on carbonaceous fuels for survival reasons. Specifically, charcoal was processed for thousands of years as a way to melt iron and copper, helping mankind to invent and create the first tools and machines. From the eighteenth and nineteenth centuries, however, coal and coke fuel became prime energy resources that powered the engine rooms of the industrial revolution in Great Britain in 1760's. Hence, the role of coal as energy source has redefined its usage as a vital energy resource in our world. The global tendency shifted from general purpose applications comprising of simple and basic tools, particularly hand-made machines, to highly technical machines. The dependency from oil has rapidly changed since the mid-1900s worldwide. In current world, an increasing number of countries rely on crude oil for economic progress. It is unrefined petroleum that occurs naturally and may be used to produce chemical products such as gasoline, diesel, and others. The supply of crude oil is limited, since it is a nonrenewable resource.

Crisis is referred as a situation that introduces specific difference between the supply and demand of a product. Correspondingly, a situation dealing with definite difference between power supply and power demand is termed as energy crisis.

Energy crisis, also, is referred as the result of narrow utilization of alternated energy sources and fossil fuel extravaganza. It is mostly caused by significant disruptions in the supply of energy resources of a country or a region. Most of the times, these interruptions are connected with the supply of national energy grids of electricity or oil refineries.

Over the past decades, our world has faced three notable energy crises, also referred as oil socks. The oil shock occurs when the price of oil suddenly and dramatically changes. There are a number of negative economic implications that might result from substantial rises in the price of oil. Volatility in the oil market is not only asymmetrical but also non-linear and this is known as directional asymmetry (Owyang, Wall and Engernann 2011, 1). In other words, rising oil prices hurt the economy, but falling oil prices frequently have little impact. Price shocks frequently exert a significant external influence on macroeconomic volatility. Higher energy prices are usually regarded to have a negative association with aggregate indices of productivity, output, price levels and employment. Recessions have often been preceded or accompanied by oil shocks (Kliesen 2001).

Such price shocks that raise the cost of oil are significant because they have the potential to impair consumption, production, and GDP output. Every rise in the price of oil reduces the amount of money that can be spent on other things, which is harmful to economic growth. Correlation, on the other hand, does not imply causality. It is found that the most useful model for forecasting GDP growth is a non-linear analysis of oil price variations. Additionally, such models are much more beneficial for positive than negative price shocks. Following a period of volatility, oil price movements are less effective in predicting GDP developments.

Numerous variables can influence the economic impact of an oil price shock. First and foremost, the magnitude of a crisis in relation to the actual oil prices as well as the duration of the shock. All of these are related with the economic and political environment worldwide. Furthermore, the role that each nation plays in terms of its reliance on oil as well as energy is crucial. Energy-related nations will be more affected by the shock and implications than those that do not rely substantially on oil.

Eventually, policymakers are the one with the responsibility of long-term responses and decision making. Responses require not only fiscal but monetary policy considerations too. Diplomatic approach and military actions have been used in the before.

2.3 Three main Oil Shocks

In the last 50 years, there were three significant oil price shocks, as well as countless minor ones. Each one of them took place in different time periods with disparate key players. The common characteristic of the three main oil crises is the oil price fluctuation globally. Furthermore, the effects of each oil sock had great impact on the economies of the involved countries, leading to short-long term national crises.

1) 1973-1974: OPEC Embargo

Egypt and Syria led an attack on Israel that began on 6th October 1973. On October 17, the members of OPEC imposed an embargo on countries that supported Israel during the Yom Kippur War, which was followed by significant cutbacks in OPEC's total oil production, around 7.5% of global output (Kilian 2008). Eventually, production was cut by 25%. The nations mostly affected were United States, Canada, the United Kingdom, the Netherlands and

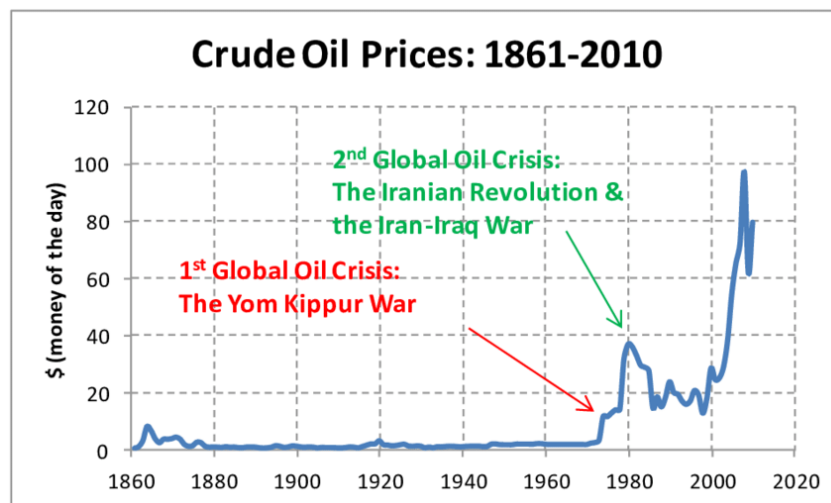
Japan but the embargo later extended to Portugal, Rhodesia (modern Zimbabwe) and South Africa. However, the affected nations did not undertake serious policy changes.

By the end of the embargo in March 1974, the price of oil had already risen about 300%, from US\$3 per barrel to US\$12 globally. The quarterly average price of a barrel of West Texas Intermediate, measured in U.S. dollars (Figure 1). The figure shows how an era of stability came to an end in 1973, generating a new age characterized by large and persistent fluctuations in the price of oil, with occasional sharp run-ups and spikes and ending with the rise of the past few years.

The economic effects of 1973's oil crisis had huge impact mostly on oil exporting nations. Price increase led the countries of Middle East, who had been dominated by the industrial powers, to take control of a vital commodity. The oil-exporting nations started to accumulate vast wealth. Also, some scientists relate the 1973 "oil price shock" and the accompanying 1973–1974 stock market crash as the first event since the Great Depression to have a persistent and dramatic effect on the United States economy (Perron P. 1988).

Price controls and rationing aggravated the crisis on US economy. As a way to reduce energy consumption and demand, US government procced to campaigns and government programs to persuade citizens for energy saving. In order to find oil supplies, many oil companies even explored rugged terrains such as the Artic.

Figure 1: Prices of crude oil between 1861 and 2010. Prices not corrected for inflation



(Source: British Petroleum Company plc, Statistical Review of World Energy 2015)

Aside from the oil price increases of 1973-1974, the specific timing, magnitude and the supply cutbacks were closely related to geopolitical events. Many scholars agree that most of the members of Organization of Arab Petroleum Exporting Countries (OAPEC) supported the use of oil as a weapon in order to influence the political outcome of the Arab–Israeli conflict. Even Saudi Arabia consented to the embargo, after the military aid of the United States to Israel.

Regarding the effectiveness of the embargo, there are many scientists who believe that it has not achieved the desired outcome (Roy Licklieder 1988), while there are also the ones who claim that the oil embargo changed the nature of policy in the West towards increased

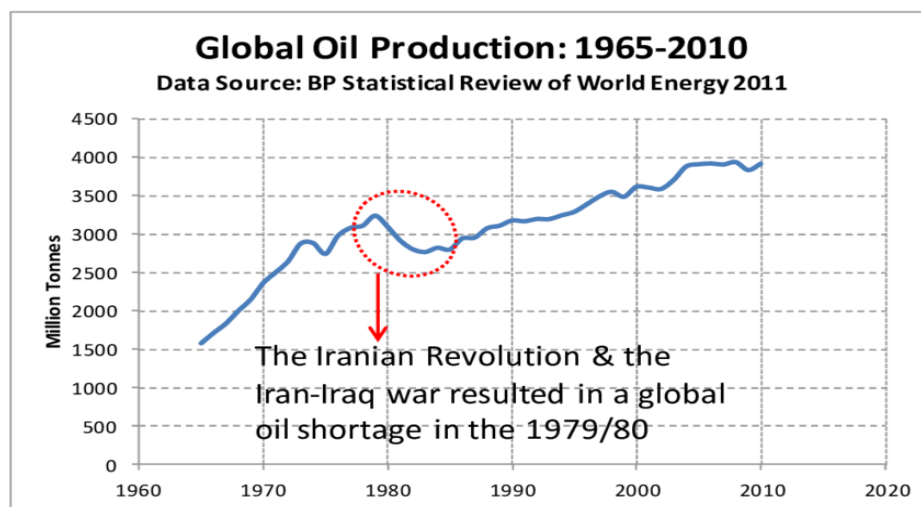
exploration, energy conservation, alternative energy research and more restrictive monetary policy as a way to fight inflation.

The embargo was lifted in March 1974 after negotiations at the Washington Oil Summit, but the severe effects continued throughout the 1970s. On 1975, the dollar price of energy increased again due to the weakening competitive position of the dollar in world markets.

2) 1978-1979: Iranian revolution

The next shock occurred in 1979, succeeding the Iranian revolution, and culminated in 1980 with Iraq's invasion of Iran. As a result, oil output in both nations declined dramatically, accounting for a 6 percent reduction in worldwide oil supply overall (Hamilton 2013, 17). The oil markets, as a way to react, raised the price of crude oil significantly over the next 12 months, reaching it to \$39.50 per barrel (Figure 1). Fuel shortages and lengthy queues at petrol stations like to those during the 1973 oil crisis were caused by this sudden price hike. Geopolitical developments in the Middle East caused the second crisis, although a rise in international demand also played a role.

Figure 2: Global oil production between 1965 and 2010



(Source: British Petroleum Company plc, Statistical Review of World Energy 2010)

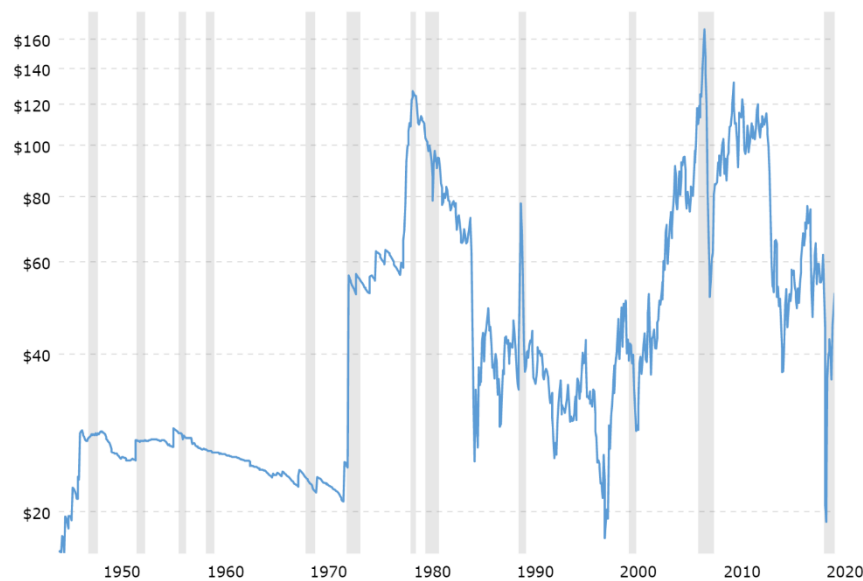
Iran, acting individually and ignoring the Arab states, had increased its oil production during the 1973-1974 embargo but faced large public protests in 1978. Amid many strikes that took place in the oil sector on 1978, Iranian oil production decreased by 4.8 mb/d (7% of world production) between October 1978 and January 1979 (Figure 2). Also, during 1979-1980, Iranian revolution had caused a drop in oil production that had led to another round of oil crisis. Correspondingly, the global shortage of oil supplies which had caused the prices of oil to more than double during that period (Figure 1). The losses from the Iranian production was covered by increases mostly from Saudi Arabia and elsewhere.

3) 2003-2008: The 2000s energy crisis

After 1980, oil prices fell steadily for the next two decades, with the exception of a brief spike in 1990 due to the Persian Gulf War. Prices began to increase again in 2003 until 2008, causing the 3rd oil price shock.

From the beginning of 21st century, there are a number of countries that have made the shift from a rural economy to an industrial one. Oil consumption is the driving force behind both urbanization and industrialisation. Emerging economies are responsible almost for 70% of the increase in global consumption. The welfare combined with the rising of living standards motivate more and more people to purchase automobiles, appliances and general items that require a lot more energy to power their households. The two emerging economies that increased drastically their oil usage in order to cover their energy needs were China and India. The 2000s energy crisis hit inflation-adjusted records for the price of oil. Oil prices varied about \$30 per barrel in 2000, but from 2003 to 2008, there was a tiny but discernible rising trend. By 11 August 2005 the prices reached \$60 and peaked at \$147.30 in July 2008 (Figure 3).

Figure 3: Crude oil prices in terms of US\$ 1946-2020



(Source: Macrotrends, crude oil price history chart)

The causes of this price hike are related to various reasons. Turmoil in the Middle East, the increasing energy demand from emerging economies, the falling value of US dollar, shocks to supply from oil exporting countries that impacted the availability of crude oil in the world market and financial speculation. The failure of Saudi Arabia production to increase between 2005-2008 in the face of booming demand for oil from the newly emerging economies was also a key reason for the dramatic increase in oil prices over that period.

2.4 Correlation of energy crises in the 2000s and the 1970s

It is widely acknowledged that the energy crisis of the 2000s is quite different from previous crises in 1973 and 1979. The primary causes of previous oil shocks were physical impediments in supply. The crises of the 1970s occurred during a crucial point. According to Kilian 2010, stagnant inflation, economic decline, and rising chronic unemployment all contributed to stagflation.

Additionally, as a result of the demise of the gold standard, other factors such as financial regulation and prices of oil emerged. The OPEC embargo restricted or even stopped oil deliveries to the nations that were targeted. As Mohan stated in 2015, this was a retaliatory move against Israel's supporters during the Israeli-Arab war. In the aftermath of the embargo, US strategy in the Middle East was truly challenged. Because of the characteristics of the supply problems, the price increase was motivated by political considerations. In the case of the 1979 oil crisis, a distinct geopolitical incident, the dispute between Iraq and Iran, caused supply restrictions.

Furthermore, the recent energy crisis cannot be linked to a single political event, in contrast to the 1970s energy crisis. The price increase was caused by a confluence of changes in supply and demand. Political events occurred, although not of the kind as the crises of 1973 and 1979, which caused supply to stall. Another distinction is that in the past, oil shocks had a greater impact on inflation and output, eventually having a negative effect on both. A plausible reason for this is that the change occurred at a considerably faster rate. Sester and Roubini (2004) stated that monetary policy measures were slow and ineffective, which resulted in rising inflation in addition to already elevated inflationary expectations. In addition, the oil shocks of the 1970s lasted longer before prices began to fall again. In 2008, however, the Great Recession quickly lowered prices.

2.5 Other minor Oil Shocks

Apart from the three notable oil price shocks, there were also several smaller ones that had a negative impact on the global oil market.

1) 1956-1957: Suez Crisis

In 1956-1957 began the Suez Crisis, when Israeli armed forces pushed into Egypt toward the Suez Canal after Egyptian president nationalized the canal, a valuable passage which fuel 2/3 of the oil used by Europe. Half million b/d that were shipped from Syria to the ports of eastern Mediterranean, through the pumping stations of the Iraq Petroleum Company's pipeline, were also sabotaged (Michael H. Coles 2006). In November 1956, the total oil production from the Middle East fell by 1.7 mb/d that represents 10.1% of total world output at the time. These events had dramatic immediate economic consequences for Europe. Notwithstanding, production from countries outside the Middle East was able to fill in much of the gap. U.S.

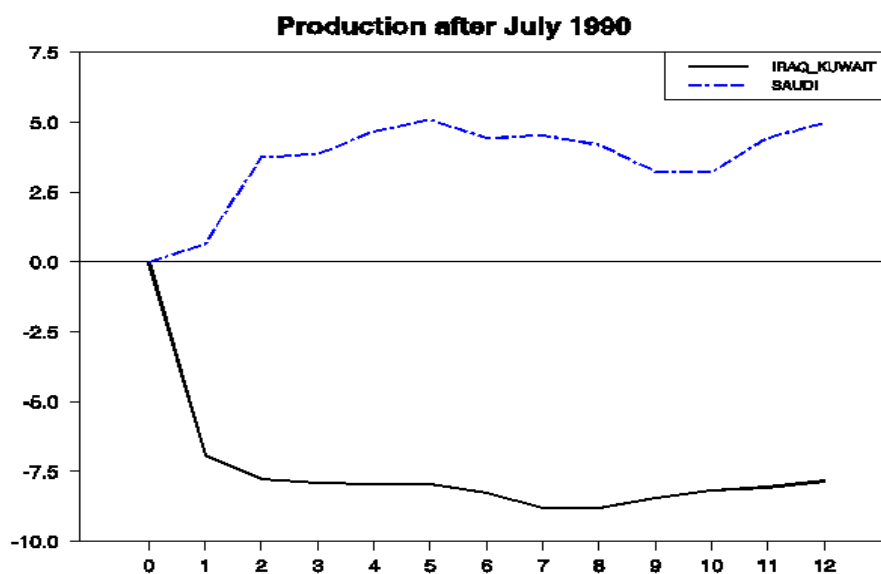
exports of crude oil and refined products covered the loss by adding a third of a million barrels a day. Oil production from Middle East had returned to its pre-crisis levels in the mid of 1957.

2) 1990-1991: Persian Gulf War

After 1980, there was a period that lasted 20 years in which prices fell. The Persian Gulf War of 1990 was only a mild shock when Iraq and Kuwait (both accounted for almost 9% of world oil production) were completely knocked out by the military conflict (black line, Figure 4). The main causes of this collision were mainly economic (Kuwait was selling great amounts of oil and it was making the prices to decline, so Iraq had not as many profits as before) and geopolitical (Iraq always thought Kuwait as part of it, which led to hostilities. Moreover, there are several oil wells along the borders of the two nations and Iraq claimed that Kuwait was illegally tapping them).

Fortunately, Saudi Arabia had considerable excess capacity, and their increased production amounted to almost 5% of global supplies (blue line, Figure 4). This was a significant factor in minimizing not only the duration but also the size of the increase in oil prices and helped in order to mitigate the economic recession of 1990-1991.

Figure 4: Oil production after the first Persian Gulf War



(Source: U.S. Energy Information Administration EIA 2017)

(Vertical axis - Percentage of total global production levels in July 1990, Horizontal axis - Number of months from July 1990)

Table 1 summarizes key features of the postwar events, some of them that were analyzed in the preceding sections.

Table 1: Summary of significant postwar events

Gasoline shortages	Price increase	Price controls	Key factors	Business cycle peak
Nov 47- Dec 47	Nov 47-Jan 48 (37%)	no (threatened)	strong demand, supply constraints	Nov 48
May 52	Jun 53 (10%)	yes	strike, controls lifted	Jul 53
Nov 56-Dec 56 (Europe)	Jan 57-Feb 57 (9%)	yes (Europe)	Suez Crisis	Aug 57
none	none	no	---	Apr 60
none	Feb 69 (7%) Nov 70 (8%)	no	strike, strong demand, supply constraints	Dec 69
Jun 73 Dec 73- Mar 74	Apr 73-Sep 73 (16%) Nov 73-Feb 74 (51%)	yes	strong demand, supply constraints, OAPEC embargo	Nov 73
May 79-Jul 79	May 79-Jan 80 (57%)	yes	Iranian revolution	Jan 80
none	Nov 80-Feb 81 (45%)	yes	Iran-Iraq War, controls lifted	Jul 81
none	Aug 90-Oct 90 (93%)	no	Gulf War I	Jul 90
none	Dec 99-Nov 00 (38%)	no	strong demand	Mar 01
none	Nov 02-Mar 03 (28%)	no	Venezuela unrest, Gulf War II	none
none	Feb 07-Jun 08 (145%)	no	strong demand, stagnant supply	Dec 07

(Source: Historical Oil Shocks, Hamilton 2011)

The first column indicates the months in which there were contemporary accounts of consumer rationing of gasoline due to shortage. The second column depicts the oil price increases of each oil shock, minor or significant. The third indicates whether price controls on crude oil or gasoline were in place at the time that the shock took place. The fourth column of Table 1 summarizes some key contributing factors in each episode. The last column reports the starting date of U.S. recessions as determined by the National Bureau of Economic Research.

2.6 Conclusions

To sum up, in this chapter we analyzed the role of coal and its importance in human's life from the pre-industrial civilizations until now. We underlined the three main oil shocks and other minor shocks that affected the prices, the production and the supply of crude oil. Furthermore, we explained the reasons for these sharp increases, as well as the consequences for the countries involved. We compared the relation between the 2000s and 1970s energy crises, concluding that there are essential differences between them. Consequently, it is clear that the oil crisis is greatly connected with geopolitical events, economic crises and political changes in a region. Apparently, the effects and the consequences of an oil crisis differ heavily from an energy-related country to one that does not heavily rely on oil or has alternative ways to cover its energy requirements.

3. The causes that led to the 2000s energy crisis

3.1 Introduction

In the beginning of this chapter, we introduce the main general factors that can lead to an energy crisis. Imbalance between demand and supply, insufficient energy infrastructure, wars, major accidents or natural calamities are some reasons that tend to create serious energy problems with many economic, social and geopolitical effects. As far as the causes that led to the 2000s energy crisis, we underline four leading reasons, particularly the upward shift of oil demand, reflecting the huge economic expansion of developing market economies such as Russia, India Brazil and China. Secondly, we analyze the stagnant production that leaves oil industry vulnerable to supply disruptions and the limited spare capacity that puts upward pressure on oil prices. In addition, the fall in the value of the dollar has had a significant impact on the rise in the price of oil in dollars. Also examined is the impact of financial speculation on global oil prices between 2003 and 2008, as well as the number of investors in crude oil futures markets.

3.2 General causes of energy problems

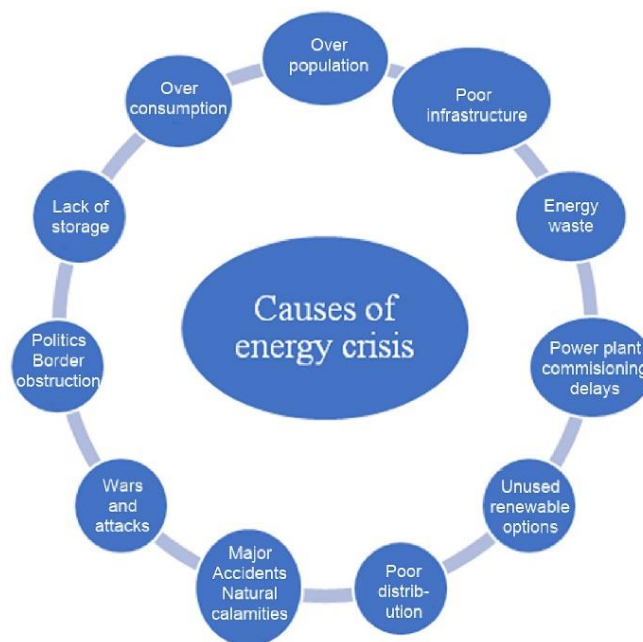
Our world has been suffering from serious energy crises, especially the last decades. It has severely affected its social, economic and political developments. The most likely explanation for the rise in oil prices is an increase in worldwide commercial activity and a stagnant supply. This imbalance between production and consumption of energy requires complex energy management solutions. Normally, prices tend to fluctuate in order to maintain the demand and supply. "In the oil market, however supply and demand are extremely slow to respond to price shifts, which means that prices can undergo big swings before a balance is restored (McNally, Levi 2011) ". Because there are no precise alternatives to oil, it is hard for consumers to respond to price changes in the short term. The oil supply, on the other hand, may not have the potential to rapidly shift (Konrad 2012). As argued by Kilian, oil's price is mostly determined by dynamic demand and supply changes (Kilian 2009, 1053). He also established an econometric model for measuring the linear interdependencies of specific variables over various time series, the structured vector autoregressive model (VAR). According to his research, the prices of industrial goods rose because of positive demand shocks.

Other general factors leading to energy crises or energy problems within a country may concern outdated and insufficient energy infrastructure, meaning that the infrastructure for power generation and transportation is ageing and it is too costly to preserve it, or transmission and distribution losses. Moreover, the occurrence of energy theft which is widespread in some countries, deficient energy management and lack of energy conservation are key elements that can lead a developing country to an energy shock. Energy may need to be stored until it is

needed. In the same time, the storage capacity has to be uninterruptedly increased to match the future demands. Additional factors worsening the energy crisis can be attributed to geographical and geopolitical problems, the heavy dependence on energy imports and inadequate exploitation of the vital amounts of renewable energy resources in many countries are still underutilized. It is notable that low efficiency of equipment, unsatisfying energy market regulations and unsustainable energy pricing strategies are also included as general causes of an energy crisis.

Undoubtedly, natural disasters and accidents such as pipeline bursts, natural calamities essentially earthquakes, floods, hurricanes and even cyber-attacks can damage the power infrastructure, sometime in the long term. Wars and civil unrests in some areas may significantly disrupt the energy supplies. The general causes of energy problems, mainly seen in developing countries, are summarized in Figure 5.

Figure 5: The general causes of energy problems in developing countries



(Source: Renewable and Sustainable Energy Reviews, Ramhari Poudyal 2019)

3.3 Causes leading to 2000s energy crisis

Hamilton argued three main causes of the oil price rise happened on 2007-2008. Firstly, the low-price elasticity of demand for oil. Second, demand from newly industrialized nations such as Brazil, Russia, India, and China increased significantly (BRIC countries). Thirdly, there was a decline in world oil output. Hamilton cited that as the global economy grew, demand

increased, and supply remained static, resulting in a price jump in 2007 and 2008. Another probable explanation is the effect of speculators on the futures market. As a general rule, people's opinions of the markets can change as a result of speculating. The increase of speculators throughout the 2000s could well have contributed to the bursting of a speculation bubble in 2008. Finally, the declining value of the US dollar has contributed significantly to the rise in oil prices.

1) Demand

One key factor contributing to the energy crisis of 2000s is the overconsumption. This is the result when the overall energy demand is increasing faster while energy is not utilized optimally and its distribution is inefficient. Supply and demand are influenced by expectations of the international business cycle and ambiguity about the unforeseen declines in levels of accessible supply. Volatility in the global economy is a major factor in demand shocks. According to IMF estimates, real gross world output expanded at a yearly average rate of 4.7% during 2004 and 2005, showing that the global economic cycle was expanding (Hamilton 2010, 21). Also, 5 mb/d (or 3% per year) was used throughout this time period. This acceleration of economic expansion is credited with being the key reason behind the oil consumption climax.

Production, on the other hand, remained stagnant after 2005. In contrast with other historical oil shocks, in case of 2000s energy crisis there was no sudden geopolitical event associated with this. The ongoing instability in some countries (Iraq, Nigeria) and the falling productivity of several oil fields (Mexico's Cantarell, North Sea) were also a contributing factor. But the most significant country that affected the oil production has been Saudi Arabia. In 2005, the kingdom represented 13% of worldwide field output. Nevertheless, Saudi oil production was approximately 850,000 barrels a day lower in 2007 than it had been in 2005.

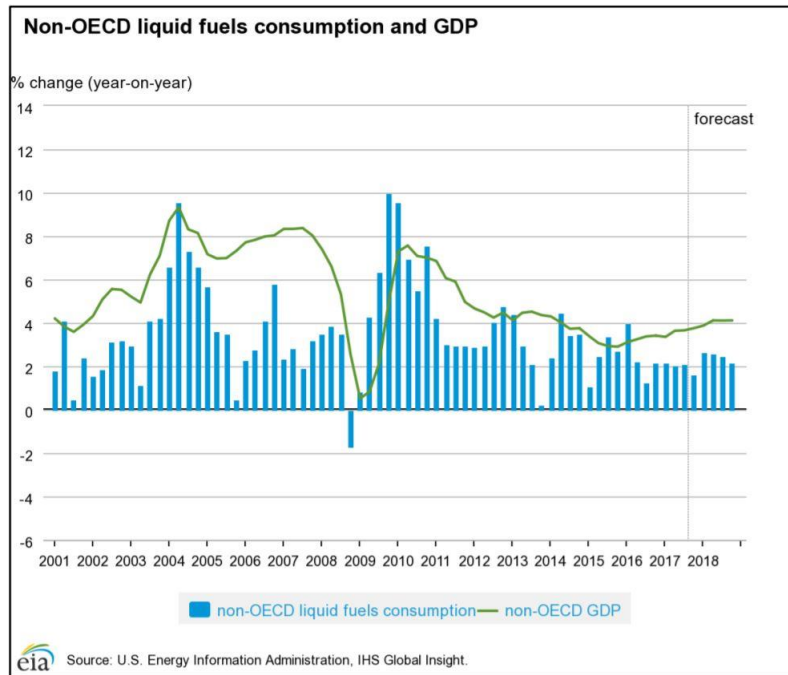
Despite this, countries throughout the world were forced to curtail their oil use since there was no more oil to be mined. Oil demand has a poor price elasticity in the near term, which means that customers react slowly to price changes. Moreover, demand is influenced by income instead of pricing in the short term (Hamilton 2009,216). If a price increase is only expected to last a short time, people are more prepared to pay more than reduce their consumption. If people's incomes don't diminish, demand won't drop if prices rise. In 2003, the rise in prices did not trigger a recession since demand was strong and the global economy was prospering.

Another aspect about the reasons that led the oil prices in 2003 comes from Kilian. The rise in oil prices was caused by an increase in demand for oil as a result of a lack of knowledge about future supply, he said. Cautionary demand shocks are caused by a change in the real price of oil due to changes in the perceived demand for oil. Uncertainty about shortages or projected oil supplies compared to demand is the source of this volatility (Kilian 2009, 1054.) In the late '00s, many believed that the supply was likely to fall as a result of a stagnant market.

Countries that aren't members of the Organization for Cooperation and Development (OECD), such as China, Saudi Arabia, and India, saw a rise in demand between 2000 and 2008. The increase in fuel consumption of non-OECD nations is seen in Figure 6 below, along with their GDP growth rates. Fuel usage has increased as a response to a rise in personal car use and

purchasing. According to the Hirsch report (World Heritage Organization), the transportation sector amounted for 55% of oil worldwide in 2006. The rise in pricing may be attributed in large part to the rise in demand for manufacturing goods as a result of increased economic activity.

Figure 6: Non-OECD liquid fuels consumption and GDP between 2001-2018



(Source: U.S. Energy Information Administration 2017)

As demand in emerging nations continues to rise, it offsets any losses in demand in wealthier countries. For the most part, the world's demand for oil grew faster than its supply, resulting in high prices (Energy Information Administration 2017). Pressure on supply was put on by an increase in demand, particularly in emerging economies. Production could not or would not keep pace with the rapid rise in demand.

2) Supply

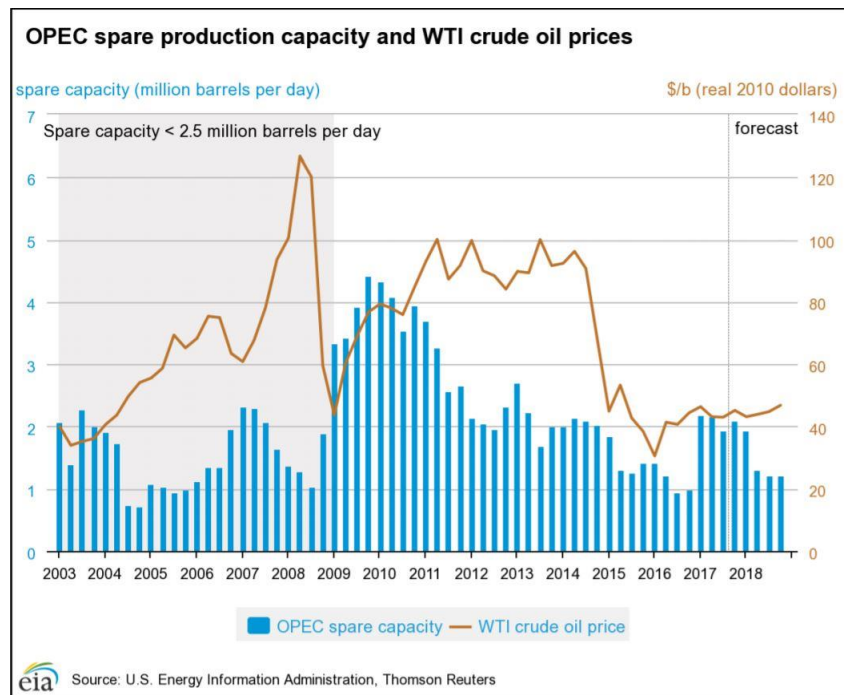
Since 2005, global oil production has been stable. This occurred despite the fact that oil prices have indeed been climbing since 2004, implying that more oil supplies were sought. The physical abundance of known oil reserves, as well as the ambiguity of estimates of future production capability, impact oil supply. Crude oil supplies are affected by supply disruptions across the world. Supply is fairly inflexible in the short term since refineries need time to modify production levels. This inelastic supply curve occurs when a change in price has no effect on the amount delivered. Due to the enormous refining of crude oil production and distribution, it is challenging for oil producing countries to modify the availability of oil. Exports will fall which will create the increase of prices to offset budget imbalances, in case demand for oil rises faster than its supply (Konrad 2012).

Historically, many geopolitical events contributed to decreases in supply. A typical example is related with the event when Venezuelan production (4th largest producer of oil) impacted oil which was taken off the market in significant quantities. PDVSA, the national oil company (NOC) of Venezuela, was forced to cease oil production during a countrywide strike in 2002-2003 as a result of workers' dissatisfaction with Chavez's policies. Invasion of Iraq by US soldiers in March 2003 sparked the Iraq War (2003-2011). Cutbacks of almost 2.2 mb/day were made between April and July 2003 as a result of the US invasion of Iraq (Smith 2009). The United States had clearly expressed interest and was apprehensive of the potential for energy instability and price fluctuations. The United States did not recognize Saddam Hussein as Iraq's president, which sparked this conflict. It cannot be ignored the strategic importance of the energy sector (oil) as a crucial cause of this war. Mexico's Cantarell field had a reduction in production, while Saudi Arabia saw a decrease in output as well (Smith 2009).

Another event that shaken the oil supply took place in 2008, when Venezuela proceed to cutbacks to ExxonMobil regarding a conflict about nationalizing the company's assets. Furthermore, in Iraq, saboteurs destroyed two huge oil export pipelines, which cut off 300,000 b/d and in Nigeria oil mine workers who supported a strike reduced the output by 780,000 b/d for ExxonMobil. Additionally, 1.36 mb/d was shut down due to military attacks and sabotages. A stagnant rise in supply and a small amount of spare capacity persisted despite all of these interruptions in supply throughout the 2003-2008 energy crisis. According to WTI crude oil prices, OPEC's spare capacity is shown in Figure 7. Typically, spare production capacity refers to the situation in which a business has the opportunity to generate more than it now does and can increase output if needed. As a result, oil exporting countries' low spare capacity limits their ability to respond to increased demand and drives up prices. It is clear that spare capacity fell in 2007 and 2008, coinciding with a spike in prices.

OPEC curtailed output for its first time in several years in 2007, causing prices to rise. Instability on the world stage and weakening economies prompted OPEC to maintain high prices. OPEC cut oil output by 1.2 million barrels per day in November 2007. Then, in February, there was another reduction, this time of about 500,000 b/d. OPEC reductions in prior years and most of the time-maintained prices high. Many people were taken aback by OPEC's decision to cut output, which was interpreted as a deliberate attempt to keep oil prices over \$60 per barrel (Farivar 2007).

Figure 7: OPEC spare production capacity and WTI crude oil prices from 2003-2018



(Source: U.S. Energy Information Administration 2018)

In general, oil consumption in Western countries reflects income growth of roughly 3%, but in emerging countries such as India and China, whose income growth is over 10%, consumption of oil has climbed significantly faster. As a result, supply has fallen behind rising demand from developing market countries. Oil prices inevitably began to climb in response to the supply-demand mismatch.

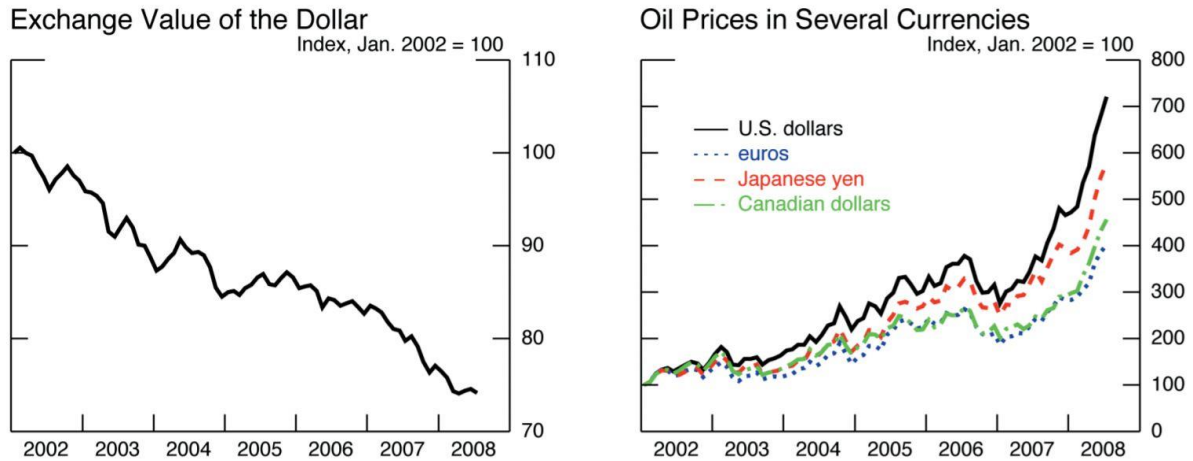
3) Decline in the value of U.S. Dollar

The relationship between exchange rates and oil prices is quite complex and the causality can run both from exchange rates to oil prices and from oil prices to exchange rates. During 2003–2008, oil prices increased significantly. Initially, many researchers attributed these price spikes not only to the rise in global demand, but also to disruptions in the supply of oil. The price increases were so substantial nonetheless, so additional factors are needed to explain these dramatic changes. The falling U.S. dollar, measured both by increases of gold prices and the appreciation of the Euro, disrupted the international finance system and played a decisive role as oil suppliers demanded compensation for the declining value of the dollar.

The available empirical studies suggest that oil prices respond almost proportionately to changes in the dollar when all other economic factors are held constant. In other words, a 10 percent depreciation of the nominal, trade-weighted, multilateral exchange value of the dollar is associated with a 10 percent rise in the dollar price of oil when other factors are held constant. This point is also evident in Figure 8, which graphs the spot price of West Texas Intermediate crude oil in several currencies. Apparently, oil prices have risen sharply regardless of the

currency of denomination. Moreover, from mid-March until June 2008, while the dollar was stable, the oil prices increased remarkably.

Figure 8: Oil Prices and Exchange Rates from 2002 to 2008



(Source: Federal Reserve Board. The measure of the dollar is the broad nominal index and the oil price is the spot West Texas Intermediate crude oil)

Oil as product, is traded globally in U.S. dollars because it is the reserve currency. The price of oil is affecting and is being affected by its exchange rate. The fluctuations of dollar influence some products that are linked with it. As the dollar weakens, prices of oil surge, which is exacerbated by the fact that the United States imports a considerable amount of oil (Figure 8). According to Holodny (2014), the United States imported a net 12 million barrels per day in 2008. On the other hand, if the dollars' worth increases, the real dollar prices of globally traded commodities such as oil and gold decline since fewer dollars are required to acquire them.

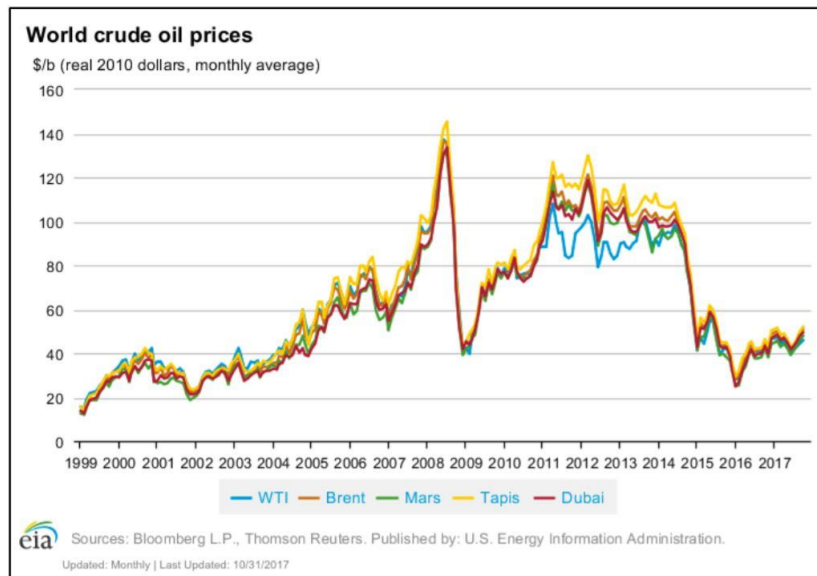
A further link between exchange rates and oil prices is established by the production schedules of major oil exporters. When the value of the dollar depreciates, oil exporters' income loses purchasing power. To protect their purchasing power on the international market, producers might seek an offset rise in the dollar price of oil by reducing supply. The United States dollar was still in its lowest point in 2006. The currency exchange rate was 1 € to 1.6 \$ per unit. Oil prices as well as the dollar's value have a fairly steady relationship. OPEC determines the price of oil in U.S. dollars based on many variables such as the growth of the global economy, world demand and supply and the strength of the U.S. dollar as in terms of other currencies, among them the Euro. Then, OPEC applies the appropriate global supply to the extent that it can to set a stable price. Devaluation also interrupts supply and demand worldwide. Eventually, oil-exporting countries' buying power has declined. As a result of the weakening dollar, oil companies have to raise their prices. More than half of the \$97/barrel rise occurred between 2003 and 2008 as a result of the depreciating value of the dollar (Hanke 2008). A drop in the value of the dollar has lowered the value of US assets as well as decreased central banks' foreign exchange reserves. Also, U.S. expansionary monetary policy led to low interest rates and high inflation. The government and the US Central Bank took no action to restore the dollar's value.

4) Speculation – Futures Market

It is well known that the magnitude and duration of a price shock can hardly be explained only through demand and supply research. Several claims have been made implicating financial speculation as a major cause of the oil price increases. On 2008, the U.S. Senate committee indicated that institutional investors are responsible for the demand shock, which had increased by 848 million barrels over the previous years, almost similar with the increased physical demand from China, accounting 920 million barrels. The same year, Evans-Pritchard Ambrose, the transport chief for Germany's Social Democrats, argued that 25 percent of the rise to \$135 a barrel had nothing to do with underlying supply and demand. Furthermore, Lehman Brothers suggested that price increases were related to increases in exposure to commodities by such investors. From 2003 until mid-2008, more and more financial investors chose to enter to the futures market and at the same time, spot and futures prices also increased. The gap between the spot and futures markets reveals the global oil market's current position which could be used to forecast future prices. In 2008, Masters Capital Management released a report for the oil market, concluding that speculation had considerably impact to oil price. The study stated that over \$60 billion was invested in oil industry during the first six months of 2008, leading prices from \$95 to \$147 per barrel. By the beginning of September, speculators had withdrawn \$39 billion, causing prices to fall.

Participants in the futures market agree to purchase or sell a particular number of barrels of oil each day at a certain price at a future date (future contracts). It is true that speculators are not buying any actual crude. When the contracts mature, they either settle them with a cash payment or sell them on to genuine consumers. Investors aim for profit. They place a wager on a certain price and reap the rewards if they are accurate. However, speculating may also be defined as "the act of acquiring a thing today with the intention of later selling it for a profit." Oil futures contracts rely on two primary benchmarks for oil futures. To begin, the benchmark for North American oil is West Texas Intermediate (WTI), which is traded on the New York Mercantile Exchange (NYMEX). On the other hand, the Brent benchmark is used across Africa, Europe, and the Middle East and is traded on the Intercontinental Exchange (ICE). The one-month product, which is the closest futures term, accounts for the majority of activity. Figure 9 displays growing global crude oil prices as measured by main benchmarks.

Figure 9: World Crude Oil prices from 1999 to 2017



(Source: U.S. Energy Information Administration 2017)

There was a consistent increasing trend from 2003-2008 that dropped somewhat in 2006-2007 before immediately changing and peaking in 2008. Speculative price bubble, according to Hamilton, was caused by an excess of futures contract purchasers over the sales of expiring contracts (Hamilton 2009, 234). The premise was widely accepted by policymakers as a viable explanation and remedy to the issue of high oil prices. All they'd have to do is keep tabs on oil futures trading. Oil prices have been inflated by speculation and a weak dollar, according to OPEC, which has repeatedly said that the market is sufficiently supplied and also that high prices are the product of speculation.

A convincing case can't be made that speculation-futures markets pushed up oil prices between 2003 and 2008. As a starting point, speculators were unable to foresee the direction in which prices would go. In the beginning of 2007, some projected a decline, whereas others forecasted a rise (Mouawad 2007). Using VAR models, Kilian argued that speculation is based on common economic fundamentals, and that it has little impact on oil prices (Kilian 2009). As part of its investigation into the alleged impact of speculators on the petroleum market, the United States government set up an interagency task group on commodities markets.

The United States government established the Interagency Task Force on Commodity Markets to investigate reports of speculators' impact on the oil market. The conclusion of this survey resulted that "market fundamentals" such as supply and demand provided the best explanations for oil price increases and that increased speculation was not directly related with the increases.

In addition, the report also underlined that increased prices with an elastic supply would cause increases in petroleum inventories. As inventories actually declined, the task force noted that market pressures were mainly to blame. Over the same time period, other commodities that were not subject to market speculation, such as coal and steel, had similar price increases.

Finally, these new demand and supply realities have contributed to an increased interest to participate in futures markets of oil sector. Various players, such as investors or commercial entities, seeking to avoid exposure to fluctuations in the prices of crude oil, will buy or sell so as to establish hedges. Moreover, some participants perceive holding long crude oil futures positions as protection from further declines in the value of dollar while others utilize futures positions to mitigate risk from their other portfolio holdings.

People don't agree on what speculating is or why it's damaging to the economy, and there's no precise definition of it. The oil futures market's function has altered, but conjecture about how oil prices will move remains an open topic.

3.4 End of Crisis and the Great Recession

The 2008 financial crisis and the subsequent Great Recession had a detrimental influence on the oil sector, since they resulted in a sharp decrease in oil prices and credit contraction. Expectations of a severe recession resulted in a decline in oil usage. The financial crisis also led to tight credit conditions that resulted in many producers paying high interest rates when raising capital, resulted in crimping their future earnings. The recession led to a general drop in asset prices in the world as credit contracted and earnings projections fell. At the same time, rising unemployment and lower spending led to less demand for oil by both consumers and businesses as well as the price of a barrel of crude oil fell from \$147 to \$32 in just 5 months. OPEC answered by reducing output in order to maintain price stability.

Several studies supported that important rise in oil price in 2008 contributed to the great recession that occurred between 2008–2009. However, there are researches provided evidence that the adverse effects of oil price change on global output that occurred in the 1970s is no longer present. Hamilton (2009) stated that a link existed between the financial crisis and the rise in oil prices. He argued that the increase in oil prices preceded nine out of ten post-1945 recessions in the United States. Monandjemi (2017) argued that if there had been no increase in the price of oil between 2007 and 2008, the Great Recession may not have occurred.

Contrary to popular belief, there are others who believe that the financial crisis and the rise in oil prices were two separate events. Kilian (2009) no longer saw the impact of oil prices on the world economy that justified output decreases in the 1970s oil crises. Monandjemi (2017) substantiated that allegation, stating that while oil prices may have influenced global rates of growth in the past, this was not the case during the 2000s energy crisis.

Table 2 shows that oil price changes (in parenthesis) have positive coefficients and have no effect on production. This shows that global output hasn't been much affected by oil price changes in recent years.

Table 2: Regression results between 2006-2014

Dependent Variable	Constant	Real interest rate	% change in real oil price
World growth rate	-5.69	0.84 (3.08)	0.18 (0.64)
OECD growth rate	-7.07	0.80 (1.15)	0.23 (0.32)
US growth rate	8.84	-0.02 (-1.82)	0.23 (4.07)

(Source: Oil Price Rise and the Great Recession of 2008, Monandjemi 2018)

According to the findings, oil prices no longer have the same macroeconomic impact that they formerly did. Furthermore, these findings indicate that the Great Recession of 2008, which was triggered by the financial crisis, happened irrespective of a major spike in oil prices, implying that the financial crisis and oil price hikes happened separately from each other (Monadjemi 2017).

3.5 Conclusions

The review of the causes that appear to have a significant impact on oil prices, showed us that an energy crisis is the result of many different factors. From the examination of all the above causes resulting to the 2008 oil price shock, we reasoned that there are two main factors with the largest share of responsibility, the overconsumption from the emerging economies and the stagnating oil supply. As a result, oil prices have gone up in order to maintain global oil demand in line with supply. While some assumed that speculation had a larger part in the 2000s energy crisis, it doesn't really appear that speculation was a key cause of the price increases. Yet, the effects of the US dollar's drop, as measured by the strengthening of the Euro and gold prices, should not be overlooked, since it played a significant role since oil suppliers wanted reimbursement for the dollar's declining value.

4. The effects of energy crisis on global economy

4.1 Introduction

In this part, we will examine the global economic repercussions of an energy crisis, focusing on the macroeconomic impact of oil price disruptions in the 2000s. In addition, we will refer to the most typical and prevailing characteristics of an oil price augmentation according to Hamilton, such as the rising cost of oil production, the reduction in consumption, the negative consequences in exchange rates and local currency. We will underline the major effects of the 2000's energy crisis in relation with some indexes, essentially the unemployment, GDP and inflation. Finally, we examine the most major oil importing and exporting countries and their performance during 2003-2008 oil shock, as prices fluctuations affected each economy differently depending on the extent to which each country relies on oil.

4.2 Common effects of an oil price rises

A frequent impact of rising oil prices is that it significantly raises the costs of production, primarily in oil-importing nations. As a result, output will be negatively affected, resulting in a change in the aggregate demand curve. Also, consumption will most likely decrease due to higher prices spent on oil.

Hamilton argued that because short-term demand for oil is very much inelastic, any drop in use would be minimal (Hamilton 2013, 28.) Only if price rises are seen to be long-term will consumption and investment fall dramatically. Prices for commodities linked to oil will rise, potentially increasing inflation. Inflationary pressures put a lot of pressure on central banks to alter their monetary policy and increase interest rates in order to lower inflation. Budget deficits increase while tax revenues decrease.

Another effect is related on exchange rates and trade. The oil consumption does not change much in short-term. If demand is inelastic, expenditures on imports must grow to meet it. Furthermore, this has an influence on the exchange rate and devalues the country's currency, resulting in severe economic consequences. Hamilton on 2009 argued that “depreciation of currencies raises prices of imports due to rising exchange rates”. Oil prices have an influence on several businesses that rely on it, particularly the aviation and trucking industries. People's expenditure on automobiles in the U. S. has fallen, particularly on bigger vehicles. As a result, capital and manpower that contribute to automotive manufacture and sales suffer. Hamilton linked the reduction in automotive sales to growing oil costs or income declines. (Hamilton, 2009, 28). Generally, oil shocks impact each country in various and different ways. The oil price shocks produce winners and losers. Countries that heavily rely on oil imports or are

energy intensive will react when oil prices increase. On the other hand, rising oil prices help most oil-producing countries by bringing in more tax money.

4.3 The effects of 2000's energy crisis

The general effects of the 2000's energy crisis was quite different and with less harmful consequences to the oil market than the previous oil shocks. High economic activity worldwide paired with a sharp augmentation in demand, drove many countries to financial prosperity and high inflation.

In 2008, when the recession hit, the economic activity started to fall. A main general effect was that the rising of oil prices also influenced the prices of commodities coming from petroleum products and reduced dramatically the demand of certain products or services due to insufficient wealth from consumer side. Furthermore heating, manufacturing and transportation costs increased, leading to many economic and social problems. The macroeconomic impacts of oil on the supply and demand for other items (directly or indirectly) do not appear to have a significant impact on economic growth.

Between 2003 and 2008, the oil price shock altered popular perceptions of oil prices possessing a detrimental effect on economic development, as it did not have a positive relationship with unemployment and inflation. Moreover, according to the viewpoint of Arezki et al. on 2015, "the rising oil prices did not coincide with a decrease in real GDP growth". He has also stated that via many econometric structural models, it is proven that the relation between oil prices and GDP has declined over time. In the beginning of 21st century, economies of many countries showed their strength and performance due to the fact that even if oil prices started to increase, consumers could afford it. There are various explanations for this fact. To begin, our world is far more ecofriendly than it was previously, and prices of energy no longer have a significant impact on consumers, as they once did. Secondly, increased flexibility in labor markets and improved monetary policy strengthened the national economies and provided them reliability. As a result, the global community had shifted dramatically, and the changes in oil prices were less severe (Federal Reserve Bank of San Francisco 2007). Previous oil crises may have had more adverse consequences to the economies because of other financial factors.

4.4 Country case study of the 2000s oil crisis

Volatility in oil prices has a varying impact on different nations, based on their economic performance and structure, the energy mix, and, most importantly, their reliance on oil imports or exports. As a result, governments seek to respond with regulations that are consistent with their economic, political, and social interests. It is clear that oil importing countries will not benefit in case of an augmentation in oil prices, as their GDP does not depend on oil and vice versa. Additionally, oil-importing nations are in a loss-making situation with many losses when the price of oil rises, since it affects the national economy by increasing the cost of inputs while decreasing production.

Policymakers of oil-exporting countries have to overcome the oil prices fluctuations nonetheless. In 2007, forecasters anticipated that the spike in oil prices would create a long-range problem globally. If oil prices had remained stable following 2008, the repercussions of the oil crisis would have been other. As the world's largest oil producers and consumers, the United States, China, Russia, and Saudi Arabia (OPEC's leader) all exert influence on the global oil market.

1) The United States

USA is a country that is greatly depends on oil producing but at the same time it also depends on oil imports. As a result, U.S. economy is vulnerable to oil price changes. Despite the fact that price shocks are a significant factor in recessions, oil shocks seldom cause recessions. However, in the last decades, oil price shocks led to U.S. recessions. The United States' primary fears were that a significant spike in oil prices would be detrimental to its finances and that political unrest in the Middle East would result in a loss in oil supplies.

During the Bush Administration, energy security and U.S. energy independence were on the top of the political list. In 2005 particularly, due to the growing unrest for reasons related to high oil prices and energy security, the U.S. government passed the Energy Policy Act which included certain incentives in order to increase the alternative ways of transportation fuel and even new investments for domestic oil exploration. Furthermore, in 2007 the Energy Independence and Security Act (originally named the Clean Energy Act) was passed aiming to:

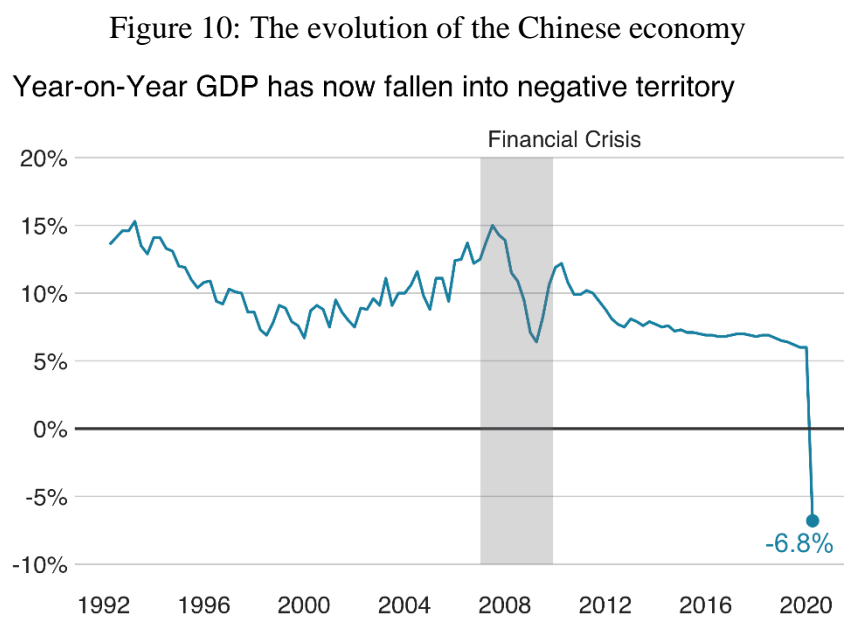
- boost the production of clean renewable fuels
- drive the United States into energy independence and security
- enhance the efficiency of buildings, vehicles and other products
- protect consumers
- promote research and investments in order to deploy greenhouse gas capture and storage options
- upgrade the energy performance of the Federal Government and
- expand renewable fuel production, increase vehicle fuel economy and also promote U.S. energy security.

Moreover, the Bush Administration continued to push OPEC to produce even more oil with the purpose of cutting the prices. Under these circumstances, OPEC responded that at the first place, the U.S. had to fix their financial issues within the country, indicating the weak dollar. Without a doubt, the rise of oil prices damaged the U.S. economy and led the consumers to lose a part of their purchasing power. Notwithstanding, OPEC declined the request of Bush and eventually the Saudi Arabia stated that the only case that nation would increase the levels of production is when the markets justify it.

The discovery of shale gas, a natural gas that is notably found trapped within shale formations, changed the U.S. oil production. The shale revolution gave the chance to U.S. to obtain greater amounts of oil and practically to grow its oil and gas industry. Hence, the augmentation of oil prices generated the boost of employment in the oil and gas business. The expectation of increased long-term oil supply from shale basins aided in balancing the negative impacts of the U.S. oil price increase and finally launching a new era of US energy production. In consequence of this unexpected upstream, U.S. crude oil production expanded even more and now U.S. is an exporter of light crude oils produced from shales.

2) China

During the last decades, China’s energy demand has grown continuously and has already become a significant energy user. Since the beginning of 90’s, the economy of China has grown with huge steps and is only recently it started to slowing down. The industrial sector of the country led to social welfare and most of the people increased their economic status. Moreover, oil demand even tripled since 1980 as a result of the boost of industrialization (Mouawad 2007). The growth of consumption in China has been higher in comparison with the U.S. although the former uses less oil in compare to the latter. China can withstand the rises of oil prices because in its energy mix coal has a vital and major role. Also, China is characterized by inexpensive manufacturing, low costs of production and cheap labor that helped its economy to flourish.



(Source: China’s National Bureau of Statistics)

According to Figure 10, during the financial crisis of 2008, Chinese economy started to shrink. Economic development slowdown was a major issue for China, which finally made them wary of rising oil costs. With the ambition to diversify its oil mix and to invest abroad, China started to search different ways to increase the energy production capacity.

Energy security is heavily dependent to the relations with the Middle East. China's energy policy is centered on excellent ties with the Middle Eastern and North African (MENA) countries. From the beginning of 21st century, China has followed a certain strategy that promotes many investments of gas and oil abroad, production and exploration to other countries in order to increase its international image and influence (Lai 2012, 59). In the midst of competition for influence with the United States, Chinese response was the concept of soft power. China tried not only to diversify its energy mix but also expand the oil transportation routes so as to maximize its energy security (Lai 2012). In the last years, China is steadily increasing its role in becoming active in oil politics, even if its dominance over the world as a developing economy was not so successful.

3) Russia

In the list of the world's largest oil exporting countries, Russia is placed second on an annual basis. Between 2003-2007, the production of oil began to surge. As a major oil exporting country, responsible for approximately 11.5% of global oil exports and with a total value of \$129 billion, Russia's economy impacted positively as the oil prices started to increase. This prompted the majority of Russia's largest oil corporations to restrict benefits for production expansion and encouraged the Russian state and businesses to ban international investment. In 2010, Komori remarked that when prices rise, so does the money generated by the export of a barrel of oil. As a result, the same quantity of oil could be exported, leading to the reception of more income as the prices increase.

Oil sector is a significant source of income for the Russian government. Via heavy taxes to many big Russian companies, the government collects rents which are huge profit for the domestic economy (Brugato 2007). When the oil prices began to rise from 2003-2008, oil profits, market share and the role of Russia as a major oil exporting country increased even more in the global oil market. According to Brugato 2007, from the beginning of 21st century, Russia showed a more aggressive profile to the world with the typical example of the deteriorating relations between Russia and America. Vladimir Putin, Russia's president since 2000, has backed nations that have traditionally been antagonistic to the U. S. and persecuted neighboring countries in order to achieve its aims. Russia has gone so far as to use oil as a political weapon as its power grows due to the price increases. Consequently, Russian government strengthened state control over pipeline networks, oil resources and energy output in neighboring nations (Brugato 2007, 29).

The Russian government adopted more measures as a way to restrict the foreign investment, indicating that the government was certain about their successful independent oil development.

According to Komori 2010, the two main policies that the Russian government followed were:

- Firstly, revise the law of its production sharing and
- Secondly, introduce limitations upon foreign investment, especially in critical assignment areas.

The aforementioned law of production sharing was amended in order to create even more barriers towards the shares of external companies, in Russian oil expansion programs. Also, the Russian government, in 2008, went one step further by allowing only the companies with half or/and above Russian ownership, to participate in projects for expanding vital oil fields. Oil fields with over 150 million barrels of capacity or gas fields that can hold at least 1 tcm of capacity are considered strategic oil fields, which were designed to limit the supply of oil fields to foreign companies. Briefly, Russia in a way to maximize its power, fame, wealth and independence, realized that its domestic companies could flourish oil fields without the help from the outside world.

4) OPEC and Saudi Arabia

Among all countries that participate in OPEC, Saudi Arabia has the greatest oil production. Also, it has the largest national oil company in the world, the Saudi Aramco and as a result Saudi Arabia has the greatest power and influence in OPEC.

As reported by Hamilton (2013,21), Saudi Arabia between 2005-2006 was responsible for almost 13% of the global oil production. One year later, on 2007, Saudi Arabia decided to cut the oil production, a measure aiming to keep prices high. As a consequence, US began to feel the pressure of that action. Historically, US and Saudi Arabia relations are very close mainly due to the oil sector. George Bush, former president of the USA, in a public speech proposed Saudi Arabia to reevaluate the harmful impacts deriving from the rise in prices of oil, especially on the American economy. Therefore, the two countries agreed and the prices remained low and stable, as Saudi Arabia heavily depends on the protection (military and politically) of the United States, not to mention that US is one of the biggest selling market.

OPEC, in 2006, when the price of oil ranges from \$22-\$28, increased its target price even to \$55. For structural reasons mainly, Saudi Arabia has always been the swing producer in the oil market, in a sense that it can freely alter the production and supply in order to adjust prices and keep the crude oil market balanced, specifically between 1980-1990. During the 2000s oil crisis, when the prices started to increase, not only Saudi Arabia did not take any measure to restrict prices but also, according to Hamilton 2013, cutback their production by 850,000 barrels by 2007. This action is a sign that they were unwilling or unable to increase the production. Allowing oil prices to rise signaled a significant change in policy, particularly in light of the possibility of a global recession affecting OPEC nations.

Consequently, Saudi Arabia started to react more aggressively. The main causes of this change in its behavior are related to a few reasons. Firstly, according to Yetiv Feld 2011, the sharp increase in population of Saudi Arabia led the government to be more reliable for providing things such as food, jobs and sheltering to its citizens. Furthermore, turmoil in the area of Middle East and in OPEC could have an impact on the way Saudi Arabia decides to adjust the

production of oil. Lastly, Saudi Arabia began react more assertively so as to rise the domestic welfare and not try to stabilize and conciliate the tensions of the crude oil market.

4.5 Conclusions

In conclusion, rising oil prices throughout the 2000s had a less effect on the economy than prior crises. This could hint that GDP growth and oil prices are no longer heavily linked. Today, the economies of nations around the world are more capable and powerful at handling fluctuations in oil prices. Additionally, the policies adopted by each country between 2003 and 2008 were mainly based on whether the nation was an exporter or importer of oil and how much it depended on oil. Notwithstanding that oil is considered as any other commodity, it will keep its high value, strategic importance and will remain a form of influence and prosperity for oil producing states. There will be an enormous impact on the global oil market if the United States continues to develop its shale resources.

5. The role of NOCs and IOCs in the 2000s energy crisis

5.1 Introduction

The worldwide recession was triggered by the financial crisis, which began in late 2007 and reached a climax in the second period of 2008. Financial struggles resulting from falling asset prices have significantly reduced banks' capacity and willingness to lend money, limiting investment, reducing consumption and paralyzing economic activity. The weakening business climate and credit crisis had also a significant impact on the energy industry. This chapter examines the impact of peak oil on NOCs and IOCs, as well as their economic prospects during the energy crisis by analyzing the main key players in each group type. In addition, to better comprehend each type of firm, the history of NOCs and IOCs is also highlighted.

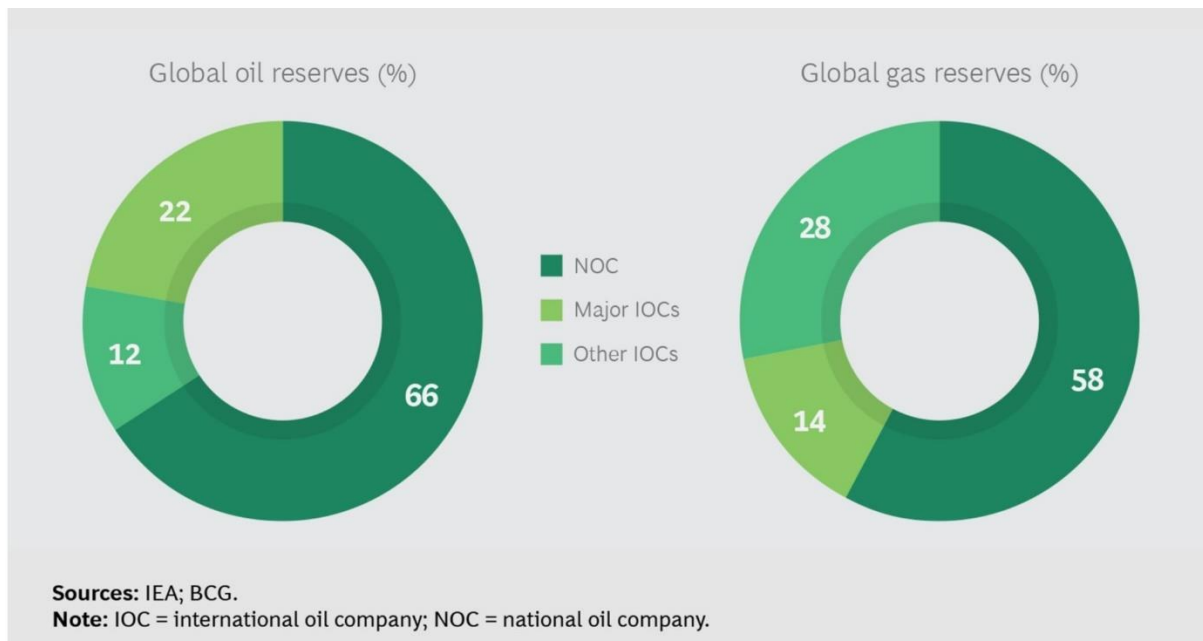
5.2 Terminology and a brief history of NOC and IOC

National Oil Company (NOC)

National Oil Company is an oil and gas company that is fully or in the majority owned by a national government of either an oil exporting or importing state. In this work, NOC is mainly used for companies in oil producing countries such as Saudi Aramco, KPC and Rosneft. NOCs are mainly engaged in oil production and exploration but can also operate in refining, transportation, oilfield services and marketing too. Despite the fact that NOCs are set up as domestic companies, they are increasingly operating outside their national borders and have repeatedly been used as instruments of political control. Furthermore, their decisions are mainly determined by the state and not according with the global oil markets.

NOCs are the larger players in the oil and gas sector globally. As Figure 11 presents, together they possess 65% and 55% of global crude oil and gas reserves respectively.

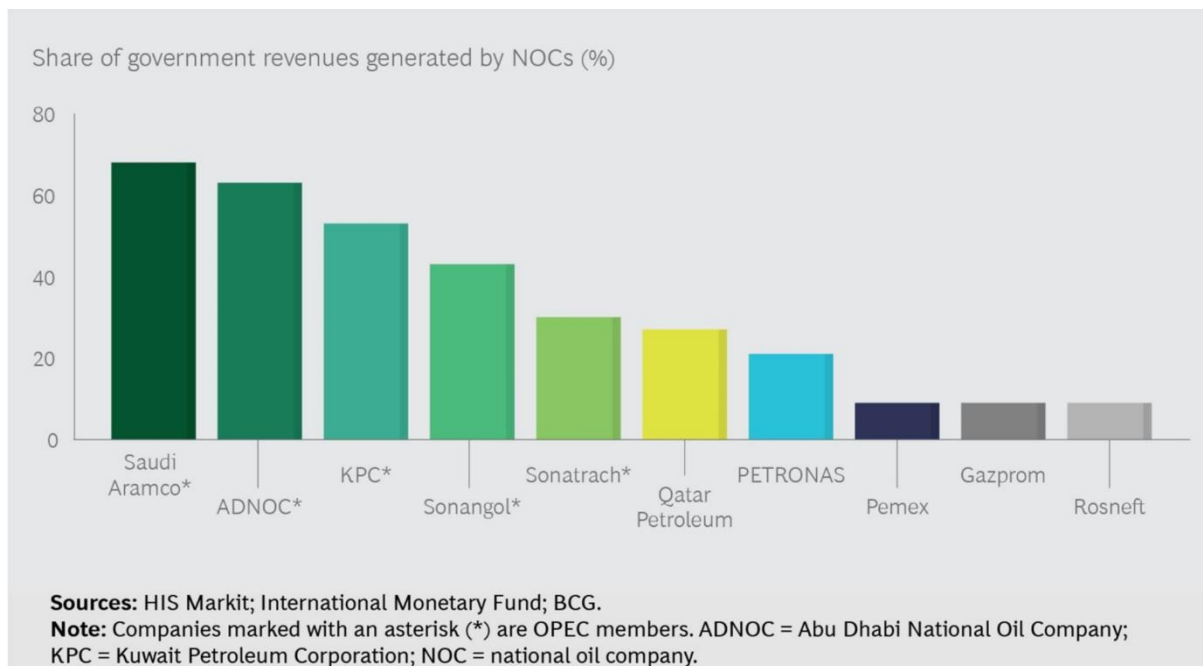
Figure 11: NOCs and IOCs global hydrocarbon reserves



(Source: IEA, Boston Consulting Group 2020)

Oil, as one of the most significant natural resources worldwide, has a vital and crucial role in modern society, from transportation fuels even to cosmetics. As a result, many governments try to nationalize the supply of oil in order to take advantage of it by giving them a higher control over the oil reserves and access to further revenue streams. In practice, nationalization usually concerns the establishment of a NOC in order to overlook the country's energy operations. From the data displayed on Figure 12, it is observed that NOCs are critical to the political economy of their respective nations. Several OPEC member nations still derive more than 60% of their earnings from oil and gas revenues made by their NOCs, despite efforts to diversify their economies. The proportion is also considerable in several non-OPEC nations, notably Mexico and Russia, which have significantly more diversified economies and where the oil and gas industries account for a lesser share of GDP.

Figure 12: NOCs contribution to governments budget



(Source: HUS Markit, IMF, Boston Consulting Group 2020)

It is reputed that the first National Oil Company was established in 1908 somewhere in Austro-Hungarian Empire. The fact that there was an excess supply of crude oil especially to private importers led the Emperor Franz Joseph to support the construction of a crude oil topping unit, owned and managed by the government. As the years passed, the development of oil as a significant and strategic commodity led all the other governments to follow the same path. According to Table 3, from the beginning of the 20th century, many NOCs were founded across the world.

Table 3: List of NOCs in chronological order

Year	Country	Company
1914	United Kingdom	BNOC
1922	Argentina	YPF
1938	Mexico	PEMEX
1951	Iran	NIOC
1953	Brazil	Petrobras
1956	India	ONGC
1960	Kuwait	KNPC
1962	Saudi Arabia	Petromin
1965	Algeria	Sonatrach
1971	Indonesia	Pertamina
1971	Nigeria	NNOC
1972	Norway	Statoil
1974	Malaysia	Petronas
1975	Venezuela	RB PdVSA
1975	Canada	Petro-Canada
1975	United Kingdom	BNOC
1976	Angola	Sonangol
2002	Equatorial Guinea	GEPetrol
2006	Chad	SHT
2015	Uganda	National Oil Company

(Source: National Oil Companies - Extractives Hub 2019)

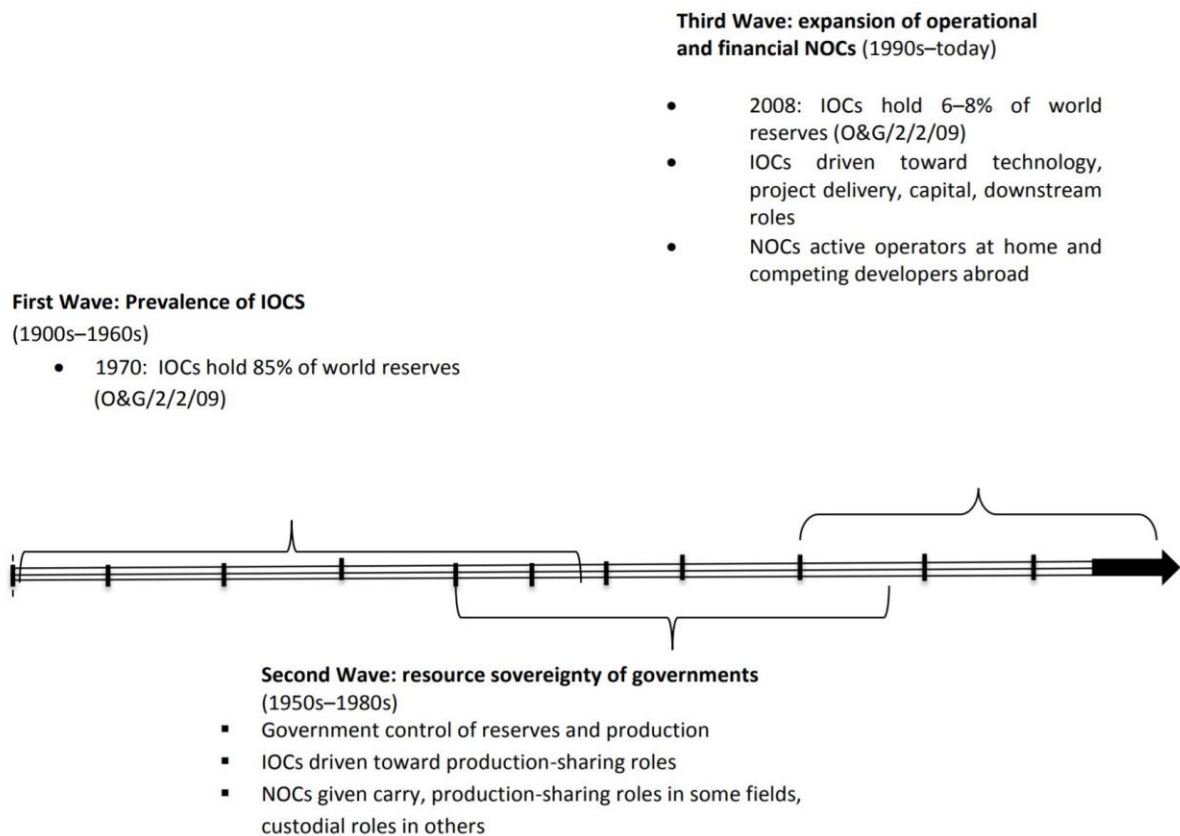
Although the creation and establishment of NOCs began in the early 20th with the formation of Argentina's Yacimientos Petroliferos Fiscales (YFP) in 1922 and Mexico's Petroleos Mexicanos (PEMEX) in 1938, the most important move for resource nationalism started in the '70s. It began with the extensive establishment of NOCs, the nationalization of hydrocarbon resources from IOCs and mostly the constitution of government cartels such as the Organization of Petroleum Exporting Countries (OPEC). All in all, the formation of NOCs was associated with the dissatisfaction of the host countries, related with the actions of IOCs (illegal deals and huge profits as Kaushal and Ward stated on 2009).

The control and ownership of the hydrocarbon industry moved from IOCs, which were prevailing until 1970, to NOCs. Mmari and Bukurura on 2014 argued that there were 16 NOCs among the top 25 oil enterprises in the world, according to the output in Barrel of Oil Equivalent per Day (BOE/D). While some countries chose the method of nationalization as was the case with Venezuela or Kuwait, other countries adopted fiscal regimes, regulations and legislation

in order to grant licensing rights and authorization to their NOCs, such as Norway, Malaysia and Indonesia. The Netherlands tried not to nationalize all the assets of IOCs, but bestowed rights up to 40% of hydrocarbon to the government via state-owned EBN. Even the United States, a country that normally preferred POCs over NOCs, acknowledged the concerns which led in the upturn to NOCs.

Although between 1990 and 2000 there was rise of financial liberalization and a market reform in many sectors, there was not an equal reversal concerning the resource nationalism. Typical example is Norway. As NOC Statoil lost all its assets, a new entity named Petoro was formed, with sole aim to manage the State's Direct Financial Interest (SDFI) in hydrocarbons. Moreover, albeit Statoil's shares were available to the public through the Oslo's stock and New York exchanges, the government still possess the larger stake. The government of Venezuela in 2007, demanded from many IOCs to hand over a significant amount of assets in the Orinoco River Basin to its NOC otherwise there would be a complete nationalization over it. Similar occasion appeared in Russia, where IOCs were directed to withdraw from their gas interests so as the Russian NOC Gazprom has the leading role. The born of a third wave related to the expanding control in hydrocarbon assets from NOCs, beginning from the early '90s to date, is indicated by Robert A. James (2011). During this new trend, NOCs are increasing their financial results and operational capabilities. As Figure 13 illustrates, there are three waves toward rising resource nationalism.

Figure 13: Trends of NOCs role and influence



(Source: James, R.A. 2011, “Strategic Alliances Between National and International Oil Companies”)

International Oil Company (IOC)

International Oil Company is an oil and gas company owned by private shareholders and states may possess a minor share of it. IOCs mainly refers to large oil companies, which are active not only in production and exploration but also in refining, transportation, oilfield services and marketing. The IOCs commonly operate in different countries and thus they called “international” and they not only differ from monolithic, but also introduce more constant characteristics. They are firm corporations that aim to the maximization of their profit concerning the varied shareholders through gas and oil monetization and extraction globally. IOCs can engage completely on the upstream sector, called “independents” or they are fully integrated. In general terms, most of the times they are not based in countries which most of their extraction operations are established. Some of the advantages that IOCs possess are related in risk management and project capabilities or techniques, easier access to capital, technology and downstream markets. It is worth noting that they can bear, transfer or absorb higher risk than many other market participants, a fact that explains why these elements were offering to NOCs and/or host governments on a contractual basis.

Notwithstanding, in this work, IOC refers to a broader concept and includes all private companies. The most renowned IOCs are BP, Total, ExxonMobil, Royal Dutch Shell, ConocoPhillips and ChevronTexaco. There are many who name them as “Major Companies” or just “Majors” because they are the largest petroleum companies worldwide with the highest revenues or capitalization. Moreover, according to Rober A. James (2011), NOC and IOC acronyms could be interpreted as “nation owned oil companies” and “investor-owned oil companies” respectively.

In order to understand how the gas and oil industry works, it is very important to know how it has changed over time and the key factor is to search who controls the gas and oil reserves. John D. Rockefeller and Henry Flagler in 1865 founded the Standard Oil Company, the largest oil refinery in global scale at its height. John D. Rockefeller that ran the Standard Oil Company as chairman up to his retirement in 1897, dominated almost 90% of America’s total refining capacity. Also, the company controlled most of the oil pipelines and gathering pipeline systems. Standard Oil’s control and influence had grown to include production, marketing, exploration, transporting and refining until the end of the 19th century. The dissolution of the Standard Oil Company led to the creation of 34 smaller companies, such as ExxonMobil, Chevron, Amoco and Marathon Petroleum which are still among the largest companies with high revenues in the world.

While John D. Rockefeller was expanding his business in the United States, the Rothschild and Nobel families were competing each other for control over the production and refining of oil wells in the Russian empire. The Rothschilds, aiming to find a global transportation network so as to trade the kerosene, supplied the first oil tanker from Marcus Samuel, a British trader. In 1897, he formed the Shell Transport and Trading company and it is worth mentioning that the first of these tankers, called Murex, got its name from a special type of seashell which eventually became the flagship of the firm. Until the late 1800s, Royal Dutch Petroleum had already started its’ operation in the former Dutch East Indies (today’s Indonesia land) and by 1892 had integrated pipelining, production and refining. In 1907 and after many negotiations,

Shell Transport and Trading and Royal Dutch finally agreed to form a new firm, the Royal Dutch Shell Group.

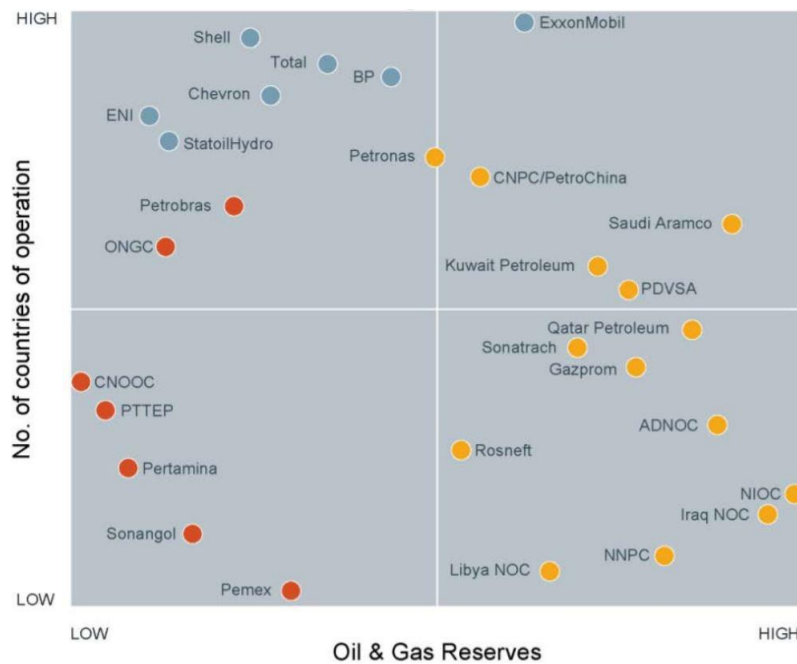
At the same year, the Anglo-Persian Oil Company was founded after the discovery of huge oil reserves in Iran by a British former gold miner and a Middle Eastern ruler. In 1914, the British government bought 51% of the enterprise to secure the Royal Navy adequate oil in the years before the First World War. In 1954, the firm was renamed British Petroleum, and it is today known as BP. These three companies, ExxonMobil, BP and Shell are now known as the “super majors”. The discovery of the Spindletop field, located in the Texas region in 1901, generated firms such as Texaco, Gulf Oil, and many others in the United States.

The United States' supremacy during this period was demonstrated by the fact that oil prices were set in the Gulf of Mexico, no matter where oil was produced globally. Since World War I, oil has been a vital energy supply as well as a huge geopolitical prize. BP, Chevron, Gulf Oil and Texaco were all involved in concessions that resulted in large oil discoveries in Saudi Arabia, Libya and Kuwait in the 1930s. Based on these findings, a cartel of seven corporations was created, which dominated the global oil and gas industry for most of the 20th century. Royal Dutch/Shell, BP, Gulf, Mobil, Exxon (formerly Standard Oil), Chevron and Texaco were eventually known as the Seven Sisters.

The relative importance of IOCs and NOCs in the world oil sector has altered dramatically during the previous few decades. In the early 1980s, the IOCs owned almost all of the world's hydrocarbon resources according to Peter A. Nolan and Mark C (2010) but until 2011 their share dropped to just 6 to 8% of global reserves, according to Rob Jessen on 2009. At the same year, NOCs hold the same commanding heights, accounting for more than 80% of global reserves (Nadejda Makarova Victor 2007). Moreover, there are many businesses which have reserves that far outnumber those of the IOCs. National businesses from as few as 10 countries contribute for half of worldwide oil output, topped by Saudi Arabia with 22%, as Rob Jessen stated on 2009.

Comparing the firms' reserves to the number of countries that they operate is one method of assessing them. Figure 1 depicts seven main IOCs, which are mostly limited to the top left quadrant. On the right side of the chart, the NOCs highlighted in yellow have been called "resource holders." (Ernst & Young, 2008). Their reserves already are significant and have no use for or desire in the reserves that the IOCs may have. Also, the NOCs shown in red on the graph's left side were called "resource hunters".

Figure 14: IOC and NOC reserves and geographic reach



(Source: Ernst & Young (2008). Are National Oil Companies the new International Oil Companies?)

5.3 NOCs vs. IOCs: Differences and collaborations

The main distinction between IOCs and NOCs is the company's owner. In NOCs, the government is either the sole owner (as in Saudi Aramco, NIOC, PDVSA and many other NOCs) or the government has a majority stake. The second category of NOCs includes Petrobras, India's Oil and Gas Corporation (ONGC) and Equinor. Businesses which have the government as a minority stakeholder are closer to IOCs than NOCs. The most famous example of this sort of NOC is Italian Eni. The rest of the petroleum firms are termed IOCs, 100% controlled by private members. However, differentiating these two groups accurately from each other is not always simple. Table 1 demonstrates that IOCs have historically had a competitive advantage over NOCs, but the difference is currently narrowing and, in some ways, reversed. Many businesses that began as NOCs have now been privatized and continue to function as IOCs, including BP (1979), ENI S.p.A. (1992) and Total (1985) according to Any Myers Jaffe and Wilson in 2007. Others, such as Saudi Aramco, were formed as IOCs before being nationalized.

Table 4: Comparison of IOCs and NOCs

	IOCs	NOCs
1) Access to capital	✓ Publicly floated companies with access to liquid stock markets, banks and bond buyers	<ul style="list-style-type: none"> • State-backed • Increased access to equity and debt in global capital markets
2) Standard technology	✓ Leaning toward low R&D expenditures that drive down costs in complex development environments	<ul style="list-style-type: none"> • Rapid growth of R&D technology and innovation. • Increase of R&D budgets.
3) Breadth of capabilities and partnerships	<ul style="list-style-type: none"> ✓ International focus. ✓ Partnerships with governments, NOCs, OFSCs and other IOCs. 	<ul style="list-style-type: none"> • Primarily domestic focus of operations (for NOCs with domestic resources). • Expanding businesses globally. • Partnerships with IOCs, Independents and OFSCs.
4) Effective local engagement	<ul style="list-style-type: none"> ✓ Developing models for local engagement by necessity. ✓ More diverse international workforce. 	<ul style="list-style-type: none"> • Operating mostly in their domestic market, and globally to access resources. • Attracting international workforce.

(Source: NOC-IOC comparison, Bain & Company 2009)

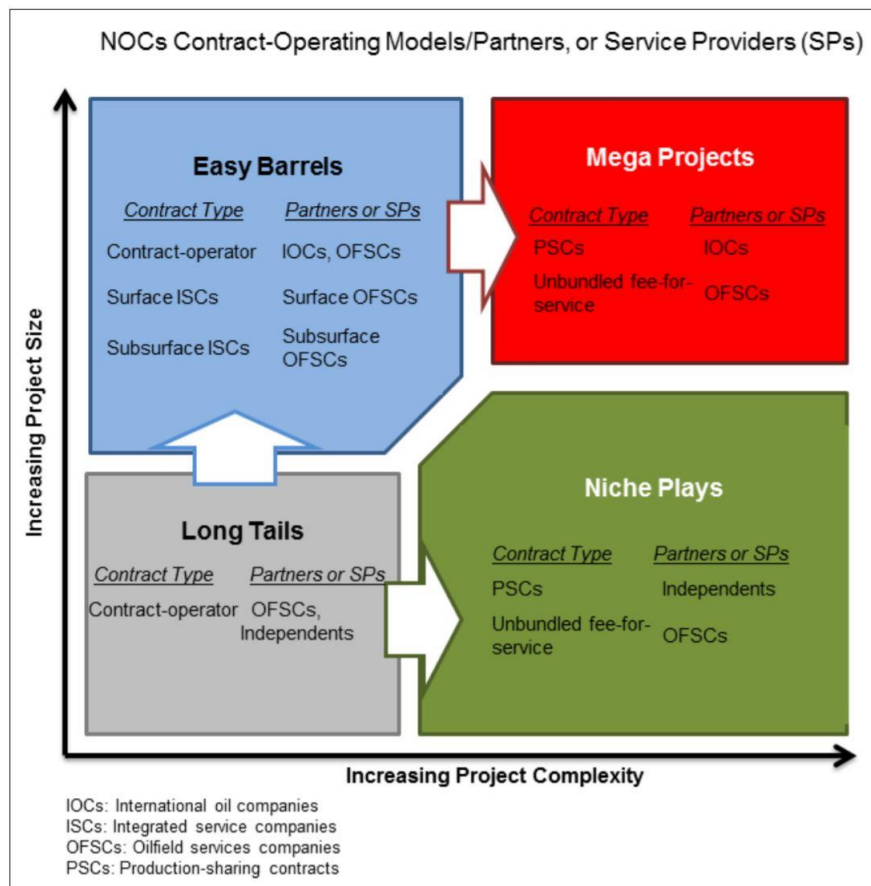
The remainder of the comparison focuses on the elements that influence NOC and IOC market positioning. As Hartley and Medlock stated in 2008, NOCs underperform when compared to IOCs and they often follow distinct production practices. Moreover, NOCs usually produce much less than IOCs on annual basis. (Eller, Hartley, and Medlock III 2007, Victor 2007). There are also significant differences in the aims of NOCs and IOCs. Although IOCs solely embrace commercial aims, NOCs may conduct various tasks other than increasing profit. The change in tax policy over NOCs and IOCs is another distinction. Although these specifics are not always made public, many NOCs follow a different taxation regime than multinational corporations. Finally, oil deposits are not equally accessible to IOCs and NOCs. The oil reserves are typically more accessible to NOCs (Pirog, 2007).

The rising trend of NOCs has altered the balance of power over the majority of the globe's petroleum reserves. Less than 10% of the world's hydrocarbons were controlled by the NOCs (super majors) in the 1970s, whereas by 2012 they controlled more than 90%. As a result of this transition, NOCs have increased their capacity to obtain capital, direct access to technical services and human resources, as well as the development of in-house capabilities. Furthermore, rather than relying on IOC partners, NOCs have expanded direct outsourcing of numerous activities through their oilfield services firms (OFSCs). As a consequence, IOCs and independents face new hurdles in order to remain relevant to NOCs, especially in the most technically demanding initiatives. Nowadays, IOCs are mainly focusing on larger and more complicated projects, including Arctic drilling and operations in unconventional oil and gas resources, based on the rising wealth and experience of NOCs. The larger independents typically take the same strategic route as the bigger independents, but with lesser initiatives.

Figure 15 depicts the contract types used by NOCs and their counterparties or service providers in relation to project size and complexity. Mega-projects are distinguished by their great complexity and enormous scale. NOCs collaborate with IOCs to carry out these production-sharing arrangements (PSCs). Such mega-projects can also be carried out through unbundled

fee-for-service deals in collaboration with OFSCs. Typical examples are the agreement between Chevron and Saudi Aramco on heavy petroleum resources, Saudi Aramco's partnership with Total to build Al-height-oil Jubail's refinery and ExxonMobil's contract in the Arctic.

Figure 15: NOC's various operational models



(Source: NOCs operating models, Bain & Company 2009)

The move in the INOCs' business strategy toward aggressive foreign resource acquisition creates problems for the IOCs and independents by doubting the sustainable development of their resource-ownership business plan. Production declines in existing oil fields, the challenge to replace oil and gas reserves in restricted access areas, the fast depletion of traditional or convenient oil reserves, rising unconventional resource production costs, and declining operating profitability are just a few of the challenges. As a result of the decline in IOCs' net asset values, investors are beginning to doubt their capacity to sustain their business models. Furthermore, NOCs' growth of internal technology skills and transition into international-national oil corporations is eroding IOCs' competitive edge (INOCs). NOCs are emerging as a new rival with certain benefits. Three types of large oil firms will likely be established in the future: NOCs, IOCs and INOCs, with the latter mainly described as the NOCs with oil-resource-poor parent nations. NOCs, on the other hand, would include those whose mother

nations are wealthy in oil deposits, even though they chose not to participate in foreign projects. Table 5 summarizes the goals and features of each category.

Table 5: Emerging Major Oil Company Types

	IOCs	INOCs	NOCs
	Seeking reserves and production growth in competition with other IOCs and now INOCs.	Primarily NOCs whose parent countries are oil-resource-poor. More direct competition with IOCs in multiple geographies.	Continue development of enormous domestic reserve base; parent countries are rich in oil resources.
1) Access to capital	✓ Free access to market capital.	<ul style="list-style-type: none"> ▪ State-backed ▪ Increasingly free access to capital markets. 	<ul style="list-style-type: none"> • State-backed.
2) Standard technology	✓ Long established, in-house R&D – looking for leadership position.	<ul style="list-style-type: none"> ▪ Improving in-house R&D capabilities. ▪ Increased R&D investments. 	<ul style="list-style-type: none"> • Partnerships with tech-savvy IOCs/INOCs/OFSCs.
3) Breadth of capabilities and partnerships	<ul style="list-style-type: none"> ✓ Long history of partnerships in multiple environments. ✓ Coming to terms with new partners. 	<ul style="list-style-type: none"> ▪ Improved partnering capabilities. ▪ Strategic differentiation on key capabilities and partnerships. 	<ul style="list-style-type: none"> • Alliances with best-in-class IOCs and OFSCs as required.
4) Effective local engagement	✓ Long history of societal engagement at multiple levels.	<ul style="list-style-type: none"> ▪ Developing skills in local engagement in diverse locations. 	<ul style="list-style-type: none"> • Limited need for overseas local engagement.

(Source: Company types, Bain & Company 2009)

When dealing with OFSCs, the main difficulty for NOCs is controlling the hazards connected with consolidated service contracts (ISCs). OFSCs are building more end-to-end services and strengthening their technological skills to better service unconventional and frontier areas.

5.4 Economic performance of NOCs and IOCs during the 2000s energy crisis

Since the millennium's turn, two relatively diametrically opposed trends in the importance and status of NOCs have emerged. Market liberalization and privatization, on the contrary, have had a significant impact on global policy-making. Furthermore, numerous significant countries including Brazil, China, Norway, Japan, Pakistan and India have largely privatized their NOCs, with others contemplating doing so. This tendency may be explained in part by prolonged political decision-making, as many of these projects were conceptualized prior to 2000, during a period of declining oil prices and constrained governmental finances. Additionally, before 2003, the majority of industry players believed that energy prices would eventually fall to roughly \$20 per barrel. A common broker projection was for a price movement to around \$20

per barrel within three to five years. Throughout many partial privatization examples, there has been no obvious aim to gradually relinquish management authority (Wolf and Pollitt 2008). High oil prices, on the other hand, have changed negotiating power solidly in favor of exporting governments (especially between 2003-2008), owing to a shortage of investment in the 1990s, the strong Asian market growth and rising of geopolitical tensions. Numerous immediate fiscal pressures on exporting nations have been alleviated and also the increasing investor interest in hydrocarbon resources as a result of their presumed scarcity has enhanced their political profile. Oil-producing countries, including Russia, Bolivia and Venezuela sought to improve the government's share of available petroleum rents by increasing taxes and, in some cases, nationalizing or quasi-nationalizing petroleum operations or creating NOCs in oil-producing regions that were just beginning to develop (such as Uganda and Chad). Some emerging nations, such as China and India, have encouraged their NOCs in acquiring petroleum resources from abroad, while Russian Gazprom's export deals moved from a commercial to a more political realm (Nadejda Makarova Victor 2008).

In general, both exporting and importing countries have emphasized the political dimension of energy decision-making. Oil price volatility, global recession and an unstable economic outlook make it impossible to precisely forecast energy demand, oil supply increases, international trade regulation or the geopolitical landscape, which are crucial for the future political and economic role of NOCs. There are a number of issues that may limit certain NOCs' capacity to invest in new upstream capabilities as initially predicted, including the drastically decreased availability of loan financing and the persistent volatility in the stock markets.

Consequences for oil and gas investment during the 2000s energy crisis

Investment reduced throughout the oil and gas industry, owing mostly to the steep decline in prices in July 2008 (due to poor demand) and to a lesser degree, to financing issues. The drop in pricing, which has considerably exceeded the drop in costs has deprived businesses of cash flow that might be used to fund capital expenditure. Additionally, it has caused many businesses to modify downward their expectations about future pricing levels and therefore the planned cash flows, reducing the profitability of new investments. Due to falling profits, certain NOCs investment programs were slashed. A rising number of businesses had declared reductions in investment budgets (relative to 2008 expenditure and those initially expected for 2009) and suspensions of scheduled and proposed projects. Upstream investment had been hurt the hardest.

The industry's total gas and oil expenditure declined sharply in 2009, both year over year and in comparison, to scheduled capital spending only a few months ago. There is no uniformity in the amount of money that is being slashed. More cuts are often made when an organization is smaller. According to Table 6, analyzing the expenditure intentions of 50 of the world's largest oil and gas producers, investment fell by 14 percent from \$513 billion in 2008 to \$442 billion this year.

Table 6: Investment plans for 50 of the world's biggest oil and gas companies

Company	2008	2009	Change 2009/2008	Change 2009 vs. plan of mid-2008
PetroChina	34.1	34.3	0.3%	-5.5%
Shell	32.0	31.0	-3.1%	-8.1%
Gazprom	31.9	25.7	-19.4%	-7.4%
Petrobras	29.1	28.0	-3.7%	-6.6%
ExxonMobil	23.9	24.9	4.3%	-1.4%
Chevron	22.8	19.7	-13.5%	-20.9%
BP	22.0	19.0	-13.6%	-16.7%
ConocoPhillips	19.1	12.5	-34.8%	-22.2%
Total	18.3	18.2	-0.5%	-16.5%
Pemex	18.0	20.4	13.3%	10.9%
Sinopec	15.8	16.4	4.2%	-22.3%
StatoilHydro	13.6	14.0	2.3%	-3.8%
Eni	12.2	12.2	0.7%	-25.8%
Lukoil	11.1	5.1	-54.4%	-51.7%
Devon Energy Corp	9.4	4.5	-52.0%	-30.8%
Rosneft	8.7	6.5	-25.3%	-30.9%
Repsol	8.2	8.5	3.7%	-3.4%
Marathon	7.4	5.5	-25.1%	-14.7%
EnCana	7.4	5.7	-23.3%	-19.6%
Occidental	6.8	3.5	-48.2%	17.4%
Canadian Natural Resources	6.4	2.7	-57.2%	-51.0%
Apache	5.9	3.4	-43.5%	-39.0%
Anadarko	5.3	4.2	-20.8%	-12.4%
Talisman	5.2	3.2	-39.9%	-24.9%
CNOOC	5.1	5.7	11.8%	-3.4%
Sub-total top 25	379.8	334.8	-11.9%	-13.5%
Next 25	133.2	107.2	-19.5%	-21.1%
Total 50 companies	513.0	442.0	-13.8%	-15.4%

(Source: IEA databases; IEA (2008a))

As a result, there are several reasons why oil firms may not be able to spend as much money as they have budgeted, such as when the government decides to redirect money from the national business for other uses or when expenses eventually fall.

In 2010, global upstream oil expenditure started to rebound, but it did not make up for the losses of 2009, when dramatically lower oil prices and finance difficulties forced oil corporations to curtail spending. Globally, total upstream capital investment on oil and gas increased by 9% to \$470 billion in 2010, up from a 15% decline in 2009. Based on the intentions of 70 oil and gas businesses, these investment patterns had been compiled. Total upstream investment is computed by adding the 70 businesses' annual spending to their proportion of global oil and gas output. Table 7 presents that in 2010, upstream spending grew at a quicker rate than downstream spending.

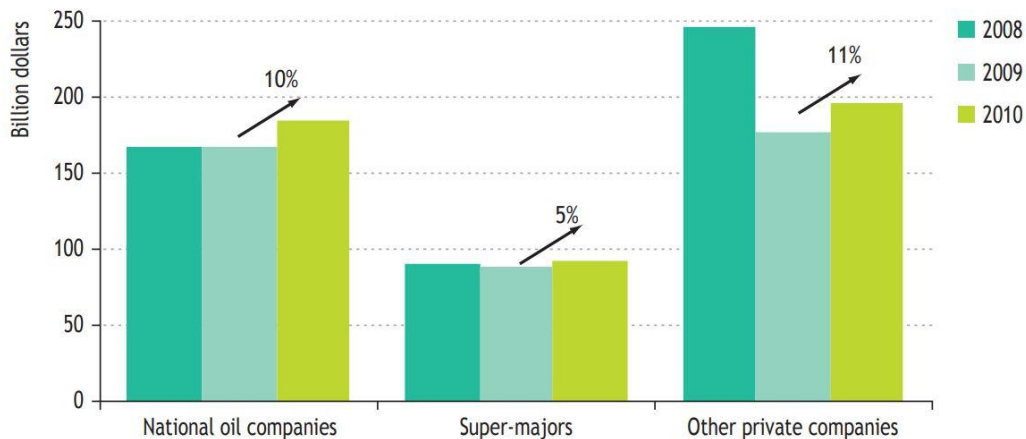
Table 7: Investment in the oil and gas sector (nominal dollars)

Company	Upstream			Total		
	2009 (\$ billion)	2010 (\$ billion)	Change 2009/2010	2009 (\$ billion)	2010 (\$ billion)	Change 2009/2010
Petrobras	18.4	23.8	29%	35.1	44.8	28%
Petrochina	18.9	23.1	22%	39.1	42.9	10%
ExxonMobil	20.7	27.5	33%	27.1	28.0	3%
Royal Dutch Shell	20.3	19.4	-5%	26.5	26.0	-2%
Gazprom	11.5	12.9	13%	15.2	23.7	55%
Chevron	17.5	17.3	-1%	19.8	21.6	9%
Pemex	16.8	16.0	-4%	18.6	19.5	5%
BP	14.7	13.0	-12%	20.7	18.0	-13%
Total	13.7	14.0	2%	18.5	18.0	-3%
Sinopec	7.5	8.2	9%	15.9	16.4	3%
Eni	13.2	13.8	5%	19.0	14.6	-23%
Statoil	11.8	11.1	-6%	12.4	13.0	5%
ConocoPhillips	8.9	9.7	9%	10.9	12.0	10%
Rosneft	5.9	6.5	11%	7.3	9.5	31%
Lukoil	4.7	5.5	17%	6.5	8.0	22%
CNOOC	6.4	7.8	22%	6.4	7.9	24%
Repsol YPF	2.5	3.4	36%	12.1	7.9	-35%
BG Group	4.4	6.2	41%	6.5	7.0	8%
Chesapeake	4.8	4.5	-7%	6.1	6.8	12%
Apache	3.1	4.7	49%	3.8	6.0	58%
Anadarko	4.0	4.5	12%	4.6	5.5	20%
Suncor Energy	4.2	4.5	8%	4.9	5.3	8%
Devon Energy	4.2	4.7	12%	4.9	4.7	-4%
EnCana	3.7	4.4	19%	4.6	4.5	-3%
Occidental	3.0	3.6	21%	3.6	4.5	26%
<i>Sub-total 25</i>	<i>244.7</i>	<i>270.0</i>	<i>10%</i>	<i>350.1</i>	<i>376.0</i>	<i>7%</i>
<i>Total 70 companies</i>	<i>345.9</i>	<i>378.4</i>	<i>9%</i>	<i>n.a.</i>	<i>n.a.</i>	<i>n.a.</i>
World	428.0	468.1	9%	n.a.	n.a.	n.a.

(Source: Company reports and announcements, IEA analysis)

Private businesses remained dominant in upstream investment; however, NOCs significantly expanded their spending in 2010. Figure 16 depicts that about one-fifth of overall spending is accounted for by the five super-majors (BP, ExxonMobil, Shell, Total and Chevron) with capital from other private businesses growing by 11% in 2010. Furthermore, NOCs' spending increased by 10%, bringing their share of global upstream investment almost to 39%, while the international upstream investment for 2009 exceeded the planned levels by \$40 billion. Raised expenditure in the second period of the year was spurred by a rise in oil prices and a decline in dollar value, which accelerated the investment outside North America (in dollars), causing an upward adjustment of spending.

Figure 16: Global upstream oil and gas capital expenditures by firm type



(Source: Company reports and announcements, IEA analysis)

Regarding the cost changes, annual worldwide upstream investment only doubled from 2000 to 2008. Although nominal investment decreased more than expenses in 2009, real investment increased by 90% above 2000 levels. Also, Figure 17 presents that the capital expenditures rose by over 4% in real terms in 2010.

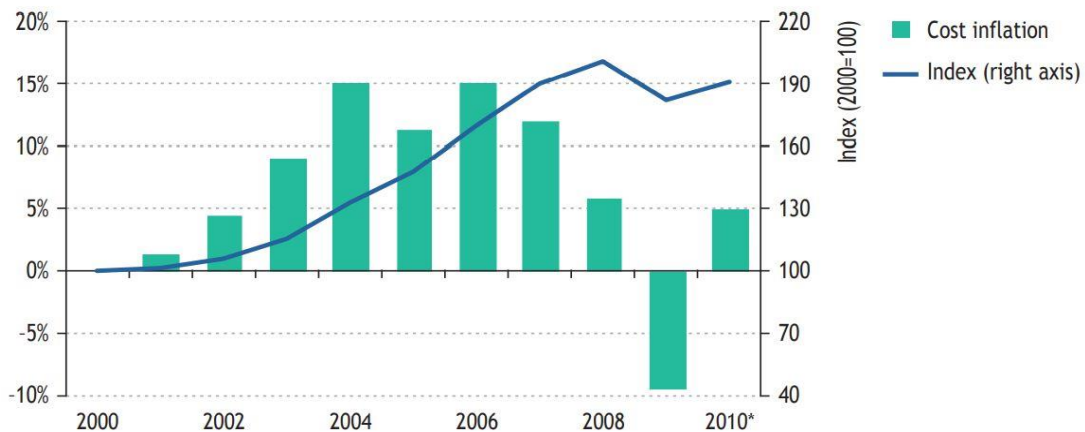
Figure 17: Global upstream oil and gas capital expenditures



(Source: Company reports and announcements, IEA analysis)

From 2000 to 2008, investment in the upstream sector doubled, before dropping back in 2009. The majority of this increase, however, was required to meet the higher unit costs of exploration and development, as the prices of steel, cement, the cost of employing skilled personnel and drilling equipment as well as the prices of oil-field infrastructure and supplies all surged vastly. According to Figure 18, investment expenses rose by an average of double for the eight years leading up to 2008. However, they lost almost 9% of their value in 2009, but recovered approximately 5% in 2010.

Figure 18: Annual inflation rate and IEA Upstream Investment Cost Index



(Source: Company reports and announcements, IEA analysis)

IOCs in profitable recession

IOCs which have historically controlled the global oil and gas market, are being pressured by the growing dominance of NOCs and diminishing reserves and production in mature basins outside OPEC nations. There has been a decline in oil production among the five "super-majors" BP, Shell, ExxonMobil, Chevron and Total, while that of other private companies (primarily smaller international firms) had remained flat during 2005-2007 as Figure 19 shows. As prices rise, the conditions in production-sharing contracts which reduces the super-majors' share of production reduces their output as well. Since 2003, NOCs' output has increased significantly. Despite this, the international gas and oil producers are still among the worlds largest. The super-majors produced more than 12% of global oil output in 2007.

Figure 19: Annual rise in oil output according to company type

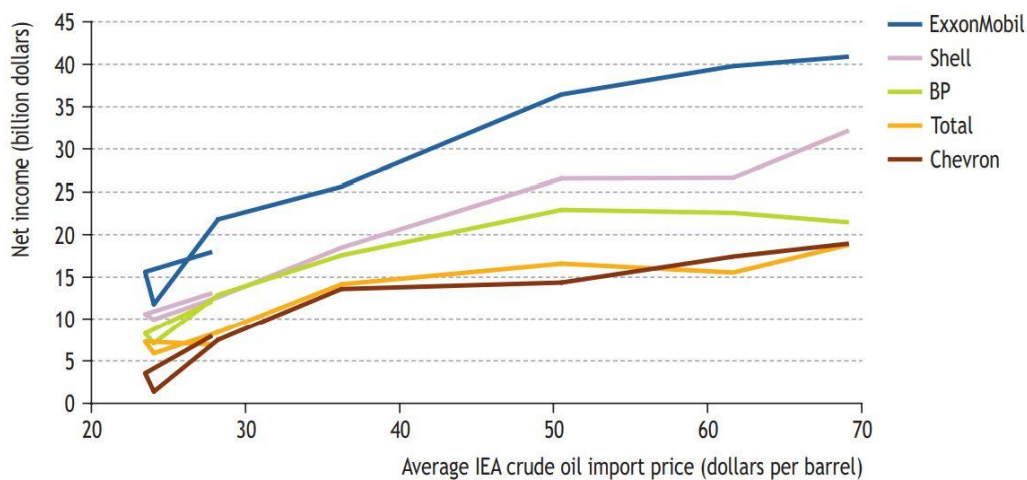


(Source: Company reports and announcements, IEA analysis)

Increased gas and oil prices had resulted in a dramatic increase in the gross income and profits of IOCs, despite greater operating costs and host-government royalties and taxes. The five supermajors' net profits (after taxes) were \$131 billion in 2007, a huge increase compared to 2002 in nominal terms.

For most of corporations, the majority of revenue growth has come from upstream operations, which historically have yielded far greater investment returns than marketing, chemicals and refining. Figure 20 outlines that between 2002 and 2005, net income for the supermajors increased broadly in lockstep with crude oil prices, but has since grown at a slower rate due to increased government receipts and rising costs.

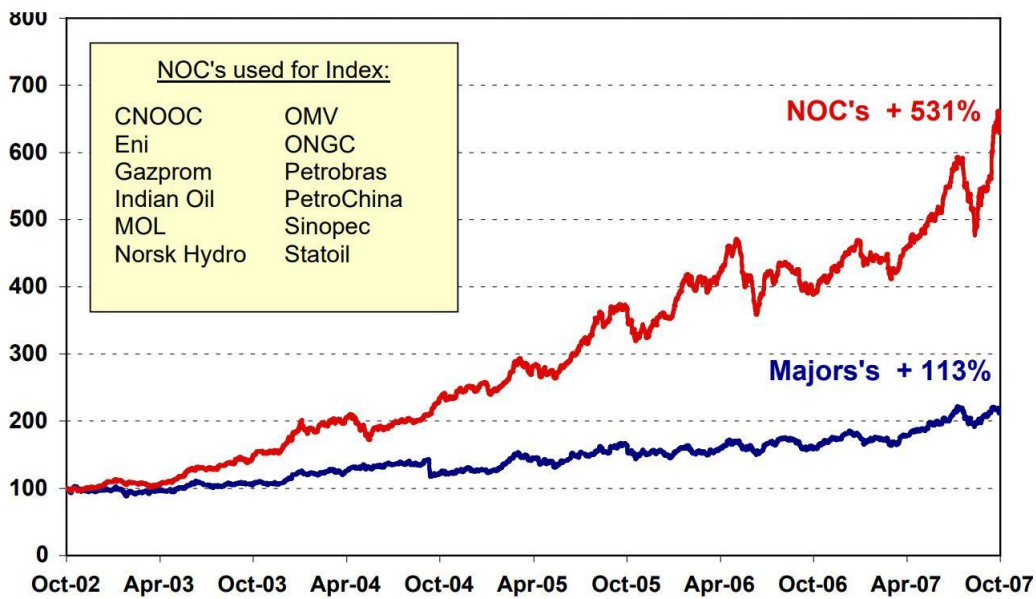
Figure 20: Super-majors' net income compared to the average IEA crude oil import price



(Source: Company reports and announcements, IEA analysis)

In addition, Figure 21 depicts an unweighted indicator of share prices regarding the Big Five, as contrasted to 12 NOCs whose shares are publicly traded and have been partially privatized. Prices of NOC shares have climbed by 531 percent since the end of 2002, while those of IOCs have risen by just 113 percent. This fact demonstrates how the financial market's estimate the reserve assets as well as the future financial returns of the two groupings of firms.

Figure 21: Share Price Performance (October 2002 index = 100)



(Source: THE INTERNATIONAL OIL COMPANIES, AMY MYERS JAFFE 2007)

5.5 Conclusions

The detailed economic analysis and performance of numerous NOCs and IOCs during the 2000s energy crisis revealed that a wide variety of businesses suffered significant losses in many different ways. The severity of the consequences varied according to the company's size, reliance on external funding, capital intensity, the susceptibility of final price and demand to economic events, and, finally, the level of state ownership and regulation. Among many NOCs and IOCs, a continuous series of announcements of capital investment reductions, project delays or even cancellations have occurred, mostly as a result of falling prices and cash flow. Furthermore, the economic and financial crisis had a three-fold impact on energy-supply infrastructure investment: i) tighter credit, ii) lower profitability and iii) less need for capacity. Concerning the upstream investment, IOCs continued to dominate while NOCs increased their spending considerably, especially after 2010.

6. Future Implications and Policy Recommendations

6.1 Introduction

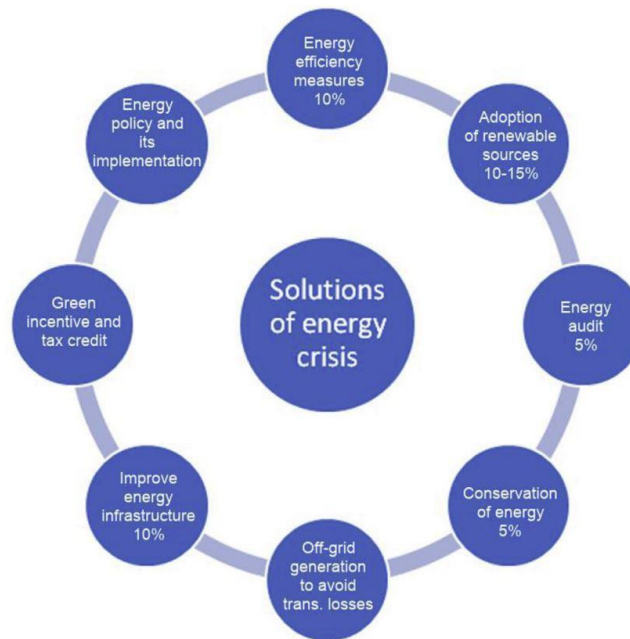
The sharp price swings of oil in 2008-2009 alarmed both producers and large consumers, who were concerned about the negative economic, political, and social implications of such unpredictable price movements. In this chapter, we analyze the possible future implications and examine the policy recommendations that the G20, governments, and other organizations are considering adopting in order to avoid a repetition of recent oil price volatility. Also, we refer to the future effects on the industrial structure and how that affects the economic activity and decision making of NOCs and IOCs.

6.2 Future Implications

As time passes, the possibility of a global peak in oil consumption will become increasingly prominent. Although complete independence from oil is unlikely in the near future, the world's reliance on it will fall as technology advances, innovation and fuel economy rise or even new markets for renewable energy develop. For a more sustainable and greener future, people are turning to alternative fuels like natural gas. Electric or fuel-efficient vehicles are becoming increasingly common in new model year automobiles. Global oil consumption might be reduced by a mix of alternative fuels and conservation. The "limited supply" argument is losing credibility, particularly in light of the advent of oil shale, oil sands and deep-water resources. Shale oil and gas are the fastest growing developing form of energy due to their abundant availability. The development of shale has significant economic consequences and it is likely that it will play a significant part in the future energy supply of the globe. The US has a substantial source of shale oil. It is currently being extracted at a tremendous pace, transforming the United States into a significant producer and exporter of oil. Extraction of these unconventional sources of oil will need significant investment, although cost reductions are projected to continue in the future due to technological advancements. (Arezki et al., 2015). Also, some crucial plans for tackling global energy problems are summarized in Figure 22.

If supply becomes less of a concern, energy demand may not decline in the future. Indeed, various indicators imply that energy consumption will continue to grow until 2030. Daniel Yergin refers to the development as a "globalization of oil demand," implying that the global economy is changing. While some nations, such as Europe, the United States and Japan have reached their pinnacle in terms of oil demand, there are still developing states with rising markets where oil consumption is expected to grow (Yergin 2013). Even with advances in technology and increased energy efficiency, economic expansion will raise countries' living standards and increase energy consumption. The remaining question is how energy would be provided in the future.

Figure 22: Strategies for resolving the energy issue in emerging nations



(Source: Renewable and Sustainable Energy Reviews, Ramhari Poudyal 2019)

On the upside, there are signs that as time passes, prices of oil do not have the same influence on the macroeconomy as they did previously. This shift in the price-growth connection can be attributed to the fact that supply is now becoming less of an issue. Demand shocks are typically the primary price drivers. Supply shocks vary from demand shocks in that they can alter the structure of economies and necessitate more deliberate policy impositions. Another likely cause is that monetary policy has got more prepared to deal with oil price shocks. In general, the typical inverse link between worldwide GDP growth rates and rises in oil prices seems to be worsening (Arezki et al., 2015).

Impact on industrial structure

Merger and acquisition (M&A) activity in the oil and gas industry may be on the rise as a result of a tightening of credit and a poorer market outlook. Historically, mergers and acquisitions of business and physical assets have occurred during periods of low pricing and low demand growth. However, for the time being, M&As are being stalled by the uncertainty of the near-term pricing outlook and the paralysis of the financial markets. Globally, M&A activity decreased dramatically in the second half of 2008, as oil prices dropped. In 2008, the value of oil sector M&As was down by more than a quarter as compared to 2007 (a record year), according to Ernst and Young (Ernst & Young, 2009). Another analysis placed the amount spent on M&As in the upstream sector alone in 2008 at \$104 billion — a decline of 32% (Harrison Lovegrove/IHS Herold, 2009). The decline in yearly expenditure disguised a record level of dealmaking in the very first seven months of the year and a slowdown in activity during the remainder of the year.

Many in the business predict that cash-rich firms will grasp the opportunity to acquire assets and competitors on the cheap in the near future. IOCs and NOCs with strong cash reserves and hardly any debt are well-positioned to acquire smaller organizations that are having difficulty refinancing their debt and raising new funds for project development. Additionally, smaller businesses may find themselves in a position where they must liquidate their assets. Financial troubles may be the catalyst for consolidation for the junior oil and gas industry, which has been predicted for some time.

According to a survey, between 30 and 40 oil businesses merged, be purchased, or go bankrupt in 2009 (Bain & Co, 2009). Notwithstanding, the oil majors are anticipated to be hesitant to their purchases, implying that a replay of the mega-mergers that changed the sector in the late 1990s is improbable. Investors are looking for share prices to fall and loan terms to loosen, while sellers are hoping for a recovery in the share and oil prices. Since late 2008, the only significant merger announcement has been that of PetroCanada and Suncor in March 2009, which established North America's fifth-largest oil and gas firm with \$43 billion in assets. Several NOCs had already taken advantage of the opportunity to acquire properties at significantly lower prices than those available before. Chinese firms and government organizations were proactively securing supply in anticipation of a recovery in demand. Numerous acquisitions made by Chinese businesses demonstrated a resolve to benefit from cheaper pricing and more favorable access terms, as well as to extend the government's projected \$2 trillion in foreign exchange reserves. China's state-owned oil companies have grown their direct equity stakes in upstream projects overseas, including significant acquisitions in Venezuela, Iran, and Africa. Furthermore, China has taken an alternative method known as loans for oil, in which the China Development Bank (CDB) would issue loans to Brazilian and Russian enterprises in exchange for future crude oil supplies. Chinese firms are also evaluating additional purchases of independent producing businesses in Africa with strong upstream development potential, such as Tullow Oil, which owns resource rich territory in Uganda and Ghana.

6.3 Policy Recommendations

Stable oil prices remain a desired goal. With growing worry regarding climate change, the oil independence is viewed as a more ecofriendly way. Carbon-based fuels including oil, coal and natural gas are environmentally damaging since they release carbon dioxide and contribute to global warming. However, as oil prices rise, it might encourage firms to extend drilling and explore new oil extraction places (Johnson T., 2010), which does not benefit the environment.

Oil prices will undoubtedly remain volatile in the future, with significant price fluctuations anticipated. Managing volatility and assisting consumers in adjusting to fluctuations in oil prices should be a priority. This might involve government diplomacy in the case of geopolitical crises and persuading consumers to reduce their gas use. Implementing a progressive gas tax, as the majority of Europe has adopted, may assist in reducing personal consumption. If people are not as reliant on oil, a price shift will have less impact. Restructuring

the transportation infrastructure to accommodate hybrid and electric cars would contribute to the reduction of reliance on oil (Johnson T., 2010). Government control of the oil sector, if done incorrectly, might potentially increase instability. Because markets are reasonably adept at self-regulation, state intervention is not always the wisest course of action. Yet, the government may contribute to market efficiency and transparency by regulating. More precise and trustworthy data on the oil market might assist speculators in making more accurate investments and in managing price perceptions.

Nations should concentrate on long-term measures that might assist in preventing the harmful consequences of oil price crises. Energy balances might be shifted by improving energy efficiency, replacing energy sources, and attempting to save energy. Improved fuel efficiency and the use of more ecologically friendly automobiles, industries, and infrastructure could not only benefit the environment, but would also lessen reliance on oil. Alternative fuel investments will change the energy landscape in the long term. To prevent significantly distorting markets, transitions to new forms of energy must be managed cautiously.

Designing effective strategies to avoid a repetition of the strong swings in oil prices necessitates, first and foremost, a full knowledge of the fundamental causes of these swings, as well as a thorough examination of current events in oil markets as well as their expected future evolution. The 2008-2009 price trend may be divided into three separate phases:

Phase 1: Throughout the first half of 2008, there was widespread skepticism about the presence and timing of price-to-oil-supply-and-demand feedback loops. This destabilized short-term expectations produced a broad band in which the oil price may vary.

Price movements within the implicit band are impacted by a wide range of public signals concerning fundamentals or expectations about fundamentals. Prices are also affected by market participants' perceptions about other market participants' expectations, which creates the conditions for herding behavior. In such an atmosphere, public information or signals might take the lead, even if they do not necessarily reflect significant improvements in underlying fundamentals and even give fresh information to the market. Furthermore, despite the amount of public information and news, traders frequently restrict their awareness to a few indications that they deem relevant since it is hard to coordinate on a huge number of signals. Due to a lack of feedback, market participants revised their longer-term expectations, and the prevalent consensus on long-term pricing broke down. As a result, prices in the short- and long - term were jointly determined throughout the boom years, and the whole futures curve was subject to a series of nearly parallel adjustments.

Phase 2: During July 2008 until February 2009, there were two different phases in the dramatic turnaround in oil prices. The first was a price drop from its highs, owing to a combination of a supply-side reaction from major marginal producers and accumulating evidence that OECD demand had deteriorated considerably more than original forecasts and provisional data had suggested. The second phase was more closely linked to the worsening of the global financial crisis and the resulting sharp drop in consensus growth projections for the world economy. Until global economic expectations began to stabilize, there was no recovery in oil prices and probably never could have been.

Phase 3: In the second half of 2009, major shocks to global oil demand were offset by expectations of global recovery and tight future market prospects, fueled by growing fear that the credit crisis and low oil prices will constrain investment in the oil sector and alternative energy sources. These long-term expectations appear to have been influenced by the analysis and opinion of major financial players. The market's willingness to discount the spot price in respect to the long-term price was limited by the stabilization of expectations of tight future fundamentals. On the one hand, considering current market fundamentals, the spot price was fairly high. The spot price, on the other hand, was low in comparison to the predicted long-term values. The oil market reached a point in the second quarter of 2009 where either the long-term price or the spot price had to shift lower. Throughout much of 2009, the spot price absorbed the majority of the adjustment.

As a result, the analysis of the oil price creation process underlines the importance of expectations and raises questions about how expectations are generated and if consumers or producers may influence market participants' assumptions about a desired price range. Moreover, there have been several requests for an oil fund to stabilize expectations, lessen volatility, and prevent dramatic price movements. Proposals like this one suffer from the fact that they must be run by parties with quite different goals. Because of this, designing institutional procedures that would protect the price from veering outside of the band would be extremely difficult. One of the primary goals of both oil-importing and oil-exporting governments should be stabilize market participants' long-term expectations regarding a range of desired oil prices. The key objective should be to prevent decisions that may lead to price changes that deviate significantly from this reference price range.

In the oil market, the recent convergence of major participants' opinions on a desired price range has stabilized expectations. However, merely sharing common interests and viewpoints will not be sufficient to maintain long-term expectations or a stable equilibrium. The suggested price range must be in accordance with market fundamentals in order to be trustworthy and conspicuous. The lack of complete and accurate market fundamentals information, as well as a lack of confidence about the behavior of important participants in various market scenarios, makes it difficult to maintain consensus and establish a credible focal point for the oil market. Building trust and exchanging information among the most key players in the market is necessary to maintain a convergence of views on market fundamentals. Finally, the market is likely to deviate from the targeted price range if expected feedbacks are delayed or missing on either the demand or supply side. This opens up new avenues for consumer-producer collaboration. If market perceptions of the magnitude and timing of feedbacks are incorrect (for example, if the market believes that no suitable instruments exist but in reality they do), policy diplomacy may help avert sudden price movements by boosting the transparency of such policy responses and feedbacks.

6.4 Conclusions

Overall, in light of the economic and financial crisis's possible ramifications for energy security, climate change, economic and human development, governments are correct to be worried about the impact on energy investment. As a result, priority should be given to reducing volatility and assisting customers in dealing with oil price shifts. The governments can help improve the oil industry's market efficiency, transparency and play an essential role in regulating pricing perceptions. Also, energy efficiency initiatives, in general may be able to meet in terms of satisfying equally short- and long-term economic objectives, as well as energy and environmental goals. Last but not least, the long-standing inverse correlation of global GDP growth rates and rising oil prices seems to be diminishing.

7: Conclusions

The spike in oil prices between 2003 and 2008 primary caused by an increase in worldwide demand, which was fueled by economic expansion and a thriving international business cycle. Consumption in developed states has stayed essentially stable or has increased quite moderately. The surge in demand in Asian emerging nations was largely responsible for the increase in pricing. Consequently, prices rose as supply stagnated, unable to keep pace with rising demand. Certain supply shocks as well as speculation had lessened consequences and they were not the primary drivers of price rises. The impact of the increase in oil prices was not as significant as past shocks. This might hint at a deterioration in the link between the price of oil and GDP growth. Emerging energy substitutes, strengthened global institutions, and more effective monetary policies may all contribute to a reduction in reliance on volatile oil prices. Oil prices, on the other hand, are not insignificant, and thus the geopolitics of oil might continue to be significant for years to come.

Oil-producing or oil-importing countries had different policies in 2003–2008 depending on how dependent they were on oil. Despite its commodity status, oil will continue to be a strategic asset for nations that produce it and a source of money and power for those governments. The growth of shale oil in the U.S. will have a significant impact on the oil market in the future. In addition, as the idea of a sustainable future gains ground, the global energy mix will be reshaped by advances in technology and energy efficiency. Oil isn't going away any time soon, but we're already seeing a decrease in our reliance on it as a source of energy. The globe may not be as vulnerable to oil price shocks as was previously if its reliance on oil is minimized. To keep oil prices stable in the future, long-term remedies must be adopted. The volatility of oil prices may never end, but actions to strengthen the economy's ability to withstand and recover from external shocks will have a positive impact.

In the last few years, the fundamentals have undergone significant transformations. Oil demand has risen as a result of robust economic development in commodity-intensive developing market economies such as China, India, and the Middle East. Some countries provide subsidies to keep fuel costs low, hence increasing oil use. The supply, on the other hand, has not been able to keep up. Over the previous few years, global oil production has grown just little. Price increases are necessary to maintain the world's demand for oil in pace with production (aside from inventory adjustments, the two must be equivalent. Since oil demand is particularly responsive to short-term changes in oil prices, the increase in oil price has been excessively substantial in order to counteract the strong, income-driven growth in demand. Furthermore, the drop in the dollar's foreign exchange value has led to a rise in the dollar price of crude oil.

During the energy crisis of the 2000s, several firms incurred considerable losses. Consequences ranged in severity based on the company's size and dependence on external funding IOCs dominated while NOCs raised expenditures significantly after 2010. Many NOCs and IOCs have announced capital expenditure cutbacks, project delays, or even cancellations due to declining pricing and cash flow.

The above emerging demand and supply dynamics have heightened interest in futures markets. Commercial companies wishing to prevent exposure to price fluctuations in the crude oil either acquire or sell are driven to hedge. Additionally, some investors view long oil futures holdings as a hedge against additional dollar depreciation. Others use futures investments to mitigate the risk associated with their other portfolio holdings. Despite these constraints, the analysis demonstrates that peak oil seems to have an effect on both the economic condition of businesses and the price of oil. By examining the influence of both challenges on the decision-making process, policymakers may obtain a thorough grasp of the impact that most of these events have on managers' decisions and so design more successful strategies.

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