

Czech University of Life Sciences Prague

Faculty of Economics and Management

Department of Economics



Bachelor Thesis

**The reasons and the impacts of crude oil prices on world
economy**

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Declaration

I declare that I have worked on my bachelor thesis titled “The reasons and the impacts of crude oil prices on world economy” by myself and I have used only the sources mentioned at the end of the thesis.

In Prague on

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Signature

Acknowledgement

I would like to thank to Ing. Mansoor Maitah, Ph.D. et Ph.D. for his useful advices and professional support during my work on this thesis.

Důvody a dopady cen ropy na světovou ekonomiku

**The reasons and the impacts of crude oil prices on world
economy**

Souhrn

Tato bakalářská práce se zabývá hlavními faktory ovlivňující světovou ekonomiku, trh ropy a cenu ropy samotnou, dále je pak podrobně analyzován historický vývoj cen ropy včetně událostí, které měly hlavní vliv.

Praktická část mé bakalářské práce je zaměřena na analýzu vztahu mezi HDP světové ekonomiky a spotřebou ropy, dále pak na provázanost HDP u čtyř největších ekonomik světa a jejich spotřebou ropy. V další části je zkoumána závislost mezi hodnotou amerického dolaru a cenou ropy. Výpočty byly udělány na základě korelační analýzy.

Klíčová slova

Ropa, ropný trh, ropný šok, světová ekonomika, americký dolar

Summary

The aim of this bachelor thesis is to determine the main factors affecting the world economy, oil markets and oil price. Historical development of oil prices is analyzed then in detail, including events which had a major influence.

The practical part of my work is focused on analyzing the relationship between the world GDP and the oil consumption. Furthermore, interdependence of GDP of the four largest economies in the world and its oil consumption is analyzed. The next section is devoted to the relationship between the value of U.S. dollar and oil prices. The calculations were conducted on the basis of correlation analysis.

Key words

Crude oil, the oil market, oil shock, world economy, U.S. dollar

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1 Introduction

Crude oil is one of the most important commodities in the modern world due to its usage in almost all the sectors from the manufacturing to the service sector. Usage of crude oil and oil derivatives can be seen in transportation, diesel and gas production, plastic, rubber, oils, and grease production and so on.

Crude oil price is influencing whole states, economy sectors and households too. Simply some of economy sectors cannot even survive without oil, but also price swings and price shocks are causing great troubles to those sectors. Oil has no real equivalent in the world and most likely there will not be any similar substitute in next years which could totally substitute crude oil. Since demand is rising and supply is diminishing we can more likely expect that prices will most likely increase rather than decrease even though last trend in the industry sector has pushed engineers to focus on the production which will consume less and less oil.

In recent years we can see huge price volatility on the financial market, which is caused by several factors which will be mentioned in the thesis.

2 Objectives and methodology

The principal objective of this bachelor thesis is to analyze how oil price affects global economy. Furthermore, factors affecting the formation of oil prices are studied. Additional supporting objectives are:

- Analysis of crude oil demand
- Oil supply
- Geopolitical factors
- Analysis of other factors that may affect the price of oil

The first part of the research is done on the basis of the available literature, whether in the form of books or information available on the internet, dealing with the issue of crude oil prices and the global economy. In the first part, there are topics divided into chapters,

which deal with first historical development, oil extraction, principles of supply and demand and furthermore, the factors of exchange market trades. The second part consists of the analysis of oil prices since the beginning of extraction to the present day, in this section; most important historical events that affected the oil market and world economy are being discussed.

Practical part deals with the calculation of correlations between real GDP and oil consumption in selected countries and the world economy as a whole. Next up is the analysis of the impact of the U.S. Dollar value on crude oil price on commodity exchange markets. As a source of information used in practical part of thesis are web pages of statistical agencies, stock exchanges, the World Bank, central banks of particular economies and reputable economic resources.

3 Literature overview

3.1 Crude oil history

History of oil extraction dates more than 3000 before Christ, at this time oil was available on the Earth's surface and such places can be compared with nowadays swamps. In the past oil was mainly used as a fire liquid, lubricant and partially as a medicament. Usage of oil is known from historic sources, for example its usage in Persia and China.

Change in usage of crude oil came in 19th century when kerosene was found by Abraham Pineo Gesner a Canadian scientist. Then the first drilling well was built in USA and those events started mass extracting of crude oil. At this time oil was mainly refined to kerosene and used for lighting in kerosene lamps instead of whale oil.

The real mass production and oil drilling has started when Henry Ford introduced the first mass produced car called Model T. We can say that this milestone was a change for the whole society and an initial impulse for the crude oil industry and connection of industries and services and therefore crude oil began to be a valuable commodity on which the whole world is dependent. At the time of petroleum industry boom, most of nowadays oil companies have been established. Initially they established a cartel to maintain prices of oil on a certain level, later their influence diminished and OPEC cartel has taken over the control. However some of them have remained such as Shell, BP, ExxonMobil and Chevron and their influence and position on the oil market is obvious.¹

3.2 Crude Oil characteristics

Crude oil is a mostly brown flammable liquid composed of a mixture of hydrocarbons and other liquid organic components. Crude oil is naturally occurring in nature and according to science crude oil was probably created by decomposition of animals and plants in the prehistoric ages.

¹ <http://petroleum.cz/ropa/>

Most of crude oil (conventional oil) deposits are located in upper levels of earth's crust in continental shelf areas up to depth of 8 km under earth surface along with natural gas. Unconventional oil reserves are mostly located in oil sands and other mineral rocks.

3.2.1 Conventional Oil

Conventional oil is extracted from ground mostly with help of oil wells as a traditional method of drilling. Natural gas is usually used as a momentum for the primary stage of drilling. Natural gas is created naturally in an oil deposit. Then after extracting certain amount of oil there is not enough natural gas pressure to push up oil and water and gas or air is surging into an oil drill hole. Last method used for drilling is usage of water steam. This method is relatively expensive and its usage depends on current oil price and level of demand.

3.2.2 Unconventional oil

Unconventional oil is produced or obtained by other methods than traditional oil extraction. Producing unconventional oil is almost always more expensive than normal oil production. However, growing global demand for oil, along with declining stocks has led to an increasing demand for non-conventional oil extraction. Significant sources of unconventional oil are heavy oil, oil sands and oil shale. Companies that extract non-conventional oil have great difficulties due to the fact that production from unconventional sources is very expensive and inefficient and also has a negative impact on the environment²

3.3 Formation of Crude Oil

“Oil and gas formation begins with the accumulation of organics on the sea-floor; these are the dead remains of organisms living in the water column, such as microscopic

² Investopedia.com

plankton, which rain down on the sea floor below. This will only occur in rather unusual settings, where the sea floor is stagnant such that there is no oxygen present to break the organic remains down and on sea-floor dwelling organisms present that might feed on the organics. A high sediment accumulation rate of may also help to bury the organics before the action of decay can break them down. As the sediment pile becomes deeper the organics within it are subjected to heat and pressure which leads to formation of oil and then gas. For oil and gas extraction, it is important that the source rock is not 'over-cooked' or the hydrocarbons will be destroyed. There must be suitable reservoir-rock, such as a porous sandstone, into which the hydrocarbons can migrate and accumulate. This must be overlain by an impervious cap-rock, such as a clay, which prevents the hydrocarbons from escaping to the surface. Finally, the geometry of the reservoir and cap-rock bodies must be such that the hydrocarbons become trapped; usually folding will suffice.”³

3.4 Crude oil classification

In crude oil industry oil is divided mostly by area of origin and chemical features. In Europe crude oil from North sea- Brent, in the USA West Texas Intermediate- WTI, Dubai- Oman crude oil and OPEC referential basket of oils. Chemical features of oil are content of sulfur (sweet oil- low content of sulfur) and sour (high content of sulfur) second most important feature of oil is density. High density oils are called heavy and low density oils are called light. Light and sweet oils are more demanded than heavy and sour due to higher processing cost in refinery and higher yield of petrol.

3.4.1 Brent

Brent is the name of the oil which is extracted principally in the North Sea, Brent traded on the ICE exchange in London. Extraction source in the North Sea was discovered in 1960 and it is extracted mainly by the UK, Norway, Denmark, Holland and Germany. Brent is distributed especially in Europe and surroundings areas. Compared to U.S. WTI crude oil, Brent crude oil is heavier and less sweet.

³ Discoveringfossils.co.uk

3.4.2 WTI

U.S. light crude WTI, traded on the stock exchange NYMEX (New York Merchantile Exchange) is of high quality and is easily refined. Compared to European Brent crude, WTI is sweeter because of its about 0.24% higher sulfur content ⁴

3.4.3 OPEC Reference Basket

OPEC reference basket consists of various types of oils from member countries within the OPEC cartel. The new OPEC Reference Basket of Crudes (ORB) is made up of the following: Saharan Blend (Algeria), Girassol (Angola), Oriente (Ecuador), Iran Heavy (Islamic Republic of Iran), Basra Light (Iraq), Kuwait Export (Kuwait), Es Sider (Libya), Bonny Light (Nigeria), Qatar Marine (Qatar), Arab Light (Saudi Arabia), Murban (UAE) and Merey (Venezuela).⁵

3.5 Price influencing factors

There are several important demand and supply factors which are influencing the price of crude oil, most important of them are: costs related to drilling activities, supply chain costs (refinery, transportation and storing costs), macroeconomics and geopolitics issues (political stability in oil supplying countries, OPEC cartel resolutions and quotas). Those are the main factors influencing price of oil, but is also affected by other factors such as bad weather- which can cause short-run cut in supply and influence the price (offshore drilling mainly), start of automobile season in USA (higher demands for oil during spring and summer).

3.5.1 Economic activity

Economic activity has the greatest influence on the demand for oil; strong growth indicated by positive GDP figures is connected with increase in crude oil price and vice versa. Future predictions on rising GDP may have an effect on consumers. If they believe that

⁴ Investopedia.com

⁵ OPEC

future demand will increase because of economic growth they may buy more options or futures on financial markets and accelerate price movements. GDP and price of crude oil will be mentioned in next chapters with more detailed analysis of different countries GDP and relation with oil price.⁶

3.5.2 Crude oil proven reserves and Hubbert's theory of peak oil

Reserves of crude oil are major factor in satisfying demand for oil because sources are limited and artificial production of oil was not successful. As it was mentioned in previous chapter there are various types of crude oil from different areas, quality and properties. Sources are conventional and unconventional and according to latest surveys most of sources have already been discovered- approximately 90%. However we can expect increase of reserves in the future due to interest of oil companies driven by higher price of oil. In the past most of oil was obtained from conventional sources, nevertheless in future we can expect higher share of usage of an unconventional sources such as oil sands, oil shale and others. Usage of unconventional sources also caused increase in predicted amount of oil, since in the past only conventional sources were counted for. Most of the recent researches claim number of around 1,340 billion barrel according to BP and OPEC organisation. The chart below shows the growth of proven reserves and share of different parts of World and share of OPEC countries.⁷

⁶ Commodity Derivatives : Markets and Applications

⁷ OPEC annual bulletin 2009

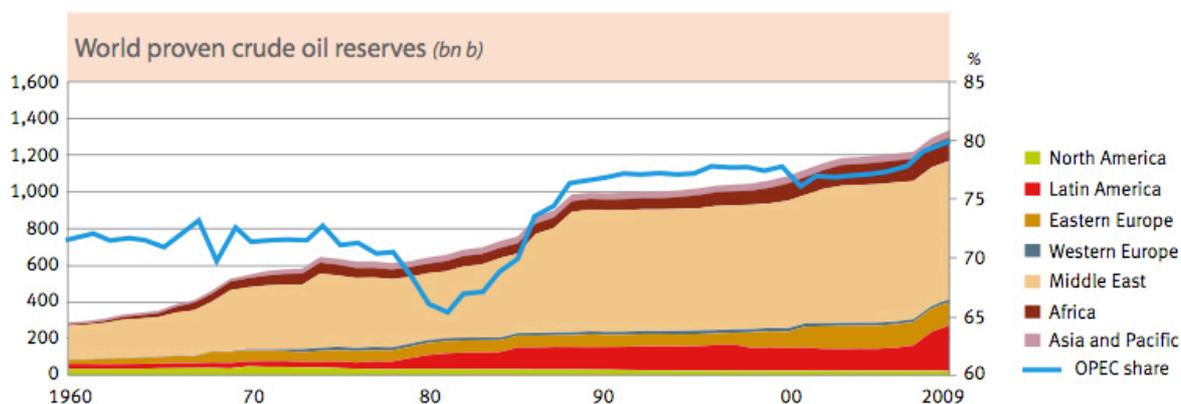


Chart 1: World proven crude oil reserves, source: OPEC annual bulletin 2009

3.5.3 Hubbert's peak oil

During 1970s American geoscientist Hubbert has created a theory based on his research, claiming that world oil production should peak around year 2000 and then reserves should start to diminish. Hubbert's research was only based on data available at the time of 1970s on different numbers of oil endowment- approximately 3 trillion barrels. Many analysts and scientists followed his research and recent studies claim that peak should occur in present decade and then the production should significantly fall during 2030's.⁸

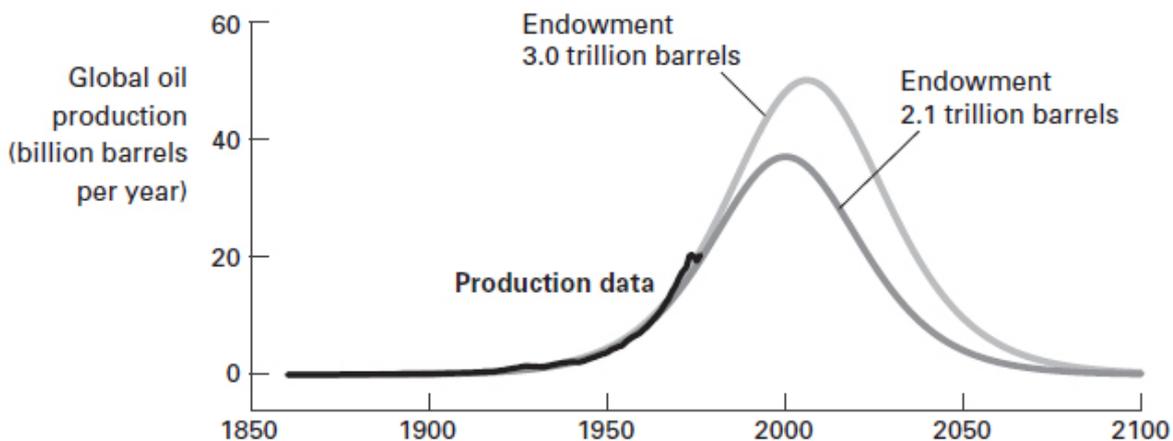


Chart 2: Hubbert's peak oil, source: Oil Panic and the Global Crisis: Predictions and Myths

⁸ Source: Oil Panic and the Global Crisis: Predictions and Myths

3.5.4 Availability Strategic reserves of crude oil

Many countries have special reservoirs to maintain strategic reserves of oil, this kind of buffer is useful when an accidental situation occurs and emergency capacity is needed. For example USA has a reservoirs system of capacity 700 million barrels, which was established in 1970. Daily US consumption is 19000 thousand barrels per day.

3.5.5 Crude oil Supply

Oil supply is understood as a quantity of oil offered for consumption, which is dependent on numerous variables, most often it is dependent on the oil price. The scale of oil production is given in million barrels per day. The current range of countries offering oil is limited only to countries extracting oil from ground. Producing oil is efficient only when there is enough demand for oil, which is expressed in oil prices. The reason is the cost associated with finding new sources and drilling.

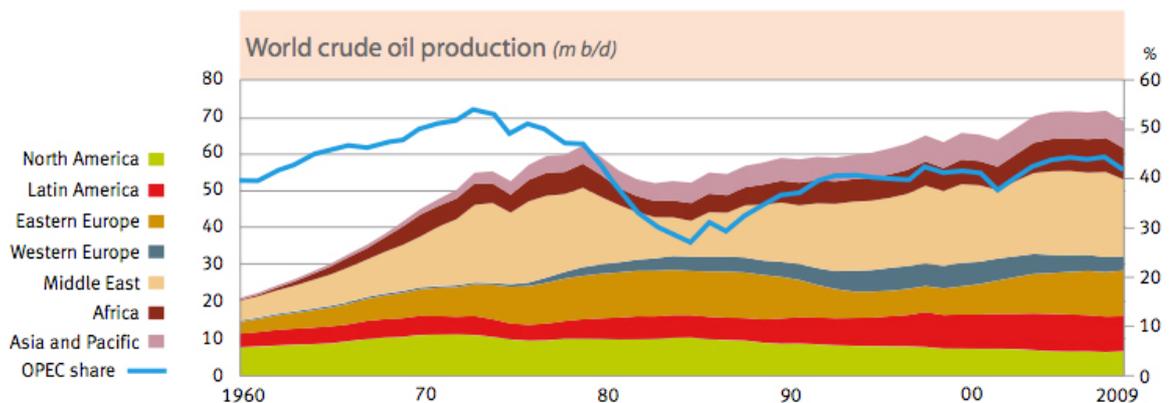


Chart 3: World oil production 1960-2009, source: OPEC annual bulletin 2009

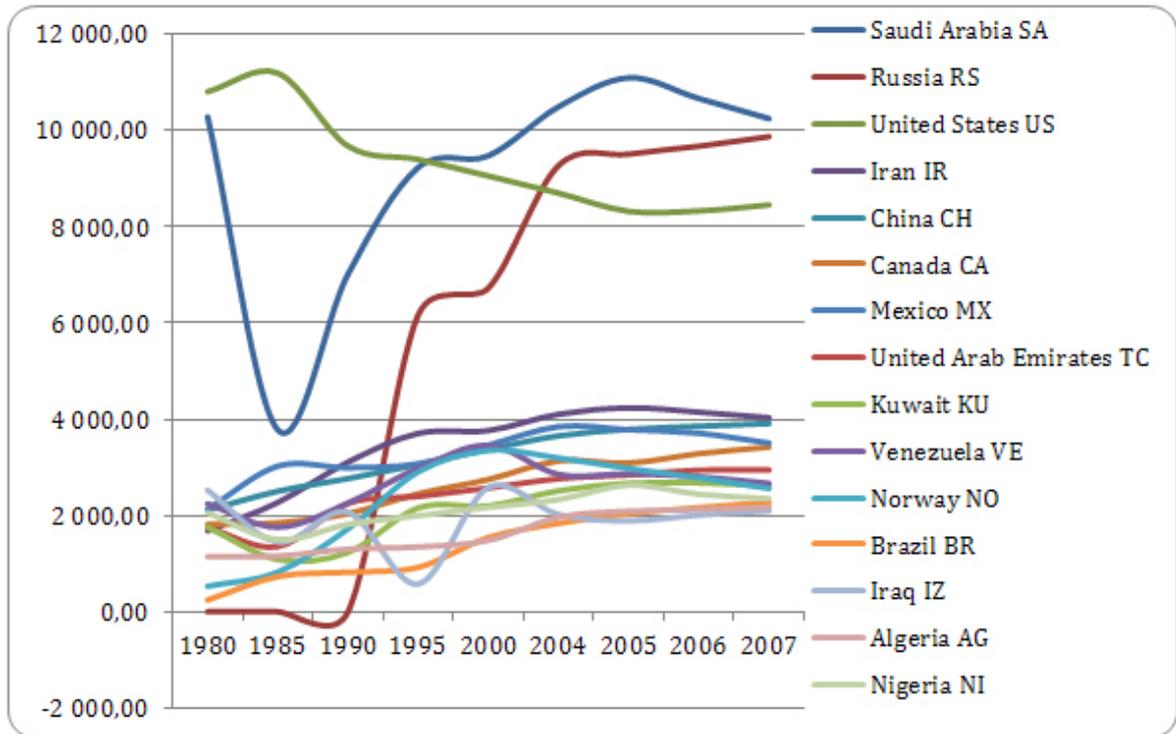


Chart 4: Top 15 producers in 2007 in thousand barrels per day, data EIA, Author

Based on the data analysis it is important to point out that OPEC countries have an approximately 43% share of world crude oil production. This market share is very influential and if the cartel would work as one country this would probably have an interesting influence on the oil price. However, there are many troubles within cartel such as breaking quotas. In the chart above, 15 biggest producers of crude oil are represented. Most significant fact is that in total those top 15 producers have been producing around 75 % of today's world production. Before 1990 their share was around 60 %. Due to higher demand, proportion of their share is increasing and overall production of oil as well.⁹

3.5.6 Crude oil Demand

Crude oil demand is connected with oil consumption itself; major determinants of consumption are price of crude oil and price of substitutes. Consumers are households and

⁹ OPEC

firms, who use oil and oil products in variety of ways (not just as a fuel, but also as all the plastics and clothing, most of the products of daily usage in human life)

Oil consumption is expressed in same way as oil production- thousands of barrels per day. In this work we will focus on consumption of main world consumers.

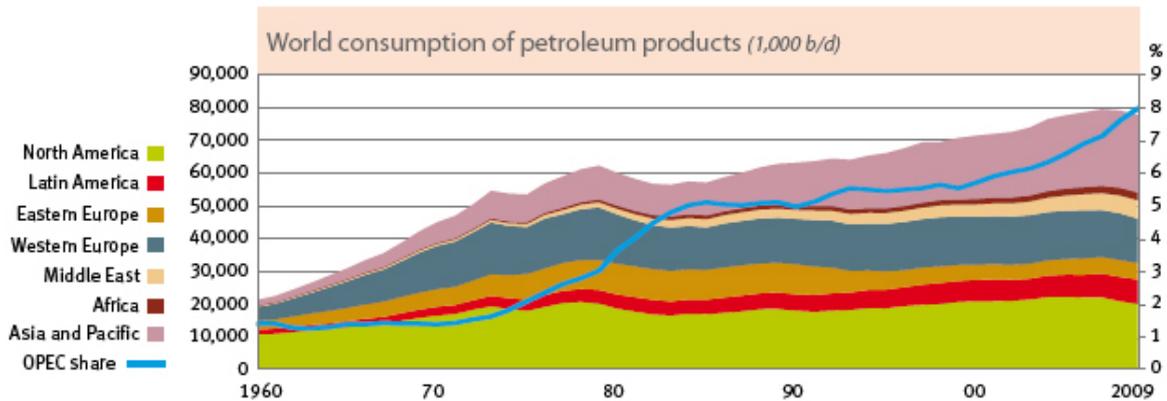


Chart 5: World consumption of petroleum products, source: OPEC annual bulletin 2009

Crude oil demand has been rising since Second World War due to high usage oil in daily life, in recent decade the major countries that are driving demand are USA – the biggest consumer in the world and 3rd biggest producer (19,5 mb/d), followed by China (7,8 mb/d), which increased consumption since 1980 by 340%, following countries are Japan (4,8 mb/d), India (3 mb/d) (Indian share of consumption is similar to Chinese-increase-ment by 350% since 1980 and this situation can be seen in most of newly industrialized countries mainly in Asia and South America- growth is visible in chart of world consumption. The 5th country is Russia (2,9 mb/d), followed by Germany (2,6 mb/d), Brasil (2,5 mb/d), Saudi Arabia (2,4 mb/d), Canada (2,3 mb/d), South Korea (2,2 mb/d), Mexico (2,1 mb/d), France (2 mb/d), Iran (1,7 mb/d), UK (1,7 mb/d) and Italy (1,7 mb/d). Total share of those countries is 69% of total world consumption.¹⁰

From the chart it is obvious that consumption in western developed world – USA and Europe is relatively on the same level and even in some countries, such as Japan consumption of crude oil has decreased due to focus on modern clean and environmentally

¹⁰ EIA report

friendly technologies. However we can still expect increase in consumption in emerging countries, further scenario will be determined mainly by research and a share of new technologies.¹¹

3.5.7 Possible substitutes

There are no real substitutes in terms of transportation apart of bio fuels, hydrogen, solar energy and others which can be massively used (according to statistics source, 65% of each barrel is being consumed by the transport sector), however in other industries or economic sectors we can use electricity or natural gas for heating. Therefore rising oil price is forcing consumers to seek for alternative products and technology tends to be more and more efficient, so that in a long run, demand is slightly decreasing in the developed countries. In developing countries situation is opposite and whole mixture of factors is an incentive for oil companies to search for new sources of oil in frozen areas of Siberia, deep water or usage of unconventional oils.

3.5.8 Taxation

Taxation of oil and oil products has great influence on the demand. Situation can differ in various countries; example can be USA, where taxes are relatively low and on the other hand Europe, where taxes on gasoline are the highest in the world. Reason for taxation is obvious, government effort to decrease consumption, protect environment and raise

¹¹ Data BP and OPEC

money

Who gets what from a litre of oil in the G7?

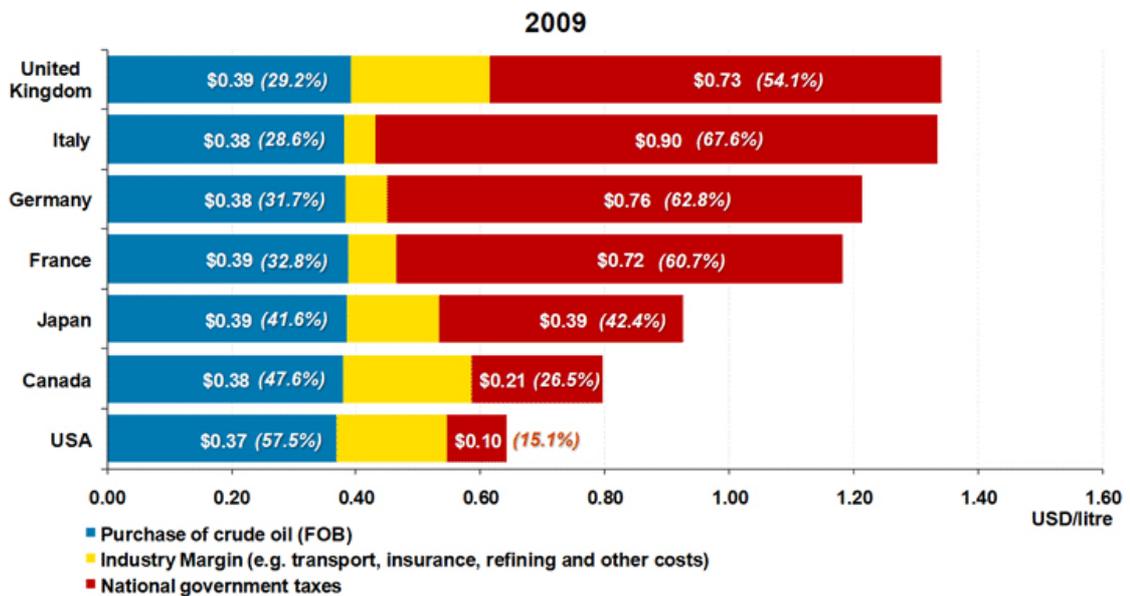


Chart 6: Taxation of oil, source: OPEC

3.5.9 Investors and speculators

Oil is traded on the financial market, and most of oil companies, institutional traders, funds, and other trades are participants of trading and they have partial influence on price forming. However main reason is still demand and supply and world economy, even though lot of politicians tend to blame speculators for rise in commodity prices. According to The Economist and other sources traders do more good than harm: *“There is almost no evidence to connect speculators to the commodity-price spikes that they are routinely blamed for creating. And what little distortion speculators may cause is soundly trumped by the service they provide. In particular, they supply liquidity and price information that makes futures markets more efficient. Speculators plug the gap when the hedging requirements of raw-material producers and buyers do not coincide, offering a counterparty for trades that might otherwise have no takers. The suggestion that speculators deliberately manipulate markets to earn profits through bubbles and busts simply does not hold water. The explanation for the sudden spikes in the prices of many commodities in recent years lies in nothing more sinister than the laws of supply and demand. A ravenous China, underinvestment in mining and agriculture, tight markets and*

unexpected disruptions to production are usually to blame for rapid price movements. An OECD report suggests that there is little difference in volatility between exchange-traded agricultural commodities (such as wheat and corn) and non-exchange-traded ones (such as apples and onions).”¹²

3.5.10 Fluctuations and value of USD

The value of the US dollar has one of the greatest influences on oil price, since oil and most of the commodities are traded in USD. Simply when US currency has high value on the FOREX market, usually price of oil decreases- for those who use the USD it is the other way around. Analysis of correlation between USD and oil price will be in upcoming chapter.

3.5.11 Refinery margins

A refinery margin is a difference between cost of one barrel of crude oil and one barrel of gasoline. The difference includes costs and profit of refinery. For that reason when refinery margins increase for some reason, gasoline price should increase as well.

3.5.12 Supply chain and supporting resources

Supply chain can be considered as a process including transportation of crude oil from an oil field to the end consumer, including all the cost connected with transportation and storing. An increase in cost of supply chain is also a determinant of crude oil prices. Supporting resources are different commodities, mainly steel, used to build pipes, refineries, tankers, oil rigs and so on.

3.5.13 Environmental issues and natural disasters

Most of governments around the globe are increasing and tightening regulations of oil extracting mainly to protect their citizens and nature. These new regulations are increasing

¹² The Economist, 11.2010

cost of extracting oil or even restricting drilling in particular area and apparently we can expect more regulations as states are getting more concerned about nature. Example can be BP's Deep water horizon oil rig-recent disaster in the Gulf of Mexico and half year moratorium on drilling oil from sea and following regulations. Natural disasters mostly lead to cutting off supplies or shrink in oil produced in certain area.

3.5.14 Geopolitics factors

Most of the oil extracting countries have a relatively unstable regime or even dictatorship. Source of money flowing into those counties is mainly from oil drilling and selling, so they can influence oil market by two ways. First can be a decrease in supply or request for more money per barrel. A single country is not powerful enough in negotiating price, but when those countries act together as a group their influence on the price increases. Another trouble might be a collapse of domestic regime (revolution, war or terrorist attack) in a country extracting oil. This of course depends on its amount of production. When important country is in unrest, shortage in supplied quantity may cause rise in price.¹³

OPEC Cartel

The Organization of the Petroleum Exporting Countries is an intergovernmental organization established in September 1960 in Baghdad. Establishing countries were: Iran, Iraq, Saudi Arabia, Kuwait and Venezuela. Later on 9 additional countries have joined the organization (United Arab Emirates, Libya, Qatar, Indonesia, Algeria, Nigeria, Ecuador, Gabon and Angola). OPEC headquarters is located in Vienna, to where it was moved from Geneva in 1965. Official aim of organization is coordination and unifying policy concerning oil between member states in order to reach equal and stable oil prices. Next aim is to secure stable supply of oil to customers and taking care of investments into the oil industry. Unofficial aim can be an increasement of its economic power and influencing oil price. Cartel has also several disadvantages for its members, major disadvantage is lack of

¹³ Commodity Derivatives : Markets and Applications

freedom in decision making of member states, which is causing breaking of cartel quotas and agreements.

OPEC has an approximate share of 42% of world oil supply, which gives the cartel a relatively high power to influence the price of crude oil. OPEC has been criticized for its influence on crude price. The influence and troubles of OPEC cartel can be seen in several oil crises such as oil shock in 1973, when the price of oil soared from 3 to 12 US dollars per barrel. In the next chapter details about oil shock are being discussed.¹⁴

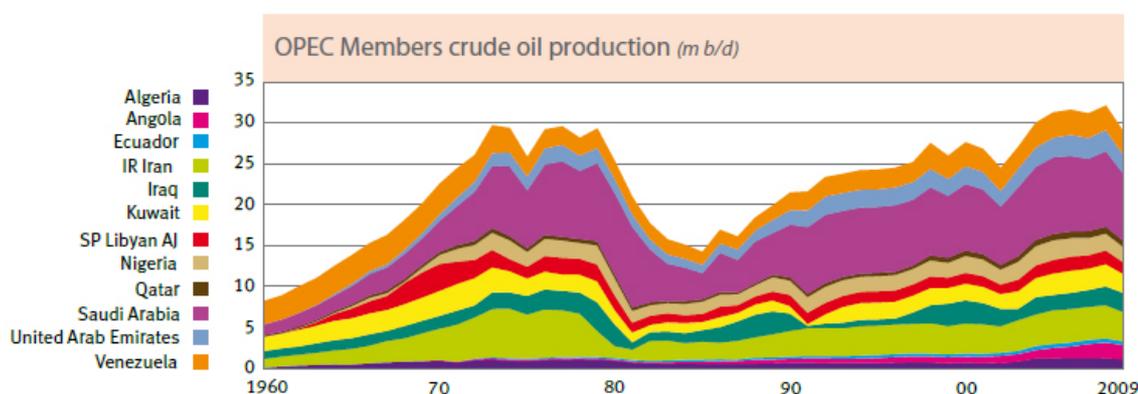


Chart 7: OPEC member's oil production, source: OPEC annual bulletin 2009

3.6 Crude oil price shocks

What is a price shock? Price shock can be caused by change in supply or demand. When supply is increased, the prices of the good decreases due to a shift in the supply curve to the right and vice versa. When demand for a good or service increases the price of that good or service usually increases due to a shift in the demand curve to the right and vice versa. This kind of demand shock is commonly caused by change of money supplied, new fiscal policy or impose/remove of tax on certain goods or services.¹⁵

3.6.1 Short run and long run demand and supply responses due to changes in price

An example of a crude oil shock happened between year 1973 and 1974, the cartel of OPEC countries raised price of one barrel from 3 US dollars to nearly 12 US dollars.

¹⁴ OPEC

¹⁵ Investopedia.com

Afterwards crude oil price soared to the level of 30 USD in the year 1979, and then price has oscillated around this level. However price trend was descending, apart from the Gulf war during 1990 (another price shock, cut in supply) and trend continued till end of 1990s when price fluctuated around 11 USD per barrel.

At the beginning of new millennium, prices were higher and higher, initially around 19 dollars per barrel then price increased to 33 USD and then was continually increasing during years 2004 and 2006. During the year 2007 price was generally higher than 50 USD and during the previous year a global financial crisis skyrocketed the price to 147 USD per barrel (historical maximum), and then when the crisis occurred price dropped sharply to 38USD.

The price movements can be explained using simple demand and supply analysis.

a) An initial restriction of supply

b) Long-run demand response

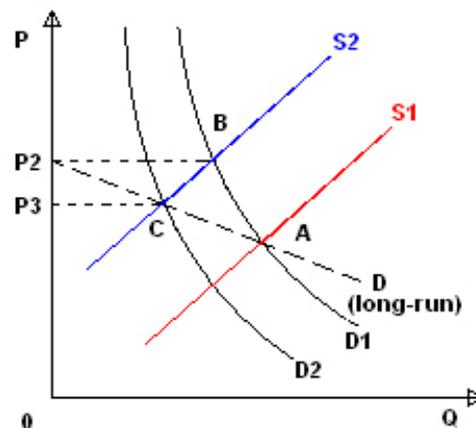
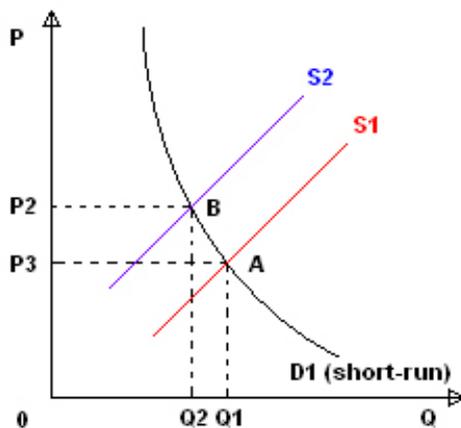


Chart 8: Supply and demand diagram, Author

The initial increase in price which occurred during 1970s when OPEC raised oil price from the point P1 to the point P2 (diagram a). Subsequently OPEC decreased oil supply by agreement on new quotas and this had influenced shift in the supply curve to S2, with quantity Q2 produced. However this quota was not that significant as expected, oil market is highly inelastic and most of the consumers have no choice in the short run.

The long run and effect on demand for oil

Demand in the long run is likely to be more elastic (diagram b), consumers have more choice how to deal with increase in price such as cutting demand, switching to alternative sources of energy and new technology has relatively high influence as well. This adaptation of consumers for higher prices caused shift of short run demand curve from D1 to D2 and price of oil fell back from P2 to the price level P3. This this gave a long run demand curve of DL, the curve which intersection points A and C. Later on, when 1980s a global recession begun, drop in demand was even more significant.

The long run effect on oil supply

During middle of 1980s, prices started to fall during the period up to 1998, mainly caused by disobedience of OPEC member countries. Main factors were rising profits from selling of oil, mostly caused by new technologies and research which decreased cost of drilling activities and secondly as OPEC members wanted to increase their wealth and broke, they have agreed on quotas for selling more oil. This mix caused price drop, which is represented in diagram by shift of supply curve to the right.

Back to square one?

During late 1990s, with the crude oil price around 10 USD, OPEC cartel agreed again to maintain new quotas on supply and whole situation started again. Whole situation is represented by diagram a). Main reason for this was a start of an economic boom and so demand curve was shifting to the right. The outcome from this momentum of the world economy was rise of crude oil price to 33 USD, this situation ended during the year 2001 when technical bubble has burst and demand curve shifted again to the left. Later on OPEC decided to impose new quotas and decrease output- shift of supply to the left subsequently increasing demand due to worries about the Iraq war caused by increasing stockpiles- shift of the demand curve to the right.

Main trouble regarding crude oil is the fact that, supply and demand are price inelastic in the short run, therefore we can expect relatively high volatility in the price, often caused by speculation on the further trend. The problem is even deepened by an income elastic

demand for crude oil products. When the world economy is picking up, demand is increasing steadily and fall of the prices is happening mainly during times of bust.¹⁶

3.7 Analysis of Crude oil prices history

3.7.1 Early history of drilling

Crude oil has been extracted from the ground since ancient ages, however commercial oil extracting begun during the middle of 19th century. Initially oil was gained from the surface and later on first oil wells were built. First wells were only few meters deep, because oil deposits were immediately under surface. These wells were dug mainly by man power and later on mechanical drilling was introduced. At this time oil was used mainly for heating and in lamps for lighting- instead of whale oil. The first milestone was invention distillation and transformation of oil to petroleum. First oilfields were in Romania and nearby Hannover in Germany and in the USA in Pennsylvania, where the first US oil industry begun. Later on Texas became the US oil centre. At this time oil was expensive commodity mainly because of difficulties in the process of drilling, primitive mechanisation and drilling itself was a risky job. Prices at this time were high, as you can see on the chart below, but when amount of barrels gained increased and the demand was still the same prices went down (approx. 20USD per barrel). Next milestone was when petroleum motor was invented. First inventor is Nikolaus August Otto, who introduced his motor in the year 1877, and then prices of oil has increased, however real boom of motoring has started when Henry ford introduced his mass produced car Model T in 1908. The further manufacturing of new cars and momentum of world economy caused rise in oil price. The First World War and later on Second World War influenced oil industry a lot. When the first world war begun in 1914, demand soared due to manufacturing and armament and prices of oil went up. Prices were high till end of the war; however huge fall in prices happened during Great depression in USA during 1929-32. The economic slump was so drastic that unemployment in USA had increased by 600% and industrial production had decreased by about 46% and international trade had fallen by about 70%.

¹⁶ Sloman, Hinde & Garratt, Economics for Business

Whole world was influenced, situation was similar in Europe but not that serious. Whole situation during Great depression caused lack of demand, which caused that prices went as low as 8USD per dollar.

Whole situation went to a circle during 1939, when the Second World War begun. Increase in mechanisation, new war inventions, aircrafts etc. so whole war progress was dependent on supplies of crude oil. Especially Germany had troubles with supplying their forces and one of their points of interest was to defeat British forces in Africa and extract oil fields. Same trouble had hit Japan at this time, however even nowadays Japan has almost no sources of oil and is relying mainly on imports.¹⁷

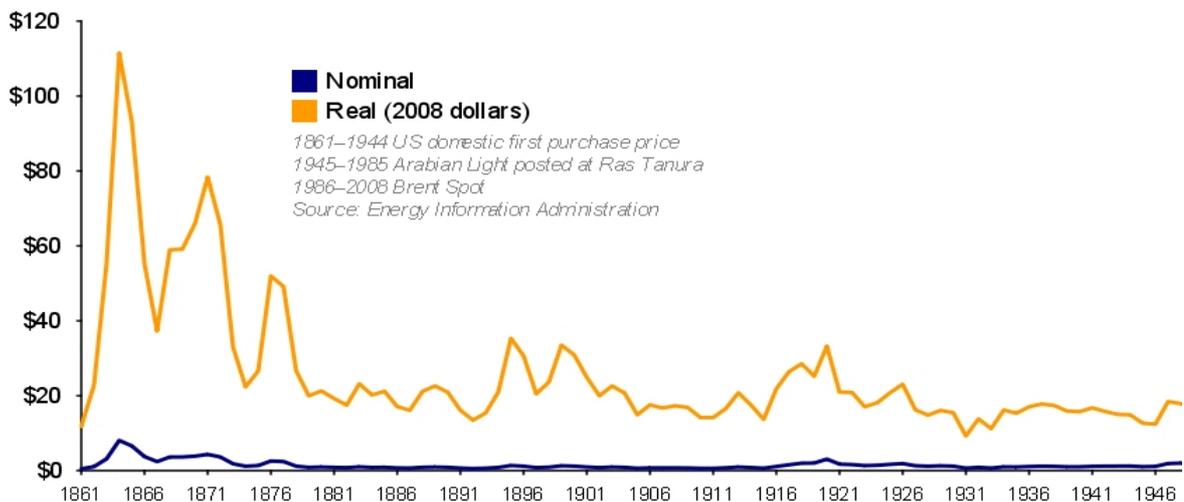


Chart 9: Long-term oil prices, 1861-1946 (orange line adjusted for inflation, blue not adjusted, source: EIA)

3.7.2 Oil price after the Second world war 1945-1972

When the Second World War ended situation in the world and mainly in Europe was miserable, most of the states were in ruins and Germany faced hyperinflation and besides that Germany was paying war reparations to the Allies. Basically whole world was in economic bust, therefore price of crude oil were low with downward sloping trend with several spikes. One of these spikes was when USA started war in Korea, which caused an increase in demand and rise in price to approx. 19 USD (2010 dollars)

¹⁷ Petroleum.cz

Next event which caused shortage in supplies was crisis in Suez channel in 1956, oil increased approx. 10%, but this was only short lasting situation. From 1958 prices were stable and relatively low, apparent reason was slowdown in US economy and partially influence of new technologies in drilling. In the year 1959 US president Eisenhower imposed new quotas on oil imported to protect home producers. Despite the fact that US prices remained relatively on the same level as they were before until 1973. On September 10–14, 1960 OPEC was established at the Baghdad Conference. At this time OPEC was solving mainly inter-organization problems and disputes rather than how to influence oil market. OPEC has gained more influence on oil price by cutting oil margin from oil companies, so final consumer price remained same. We can say that at this time OPEC was relatively weak organization even though some of member states have increased output. In the western world demand was high, but on the other hand there was abundance of new sources discovered in the North Sea, Siberia, Alaska and so on, obviously prices remained low till time of first oil shock.^{18 19 20}

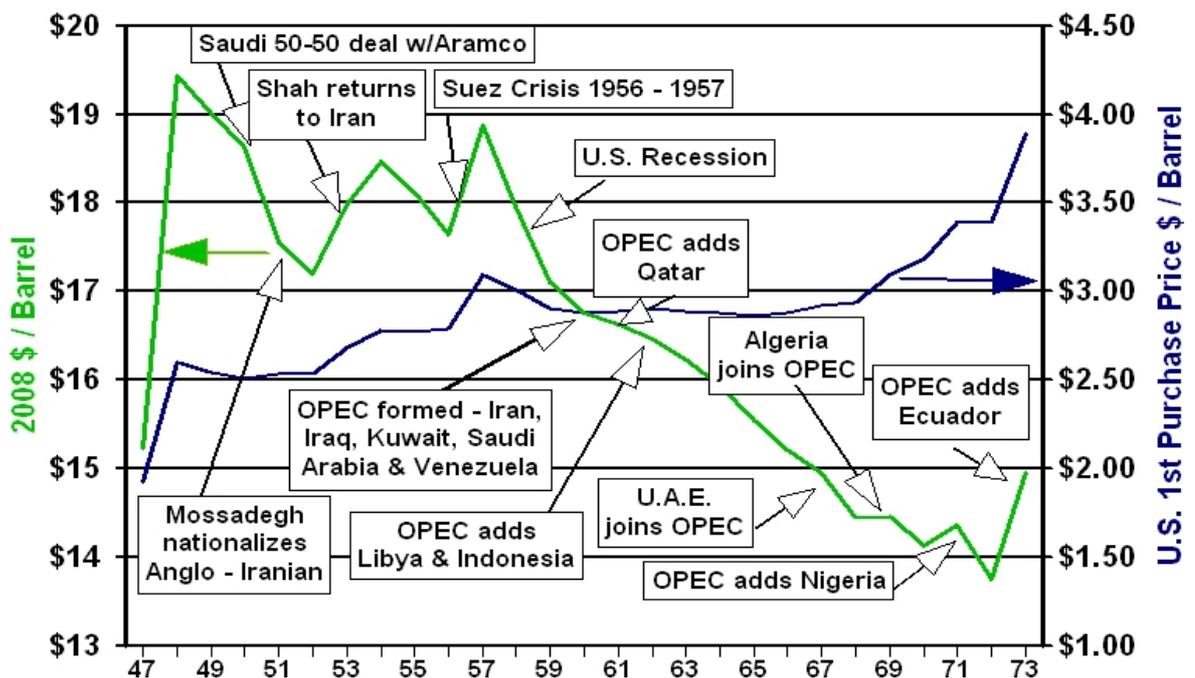


Chart 10: Oil prices 1947-1973, source: WTRG Economics

¹⁸ OPEC

¹⁹ WTRG Economics

²⁰ BBC, History

3.7.3 Oil shocks during 1973-1980 era

First oil shock was caused by reaction of Arab countries exporting oil and OPEC members to Yom Kippur War. The war was short, it took only during October 6 to 25, 1973. Parties involved were: Arabic countries, led by Syria and Egypt against Israel. Despite the short lasting of war, political consequence had a long lasting impact on the Middle East region. USA as traditional supporter of democracy stayed behind Israel with support on the political ground and army support too. Libyan leader Muammar Gaddafi and Saudi Arabia king threaten USA and UN because of supporting Israel. As a reaction for war and US and UN help OPEC imposed oil embargo for export to USA and Holland. Impact of the oil embargo was not that high, because some of the OPEC countries did not participate on it an USA had good sources of oil from other parts of world. What was higher on impact on crude oil price was decrease of output, which caused steep rise from 3 to 12 USD per barrel. *“Giovanni Serio of Goldman Sachs points out that in 1973 there was a severe supply shock because of the oil embargo, when the world had to cope with 10-15% less crude almost overnight.”*²¹

Second oil shock occurred during 1979 the Iranian revolution, which led to the war between Iran and Iraq. Whole oil export was badly harmed, and Iranian export share within OPEC was tiny. During this time price of oil soared from 35 USD to over (nowadays dollars) 70 USD per barrel. When peace was set in the Middle East, prices fell down to previous level before oil embargo, situation is graphically expressed in chart below this paragraph.²²

²¹ The Economist, 2008

²² WRTG ECONOMICS

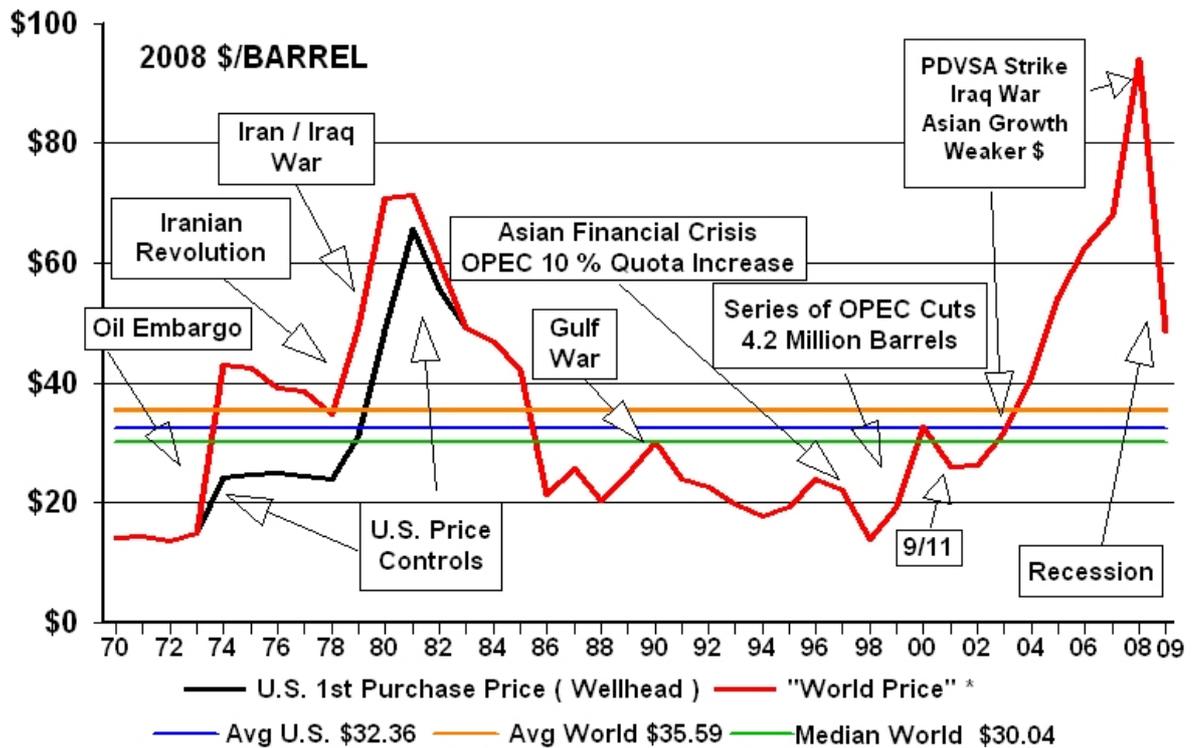


Chart 11: Oil prices 1970-2009, source: WTRG Economics

3.7.4 Situation after Iran–Iraq War till 2000

The period after second oil shock caused by conflict in Iran and Iraq was represented by downward trend and low prices of oil with several price spikes. At this time amount of oil produced was relatively high and OPEC cartel has set a new rule: Saudi Arabia can export only amount of oil as big as demand desires, which should lead to price stabilisation. What is important to mention is that oil has been traded on exchange market, The New York Mercantile Exchange (NYMEX) since year 1983. Brent crude oil was firstly traded in London on exchange called ICE in 1988. Since that exchange traded oil became more dependent on a market forces rather than OPEC price orders. However OPEC power remained in other possibilities such as: quotas and other limitations. Within Next few years oil remained low, apparently due troubles inside the cartel, situation has changed during 1987 when economic boom in USA boosted demand. Prices continued to rise with significant spike during 1990 when The Persian Gulf war begun. Prices soared nearly to 40 USD per barrel when Iraqi army seized Kuwait. Whole conflict last nearly one year and The US army left Iraq on November 1995, when operation desert storm ended. After the war prices fell back to 20 USD with downwards sloping trend and hit low in 1998. The

reason for this price dip was crisis in Asia, started in Thailand and its spread to neighbouring countries: Malaysia, Singapore, Indonesia, Philippines, South Korea and others. Crude oil demand had fallen and OPEC did not react to situation, and supplied same amount of oil, see chart below. This caused price dip which was multiplied by exploration of new oil sources in Azerbaijan.

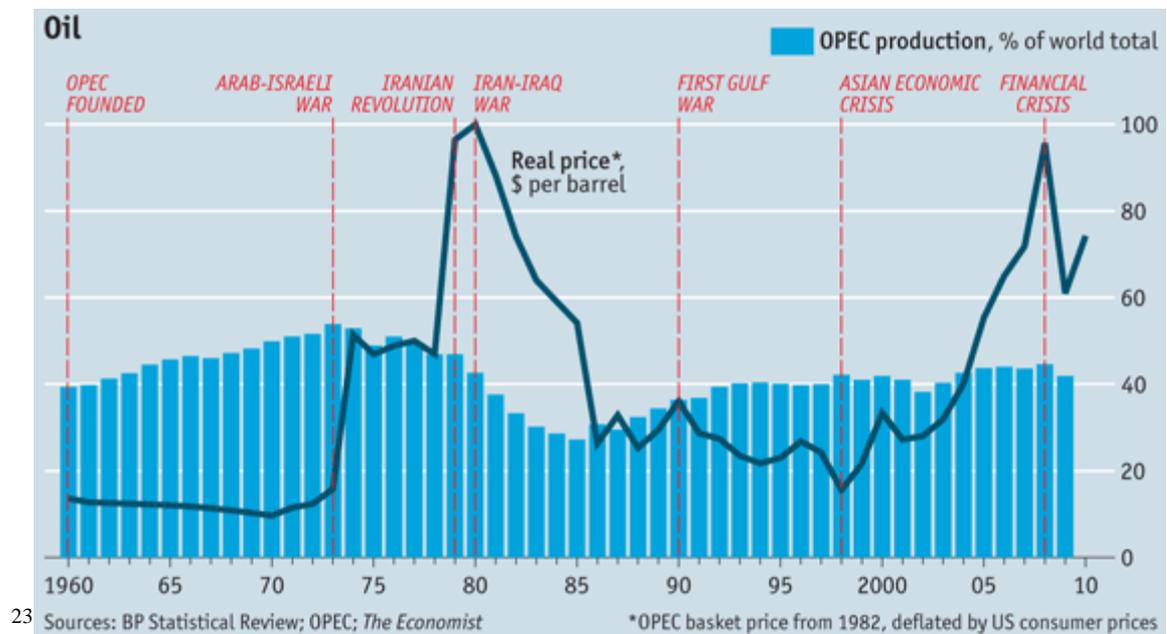


Chart 12: OPEC production 1960-2010, sources: The Economist, BP and OPEC

3.7.5 Situation After 2000

Last decade brought high volatility to oil price; USA faced terrorist attacks, war in Iraq, world financial crisis and other events. During this time oil has reached historical maximum- 147 USD per barrel. Terrorist attack on 9/11 brought political tension between western world and Arabic countries, oil became a political weapon. As a reaction to the terroristic attack USA started to seek for alternative supply from various regions, to get of dependence on Middle East imports. After attacks price reached low 19 USD and then it was steadily rising to hit peak during July 2008. Principal reason for this sharp rally was depreciation of US dollar, since 2001 USD Index (DXY) – 120 points and then it was steadily descending to hit low during 2008- 70 points, most likely caused by modest monetary policy of FED. When USA started conflict in Iraq in 2003, oil supplies decreased

²³ CIA, The World Factbook

and oil price obviously rose and moreover demand from China, India and other developing countries was increasing. Those factors pushed prices even higher. Prices steadily increased until first problems revealed on US mortgage market, which was a spark to start up financial slump, which spread to the entire world.

The world financial crisis has started during 2007; however it should be pointed out that roots of the crisis are much older problem caused mainly by low interest rates, which caused that mortgages were available for people unable to take loan in before change in interest rates. Most of the people expected that properties will rise in price continuously, later on when interest rates were increased; people were unable to pay loans back to creditors and this caused massive sell off of properties originally owned by debtors. Whole situation caused decrease in house prices and this caused troubles to banks and mortgage firms. Those high losses caused lack of money and bank needed loans for themselves, but inter-bank market was almost unable to provide loans.

Whole situation was turned to a domino effect, which caused bankruptcy of several financial firms such as: Bear Stearns, Merrill Lynch and Lehman Brothers. *American International Group (AIG). Troubles in that unit have forced the government to bail out the giant insurer, so far to the tune of \$173 billion.*²⁴

Situation spread to the rest of the world and lot of banks were saved by governments and situation caused crash on the financial markets, so commodities obviously reacted. Situation was serious, world economy slowed and fell to recession, and demand for oil fell. Whole industries were paralysed; mainly car industry and this caused that demand for oil was even lower. Oil reached its low, 38USD in December 2008 and remained low during spring 2009. In June 2009 it pulled back to the level of 70 USD as the world economy was recovering and then price fluctuated around level of 75 USD till 2010 when it reached 100USD and continued in uptrend, partially driven by higher demand and tensions in the Middle East region. *The Middle East and North Africa produce more than one-third of the world's oil. Libya's turmoil shows that a revolution can quickly disrupt oil supply. Even while Muammar Qaddafi hangs on with delusional determination and Western countries debate whether to enforce a no-fly zone, Libya's oil output has halved, as foreign workers*

²⁴ The Economist, 2009

flee and the country fragments. The spread of unrest across the region threatens wider disruption. The price of Brent crude jumped 15% as Libya's violence flared up, reaching \$120 a barrel on February 24th. But the promise of more production from Saudi Arabia pushed the price down again. It was \$116 on March 2nd—20% higher than the beginning of the year, but well below the peaks of 2008. Most economists are sanguine: global growth might slow by a few tenths of a percentage point, they reckon, but not enough to jeopardise the rich world's recovery.^{25, 26, 27, 28}



Chart 13: crude oil price, FTSE 100, Dow Jones index and historical events, sources: FT and FED, Author

3.7.6 Conclusion from history prices analysis

There are many factors influencing development of crude oil price, however the most influencing factor is stage of the economic cycle. If the world economy is in boom stage then oil price is usually rising and when there is a bust in economy price is decreasing. Special issues are conflicts, when this situation occur price react by steep rise. Next factor found is technology and technology development, initially during early years of gaining oil, new invention such as usage of petroleum or car industry boom caused increase in price and rise and after Second World War new oil fields explored caused decrease in

²⁵ The Economist, 2011

²⁶ Bank of England

²⁷ FED

²⁸ FED of ST. Louis

price. In future new technology of alternative resources and less consuming cars may cause decrease in price. Last issue from analysis is influence of OPEC cartel, from the analysis was concluded that: OPEC has influence on prices, however price is more driven by other factors, hence only sharp decrease/increase or embargo on output can affect oil price.

4 Case study: Impact of crude oil price on the world economy

Economic factors connected with growth and momentum of the biggest economies and emerging markets has great influence on crude oil. The aim of this chapter is to analyze and measure influence of macroeconomic factors and relationship with crude oil. In the first part is comparison of world real GDP (*“The monetary value of all the finished goods and services produced within a country's borders in a specific time period, though GDP is usually calculated on an annual basis. It includes all of private and public consumption, government outlays, investments and exports less imports that occur within a defined territory.”*)²⁹ and crude oil consumption. Following analysis is focused on several states and last analysis is calculation of correlation between USD index and crude oil price.

4.1.1 The world economy

Comparison of world economy and crude oil was done on the basis of world real GDP based on purchasing power parity (PPP, *“An economic theory that estimates the amount of adjustment needed on the exchange rate between countries in order for the exchange to be equivalent to each currency's purchasing power.”*)³⁰, which should provide aggregate performance of world economy during some time phase.

For research is used statistical method-correlation, *“In statistics, the degree of association between two random variables. The correlation between the graphs of two data sets is the degree to which they resemble each other. However, correlation is not the same as causation, and even a very close correlation may be no more than a coincidence.*

²⁹ Investopedia.com, 2011

³⁰ Investopedia.com, 2011

Mathematically, a correlation is expressed by a correlation coefficient that ranges from -1 (never occur together), through 0 (absolutely independent), to 1 (always occur together)³¹

Calculation itself is a correlation of proportional annual growth of GDP and proportional annual growth of crude oil consumption. Calculation is based on relatively long time period (1971-2009), hence it is should reflect realistic image of world GDP during time without influence of deviations.

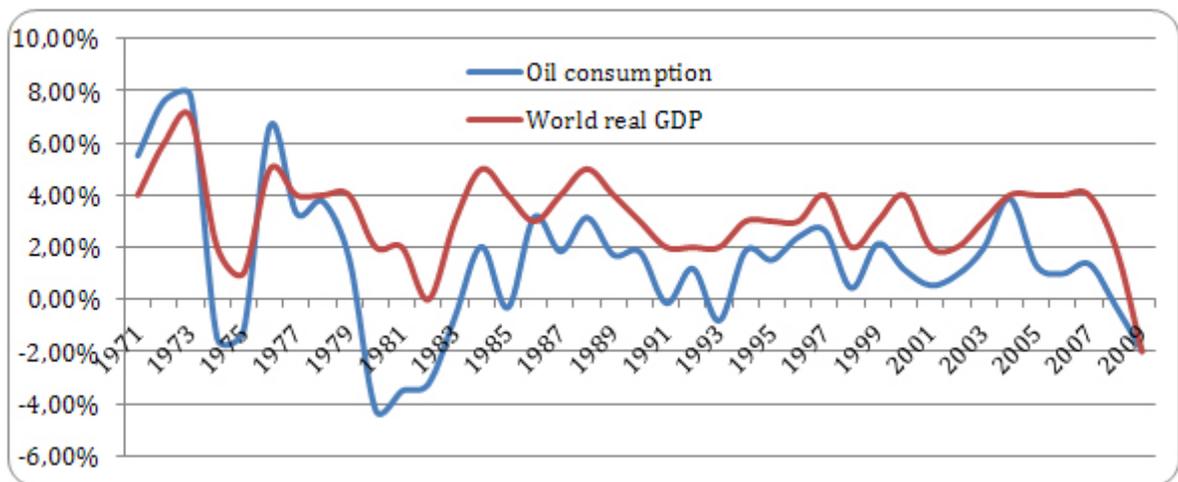


Chart 14: Oil consumption and World real GDP, data World Bank and BP, Author

For the calculation a statistical program “GRET” was used and the outcome of the analysis is that relationship between world GDP and oil consumption is highly correlated, exact number is R is 0,779743548. That means, if result is -1 there is no correlation at all and if result is 1 , means perfect correlation. Hence, result obtained 0,77 means high correlation, which is obvious from the chart above, where oil consumption curve almost copy trajectory of world GDP curve.

Another result of calculation is equation of correlation between oil consumption and world GDP ($-0.0268 + 1.31 \cdot \text{GDP}$) and on the basis of this equation we can theoretically predict

Chart 15: Oil consumption and World real GDP, Author
Data: World Bank and BP, Author

GDP %	Consumption %
1	-1,37
2	-0,06
3	1,25
4	2,56
5	3,87
6	5,18

that: if world GDP will increase by 1%, consumption will remain negative (-1,37%) and so on.

Reason for this relationship is the high usage of oil and oil based products in all the sectors of economy. Consequently when world GDP is increasing oil consumption should follow the trend of GDP. Next part of this chapter is focused on situation in 3 top economies in the world USA, China and Japan. USA and Japan is representing high GDP countries with large consumption of oil and China can be seen as a developing economy with high consumption and high GDP and high annual growth (last year China begun second largest economy in the world and most of current estimates claims that USA will be overtaken by Chinese economy in next decade).³²

4.1.2 US economy

United States of America is currently the biggest and most developed economy and one of the most influential countries in many ways such as political power, trade volume, stock market allocation and so on. USA is represented by huge GDP and enormous oil consumption(18686 thousands of barrels per day) – highest in the world (US share on world GDP is around 25% and oil consumption share is around 23% according to BP) however their production is lower than consumption, hence they import approximately more than 10-11 thousands of oil barrels per day.³³ Calculation of correlation of US real GDP and oil consumption of crude oil was similar to previous calculation.

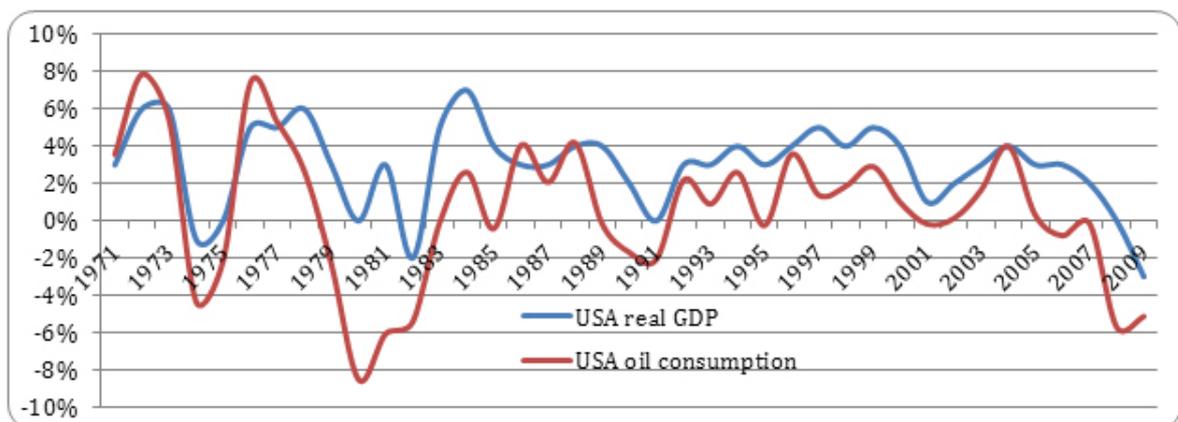


Chart 16: Oil consumption and US real GDP, data World Bank and BP, Author

³² The Economist, 2010

³³ BP annual report 2010

From the chart it is apparent that GDP have been positive since 1982 economic crisis with several dips and spikes during other smaller economic troubles such as the one in 2000, when Technological bubble has burst. The most significant dip is current economic slump-when the US economy slowed, therefore GDP declined and consumption followed it. Outcome from the correlation analysis is: coefficient of correlation 0,767, which indicates high correlation between consumption of oil and GDP. However according to latest development, USA is trying to decrease oil consumption and boost economy. This may disrupt future validity of correlation calculated.

4.1.3 Chinese economy

China is one of the fastest growing economies around the globe in last decade. Chinese rising power is not just because their massive population 1,3 billion, its due to huge trade with entire world and their investments. China is consuming huge amount of energy. China is extracting 3790 thousands of barrels per day and Chinese consumption is 8625 thousands of barrels per day, that means deficit 4835 thousand barrels of oil per day.³⁴ Which is causing big demand and China is net importer of crude oil. Reckons claims that Chinese consumption will doubled till end of 2030.³⁵

The result of calculations are made on correlation between Chinese real GDP and consumption is 0,24 which indicates only partial relationship, which means that consumption of oil in China is only slightly dependent on GDP. Reason for this can be share of oil consumption and other sources of energy. Main source in China is from coal.

³⁴ BP annual report 2010

³⁵ The Economist, 2010

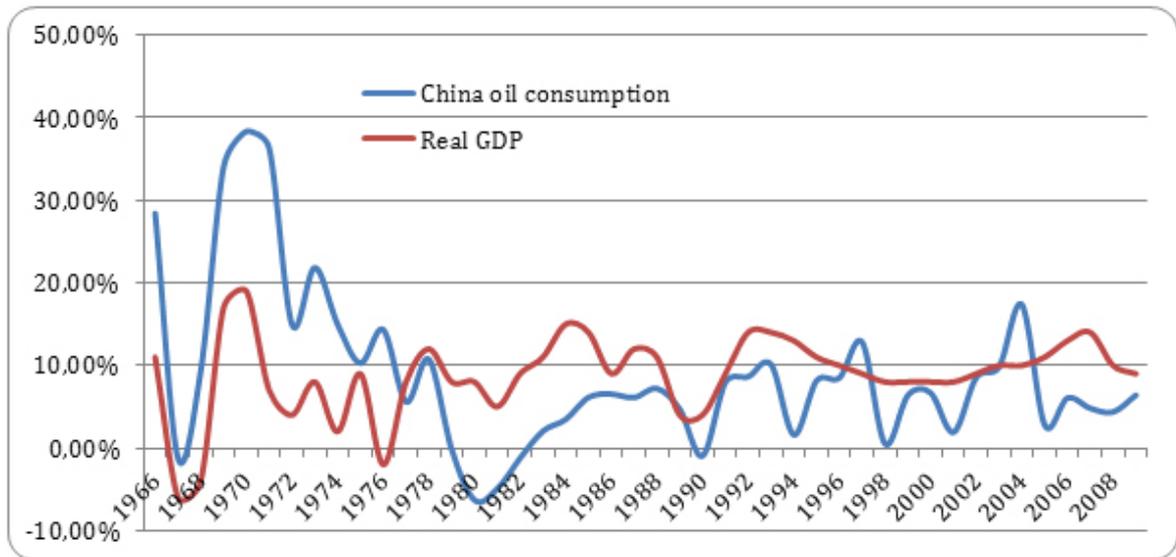


Chart 17: Oil consumption and China real GDP, data World Bank and BP, Author

4.1.4 Japanese economy

Japan with population only 126 million people is currently 3rd economy in the world by nominal GDP and one of the most developed countries.³⁶ Japanese economic miracle has been booming since Second World War and now Japan is member of G7 and other prestigious and influential organizations. Because of Japanese economy development and efficiency their consumption of crude oil is 4th in the world and daily consumption is 4396³⁷ thousand barrels per day. Japan has only tiny reserves of oil and therefore it is forced to import huge amount of oil.

“Japan imports 99% of its oil (compared to the U.S., which imports 50%). It is one of the world’s largest net oil importers. Japan’s lack of domestic sources of energy, and its need to import vast amounts of crude oil, natural gas and other energy resources, makes it particularly sensitive to changes in oil prices. Japan also lacks the flexibility to switch to nuclear power because it is a huge net importer of uranium for its nuclear power plants. In 2003, the country’s dependence on imports for primary energy stood at more than 79%. Oil provided Japan with 50% of its total energy needs, coal with 17%, nuclear power 14%,

³⁶ CIA The world fact book

³⁷ BP annual report 2010

natural gas 14%, hydroelectric power 4%, and renewable sources a mere 1.1%. Therefore, when oil prices skyrocket, the Japanese economy suffers.”³⁸

From the calculation is obvious that relationship between oil and real GDP is highly correlated, coefficient of correlation is 0,754 what is apparent even from chart itself.

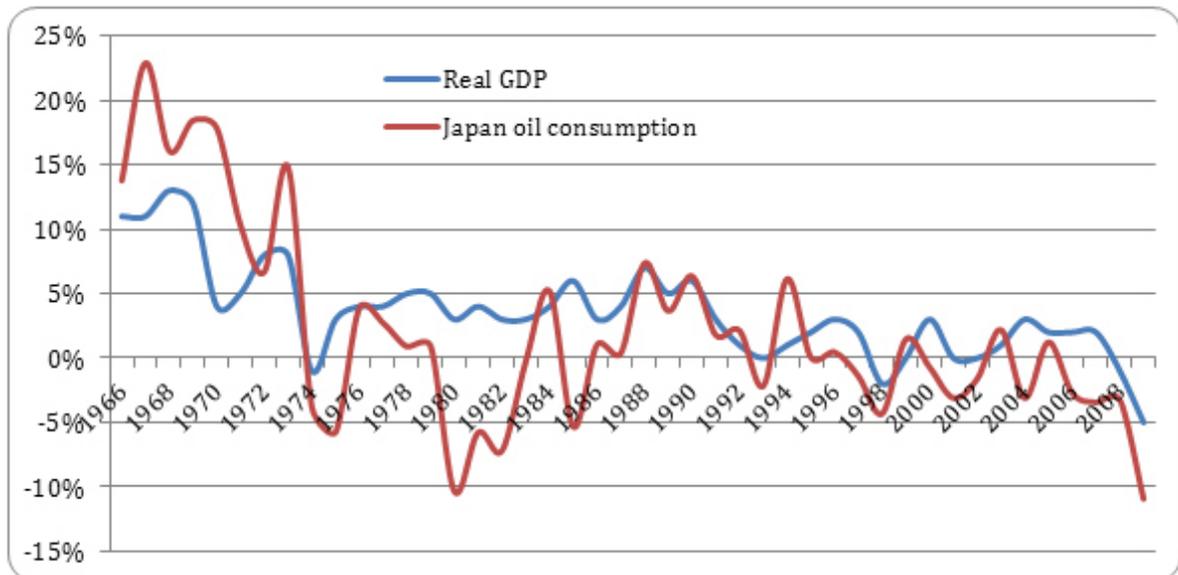


Chart 18: Oil consumption and Japan real GDP, data World Bank and BP, Author

4.1.5 German economy

In the recent ranking Germany is on 4th place in the nominal GDP and on the 1st place in Europe due to high exports of manufacturing products, cars and other high tech goods. Due to energy demanding production Germany is consuming 2422 thousands of barrels per day however their production is only small and most of the oil consumed is imported through Russian pipelines. ³⁹

German GDP has been rising since Second World War, when Germany was in ruins and post war transformations has escalated to today's strong position. Average annual growth of GDP was 1,5%, the only significant dip has occurred during contemporary financial

³⁸Forexonlinelearning.com

³⁹ BP annual report

crisis.⁴⁰ Conclusion from correlation analysis is that, coefficient of correlation is only 0,446 and probable reason can be proportion of oil consumed in Germany in dependence on other energy sources. Oil consumption is only about 33% and Germany is one of leading states in usage renewable sources.⁴¹

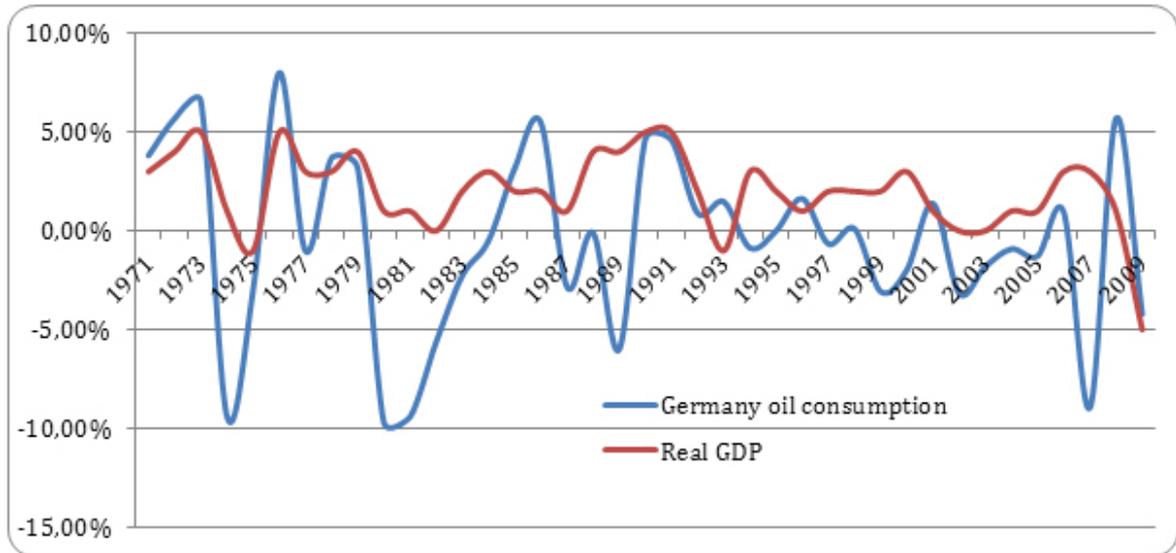


Chart 19: Oil consumption and Germany real GDP, data World Bank and BP, Author

4.1.6 US dollar and crude oil price

The value of the US dollar has one of the greatest influences on oil, since oil and most of the commodities are traded in US currency. In other words when US dollar has high value on the foreign exchange market- USD is appreciating then usually price of oil responds by decrease. Naturally when US dollar is low then price of oil is high, according to calculation of dependence there is high negative correlation -0,824 which is validating this theory. Obviously this equations can be used only during normal times, when there is not some another factor such as lack of supply, geopolitical trouble or war it does not matter how valuable is US dollar at this moment.⁴²⁴³See chart below.

⁴⁰ Eurostat 2011

⁴¹ European Nuclear Society

⁴² Commodity Derivatives : Markets and Applications

⁴³ The ICE

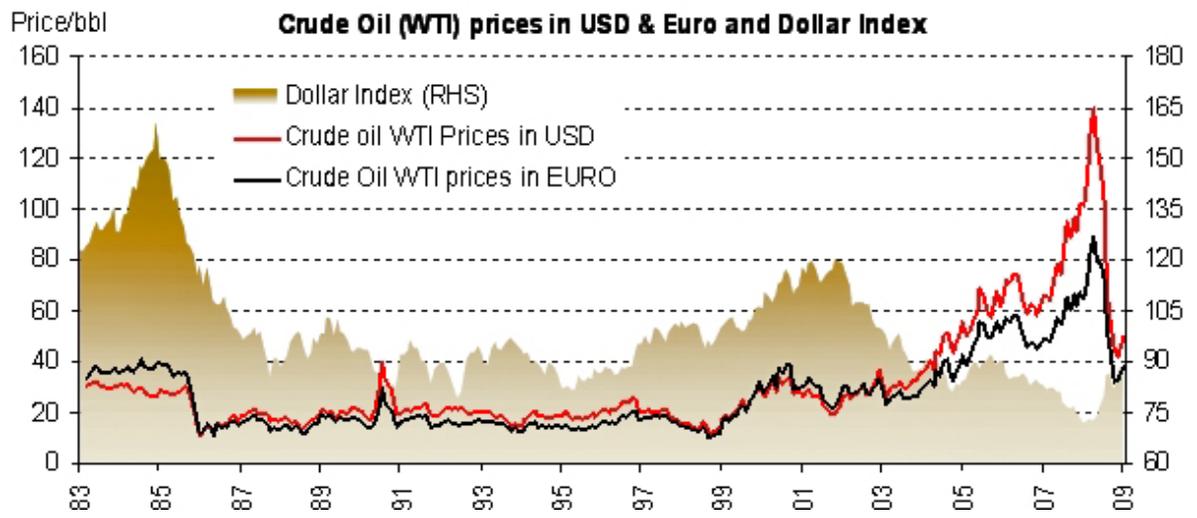


Chart 20: Oil prices and USD index (DXY), sources: NYMEX, ICE

5 Conclusion

The main aim of this thesis was to analyze oil market and how is the world economy affected by the oil prices.

After a detailed analysis of historical development since the early years of oil production until the current problems in the Middle East, especially in Libya, Egypt and Bahrain, furthermore, the degree of correlation between world real GDP and oil consumption and the correlation between the USD and oil prices has been analyzed as well. The conclusion is that: especially large impact on the oil market and world economy has the development of the global economy itself, especially, when the world economy is in a phase of boom or slump. We can say that if the world economy doing well, demand for oil increases, which pushes up oil price and vice versa. This trend was particularly obvious in the research of U.S. and Japanese economies, which are strongly dependent on oil imports. However, further examination of the economy, especially China, for which the correlation of GDP and oil consumption is not so significant, apparently in the future China will depend more on imported oil than now, which is supported by the evidence from consumption figures. A similar situation is also obvious in other emerging economies. Opposite example could be the German economy, which seems to be less dependent on oil and this trend is probably due to the use of modern technologies of renewable energy sources and efforts to reduce consumption.

The relationship between the U.S. dollar and how the stock market fluctuations affect the price of oil on the stock exchange was also examined. From that, it appeared that, the relationship between oil and U.S. dollar is almost exactly the opposite. Therefore when, the price of the dollar is rising oil prices decline. This relationship is not only for oil but also related to other commodities traded in U.S. currency. Among other factors, economic factors, which have a large impact on the price of oil, are factors of technological, geopolitical, wars, natural disasters, OPEC cartel resolutions and speculation on market trends. These factors are almost impossible to predict when will they occur. Historical research shows that those factors have always strongly affected the development of markets for oil and hence the entire world economy. In particular, it has caused a great influence of the war on the history of the Middle East, where it is extracted about 42% of world oil. Probably the best known is the oil shock of 1973. Furthermore, we noted that technological advances in the early days of mining reduced the price of oil and the

beginning of the automobile increased it on the contrary, and later influenced the cost by reducing the costs of extraction, and so on. Overall, the price of crude oil and petroleum market move modern world and without oil and oil products nearly every industry and service would stop.

We can therefore predict that world consumption will rise as the global economy will thrive, and also due to growth in the number of people living on this planet and that the whole world is not just the developed West, but also developing countries have increasingly bigger impact on the world economy and the price of oil.

6 List of abbreviations

b/d: Barrels per day

Mb/d Million barrels per day

WTI: West Texas intermediate oil

GDP: Gross domestic product

PPP: Purchasing power parity

USD: US dollar

BP: Former British Petroleum Company

OPEC: The Organization of the Petroleum Exporting Countries

UK: The United Kingdom

NYMEX: New York Mercantile Exchange

EIA: Energy Information Administration

IMF: International Monetary Fund

WB: World Bank

WTO: World Trade Organization

IEA: Information Energy Agency

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