



**Hungarian University of Agriculture and Life Sciences**

# Analysing of the Impacts of the Fluctuation of Crude Oil Price on Certain Economic Indicators

The Thesis of the PhD dissertation

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Ghazala Omar Mohamed Othman

Gödöllő, Hungary

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# Hungarian University of Agriculture and Life Sciences

**Name of Doctoral School:** Doctoral School of Economic and Regional Sciences

**Discipline:** Management and Business Administration

**Head of Doctoral School:** **Prof. Dr. H.c. Popp, József, DSC**  
Corresponding member of the Hungarian Academy of Sciences  
MATE,  
Institute of Economic Sciences

**Supervisor:** **Dr. Szira, Zoltán PhD**  
associate professor  
MATE,  
Institute of Business Regulation and Information Management

.....  
**Approval of Head of Doctoral School**

.....  
**Approval of Supervisor**

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# **1. BACKGROUND OF THE WORK AND ITS AIMS**

## **1.1. Introduction**

In this time of global market uncertainty the world requires energy in increasing quantities. Energy, which is required in all aspects of life, is critical to a country's development. Countries must use energy efficiently in order to compete on a global scale and ensure long-term development. Energy-efficient countries are successful economically and lead the competition field. Over the last few centuries, the availability of energy has changed the course of humanity. New sources of energy – fossil fuels first, followed by nuclear diversification and hydro power, and renewable technologies have been unlocked.

Currently, almost all aspects of life depend on oil extraction. The present world is centred on oil, which has been the driver of world economy for many years and, at present, it cannot entirely be replaced. Crude oil is also considered as a commodity asset, whose price is a case of concern for many investors, which transforms this physical asset into a sophisticated financial product.

Crude oil prices, like most other commodities in the market, have routinely experienced wild price swings alternating between periods of great scarcity, high demand, and high prices and periods of oversupply, low demand, and depressed prices. These so-called crude oil “Price Cycles” can last several years, depending on factors such as oil demand, the volume of oil drilled, processed, and sold by the major producers, and so on. These price swings have been triggered by economic and political events, technological advancements and changes within the petroleum industry, and continue to influence prices in the present day.

A drop in oil prices should result in lower transportation and fuel costs for businesses. Consumers will also benefit from lower transportation and fuel prices. Lowering oil prices will effectively increase their disposable income, allowing them to spend more on other goods. Because oil is the most traded commodity and has a significant impact on global transportation costs, it should cause inflation and may result in higher rates of economic growth.

However, oil prices can fall when there is a fear of an economic downturn. In this case, falling oil prices are insufficient to boost economic growth because other factors are holding it back. Furthermore, if oil prices fall sufficiently, some oil companies may go out of business, resulting in an increase in bad debts. The drop in oil prices in 2020 is a sign of an impending economic downturn, and prices have fallen so far that many oil companies will be forced out of business, resulting in job losses and reduced investment.

Lowering the cost of living is aided by lower oil prices. Particularly if a household owns a car or uses other forms of oil-powered transportation. To a lesser extent, lower transportation costs should result in lower prices for all goods.

This decrease in the cost of living is especially important when real wage growth is low, as it has been in recent years. A drop in oil prices is essentially a free tax cut. In theory, a drop in oil prices could lead to increased spending on other goods and services, increasing real GDP.

A decrease in demand for oil was expected with lower global GDP. If the oil price fall is long-lasting, the economy will be affected more strongly because consumers react more strongly to permanently lower prices. However, the impacts on global economy do not only depend on the temporary or long-lasting nature of low prices but also on what causes oil prices to fall. It can be reduced demand for oil or an increased supply of oil. The volume of impacts also depends on to what extent countries are able to adjust their fiscal and monetary policies as a cure for price decreases.

A significant increase in oil prices will contribute to higher inflation. This is due to rising transportation costs, which will result in higher prices for many goods. This is cost-push inflation, as opposed to inflation caused by rising aggregate demand/excess growth.

Consumers' discretionary income will be reduced. They face higher transportation costs but do not benefit from rising incomes. Higher oil prices can slow economic growth, which is especially problematic if consumer spending is low.

## **1.2. Problems to solve and the research questions**

The empirical question of how the oil price (volatility) affects growth indicators has continued to elicit contradictory responses from economists. On the one hand, some argue that fluctuations in oil prices boost output, thereby driving growth; on the other hand, others argue that price fluctuations will reduce output, thereby impeding growth.

Increases in oil prices are generally thought to increase inflation and slow economic growth. In terms of inflation, oil prices have a direct impact on the prices of goods manufactured with petroleum products. As previously stated, oil prices have an indirect impact on costs such as transportation, manufacturing, and heating. Increases in these costs can have an impact on the prices of a wide range of goods and services, as producers may pass on production costs to consumers. The extent to which increases in oil prices lead to increases in consumption prices is determined by how important oil is for the production of a given type of good or service.

Increases in oil prices can also stifle economic growth by influencing supply and demand for goods other than oil. Increases in oil prices can reduce the supply of other goods by raising the costs of production. High oil prices, in economic terms, can shift up the supply curve for the goods and services that use oil as an input.

Despite these effects on supply and demand, the relationship between rising oil prices and economic downturns is not perfect. Not every significant increase in oil prices has been followed by a recession.

Low growth, high unemployment, and high inflation characterized the two large oil shocks of the 1970s. It's no surprise that changes in oil prices have been identified as a significant source of economic volatility.

Despite the large amount of papers on oil prices and macroeconomic indicators, the majority of the literature has been devoted to the study of the dynamics in oil-importing industrially developed economies. One of the reasons I have chosen this topic for my dissertation is because there is only a small number of studies which have been devoted to developing countries and oil exporting countries in relation to inflation, unemployment, household consumption, CO<sub>2</sub> emission and GDP growth.

The second reason I have decided to write about this problem, because I wanted to verify or reject former studies indicating that the link between oil price and key macroeconomic has been weakening.

Based on the above reasons I have formulated my research questions as follows:

- 1. What is the relationship between oil price and inflation rate in oil exporting countries, OPEC countries and major EU countries?**
- 2. What is the relationship between oil price and unemployment rate in oil exporting countries, OPEC countries and major EU countries?**
- 3. What is the relationship between oil price and household final consumption expenditure in oil exporting countries, OPEC countries and major EU countries?**
- 4. What is the relationship between oil price and CO2 emission in oil exporting countries, OPEC countries and major EU countries?**
- 5. What is the relationship between oil price and GDP growth in oil exporting countries, OPEC countries and major EU countries?**
- 6. Do oil price fluctuations have a different impact on the economy of oil exporting and oil importing countries?**

Based on my hypotheses I wanted to answer this question with supported data analysis

- 7. Did the link between oil prices and key macroeconomic indicators deteriorate over the last decade?**

Based on my own analysis I was curious whether my results would support scientific literature on the weakening link.

The objective of the dissertation is to answer those research questions and examine oil price changes and their effect on economic development on the world. It will analyse the relationship between oil prices changes and inflation, unemployment, household final consumption expenditure, CO2 emission and GDP growth in different country groups. It is assumed that

oil prices strongly influence the economy of net oil exporting countries while little or no influence can be detected on the economy of net oil importing countries. In order I could answer my research questions I have defined my hypotheses as follows:

### **1.3. The hypotheses**

In order I would be able to answer my research questions I have defined my hypotheses

**Hypothesis 1: There is a positive linear relationship between oil price and inflation rate. Falling oil prices decrease inflation rate in oil exporting countries, OPEC countries and major EU countries.**

**Hypothesis 2/A/: There is a negative linear relationship between oil price and unemployment rate in oil exporting and OPEC countries.**

**Hypothesis 2 /B/: There is a positive linear relationship between oil price and unemployment rate in major EU countries.**

**Hypothesis 3: There is a negative linear relationship between oil price and the final consumption expenditure of households in oil exporting, OPEC and EU countries.**

**Hypothesis 4: There is a negative linear relationship between oil price and CO2 emission in oil exporting, OPEC and major EU countries.**

**Hypothesis 5/A/: There is a positive linear relationship between oil prices and the GDP growth of oil exporting and OPEC countries.**

**Hypothesis 5/B/: There is a negative linear relationship between oil prices and the GDP growth of major EU countries**



## **2. MATERIALS AND METHODS**

### **2.1. The methodology of the research**

As my research topic completely data-oriented I have selected quantitative secondary research method for my analysis.

In the dissertation I primarily sought answers to my hypotheses and targeted the 5 hypotheses by analysing them with different statistical indicators. The data used in the research were collected from several international statistical public databases. British Petrol publishes the Statistical Review of World Energy for the previous period each year, and I used the 2019 issue. Another large group of data collection was made from the World Development Indicators (WDI) database. This database is the premier compilation of the World Bank. The database contains 1,600 time series indicators for 217 economies and more than 40 country groups, with data for many indicators going back more than 50 years, it is the most accepted database because it works with various indicators requested from countries. This information is public and can be queried in many ways. Some sections contain ready-made statistical indicators, while others collect data from 1968 onwards. The database also uses graphical representations, which were also used to test some hypotheses. As both publications and sources are based on internationally accepted and secured data, I have fulfilled the requirement of reliability of the research. The WDI database is based on the conversion to the 2010 US dollar, so my research also met the criteria of objectivity.

### **2.2. Geographical factors in the analysis**

When selecting the countries to be included in the research, my goal was to include countries that are well representative of the given groups and find data for each hypothesis. To answer the questions in the hypotheses I selected 27 countries and categorized them into 3 country groups.

Country group 1. /selected oil exporters/

I selected the largest oil exporting countries in my research that are not members of the other two groups of countries. Significant factor was to

choose not only developed but also developing countries, preferably from different continents. It was important that the proportion of the population should also be heterogeneous. I used GDP per capita values.

Country group 1 includes:

Brazil, Canada, China, People's Republic, Colombia, India, Mexico, Norway, Russia, United States

Country group 2. /selected OPEC countries/

The Organization of the Petroleum Exporting Countries (OPEC) is a group of 13 major oil-exporting countries. OPEC was established in 1960 to coordinate its members' petroleum policies and to provide technical and economic assistance to its members.

Country group 2 includes:

Algeria, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar Saudi Arabia, United Arab Emirates

Country group 3. /selected EU countries/

The third group that I have involved in the research is the EU countries. I chose these countries because I compared population and GDP values from the other countries involved in the research. It was also important to select EU countries that were preferably founding countries or joined earlier, as this would ensure that the data could be found in the WDI database for each country. The development of the former Eastern countries and its dynamism differ from that of the founding countries and thus I examined more stable countries.

Country group 3 includes:

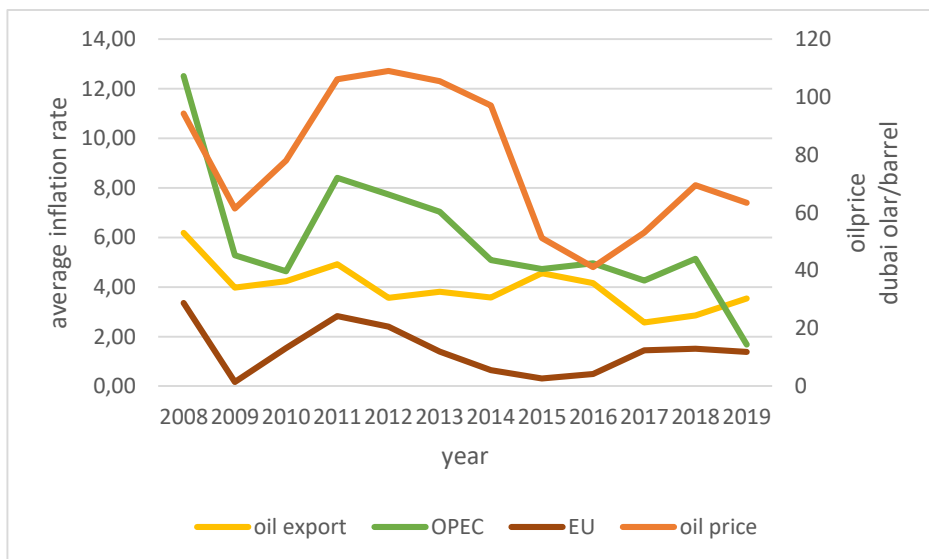
Belgium, Denmark, France, Germany, Ireland, Italy, Luxemburg, Netherlands, United Kingdom

### 3. RESULTS AND DISCUSSION

#### 3.1. The analysis of the relationship between oil price and inflation rate

**H1: There is a positive linear relationship between oil price and inflation rate. Falling oil prices decrease inflation rate in oil exporting countries, OPEC countries and major EU countries.**

If we examine the average rate of inflation in the 3 regions and the relationship between oil prices over time, (Figure 1) we can see that the development of oil prices (orange), shows similarities to OPEC and EU countries, while in the case of oil exporting countries this observation is not valid.



**Figure 1: Oil price and inflation rates of examined country groups from 2008 to 2019**

**Source: Author's own editing based on WDI**

In the next phase I examined the correlation between the inflation average of the three country groups and the changes of oil prices (Table1). The average inflation of the OPEC countries ( $r = 0.608$ ) and the average of the

EU countries ( $r = 0.643$ ) ( $p = 0.05$ ) can be considered a relatively strong relationship according to Pearson's correlation. However in the case of oil exporting countries this relationship is weak ( $r = 0.263$ ,  $p = 0.05$ ). Pearson's correlation can be detected and considered positive in all cases, the relationship is not strong for oil-exporting countries.

**Table 1: Correlation coefficient in relation to average inflation of examined country groups and oil price.**

		oil price	oil export	OPEC	EU
oil price	Pearson Correlation	1	,263	,608*	,643*
	Sig. (2-tailed)		,409	,036	,024
	N	12	12	12	12
oil export	Pearson Correlation	,263	1	,711**	,437
	Sig. (2-tailed)	,409		,010	,155
	N	12	12	12	12
OPEC	Pearson Correlation	,608*	,711**	1	,724**
	Sig. (2-tailed)	,036	,010		,008
	N	12	12	12	12
EU	Pearson Correlation	,643*	,437	,724**	1
	Sig. (2-tailed)	,024	,155	,008	
	N	12	12	12	12

\* Correlation is significant at the 0.05 level (2-tailed).

\*\*Correlation is significant at the 0.01 level (2-tailed).

**Source: Author's own editing based on WDI**

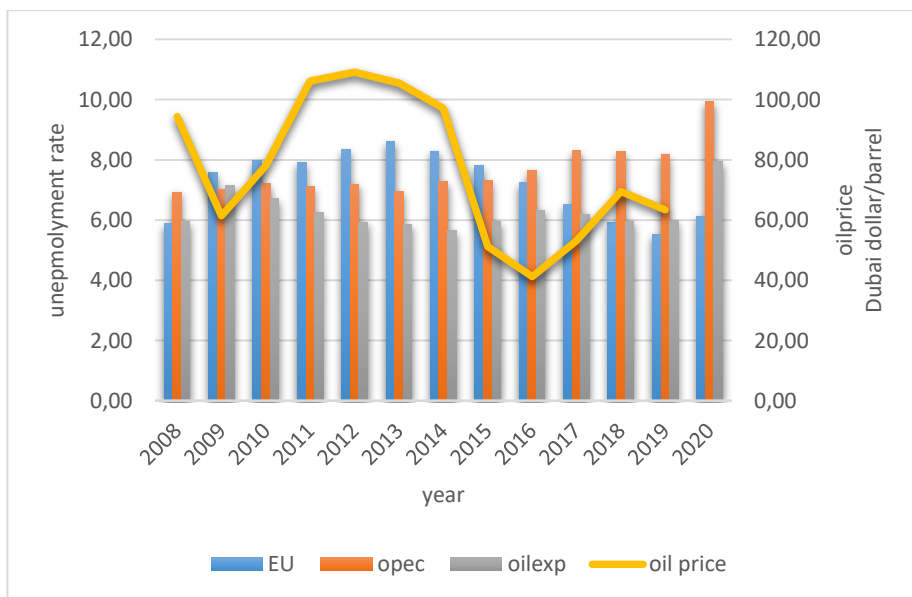
I confirmed my hypothesis that there is a linear relationship between oil price and inflation rate. Falling oil prices decrease inflation rate in oil exporting countries, OPEC countries and major EU countries. The relationship is present on a different level, the most significant in the case of OPEC countries and EU countries, in the case of major oil exporting countries the relationship is not significant.

### 3.2. The analysis of the relationship between oil price and unemployment rate

**H2/A/:** There is a negative linear relationship between oil price and unemployment rate in oil exporting and OPEC countries.

**H2 /B/:** There is a positive linear relationship between oil price and unemployment rate in major EU countries.

I compared the different types of countries with the change in oil prices. Figure 2 shows that oil prices and unemployment rates seem to move in opposite direction in oil-exporting countries, while in the case of EU and OPEC countries the two indicators seemingly follow each other.



**Figure 2: Oil price and unemployment rate in each examined country group from 2008 to 2019**

**Source: Author's own editing based on WDI**

I examined the relationship between unemployment rate of each country group and oil prices. I performed a correlation analysis with the SPSS program. As shown in Table 3, examining the hypothesis, I was able to

show correlations between the unemployment rate and the change in oil prices. The tests were satisfactory as they reached the 95% correlation level, so I accepted the hypothesis.

The examined relationship is stronger on the basis of statistical indicators than I first assumed. For the EU countries, the correlation value was 0.430 ( $p = 0.05$ ). We can say there is a correlation between the rise in oil prices and the change in the unemployment rate. This relationship is detectable, not significantly strong or weak. In contrast, in the case of oil exporting countries, as I stated in my hypothesis, is the opposite - 0.366 ( $p = 0.05$ ), the relationship is the opposite, but weaker than in the case of the EU countries. My hypothesis was confirmed that rising oil prices would reduce unemployment in oil-exporting countries. This relationship is even stronger in the OPEC countries, where the Pearson's correlation rate is  $r = -0.571$  ( $p = 0.05$ ), which means a significant opposite relationship.

**Table3: Correlation between the unemployment rate of examined country groups and oil price**

		EU	opec	oilexp	oil price
EU	Pearson Correlation	1	-,653*	,061	,430
	Sig. (2-tailed)		,021	,850	,163
	N	12	12	12	12
opec	Pearson Correlation	-,653*	1	-,158	-,571
	Sig. (2-tailed)	,021		,623	,053
	N	12	12	12	12
oilexp	Pearson Correlation	,061	-,158	1	-,366
	Sig. (2-tailed)	,850	,623		,242
	N	12	12	12	12
oil price	Pearson Correlation	,430	-,571	-,366	1
	Sig. (2-tailed)	,163	,053	,242	
	N	12	12	12	12

**Source: Author's own editing based on SPSS calculations of data from WDI**

Examining my hypothesis, I found that changes in oil prices can have an impact on either oil exporting or oil importing countries, but to varying

degrees. My hypothesis consisted of two parts, the first is that as a result of rising oil prices, the unemployment rate will decrease in oil exporting and OPEC countries as they can employ more people. This statement was substantiated because both the correlation diagrams and the correlation table showed that there is an opposite relationship between them. The correlation is opposite, if oil prices fall, the unemployment rate in these oil exporting countries will rise.

The other part of the hypothesis is that in the case of non-oil producing countries in the EU, the price of oil should move in parallel with the unemployment rate. I was able to show positive relationship between them.

### **3.3. The analysis of the relationship between oil price and final consumption expenditure of households**

**H3: There is a negative linear relationship between oil price and the final consumption expenditure of households in oil exporting, OPEC and EU countries.**

I continued my research with a correlation study to analyse the relationship observed so far between changes in oil prices and final household expenditure.

Table 4 depicting the correlation was expected to support or reject my hypotheses and I analysed the statistical averages using the bivariate correlation method. Correlation does not measure cause-and-effect, but was used to see how strong an effect exists among the factors examined.

**Table 4: Correlation of oil price change and households final consumption expenditure**

		EU	opec	oilexp	oil price
EU	Pearson Correlation	1	-,828**	-,851**	,656*
	Sig. (2-tailed)		,001	,000	,020
	N	12	12	12	12
opec	Pearson Correlation	-,828**	1	,967**	-,927**
	Sig. (2-tailed)	,001		,000	,000
	N	12	12	12	12
oilexp	Pearson Correlation	-,851**	,967**	1	-,847**
	Sig. (2-tailed)	,000	,000		,001
	N	12	12	12	12
oil price	Pearson Correlation	,656*	-,927**	-,847**	1
	Sig. (2-tailed)	,020	,000	,001	
	N	12	12	12	12

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

**Source: Author's own editing based on SPSS calculations of data from WDI**

The analysis showed significant negative linear relationship in oil exporting and OPEC countries. For oil exporting countries,  $r = -0.847$  and  $p$  is 99%, i.e. a very strong opposite relationship between them. The relationship is even stronger for OPEC countries, where  $r = -0.927$  ( $p = 0.00$ ). In the case of the European Union countries, on the other hand, I experienced weaker linear relationship,  $r = 0.656$  ( $p = 0.05$ ).

I was able to confirm only partially this hypothesis. There is a significant negative linear relationship between oil price changes and households final consumption expenditure in the case of oil exporting and OPEC countries, however this relationship positively linear and weaker in the case of selected EU countries.



### **3.4. The analysis of the relationship between oil price and CO2 emission**

**H4: There is a negative linear relationship between oil price and CO2 emission in oil exporting, OPEC and selected EU countries.**

Based on the descriptive statistical indicators, I found that the CO2 emissions of each country vary widely, the averages and the degree of variance are different, but the most significant was in different EU countries.

Correlation studies have shown that OPEC and oil exporting countries have a more significant negative relationship, whereas this is not obvious and is not true for all countries. The relationship was more positive in the EU countries, but no significant relationship could be established here either.

The linear regression calculations supported this assumption, as I could not show a significant and close relationship between CO2 emissions and oil price changes in either the ANOVA or Coefficients calculations.

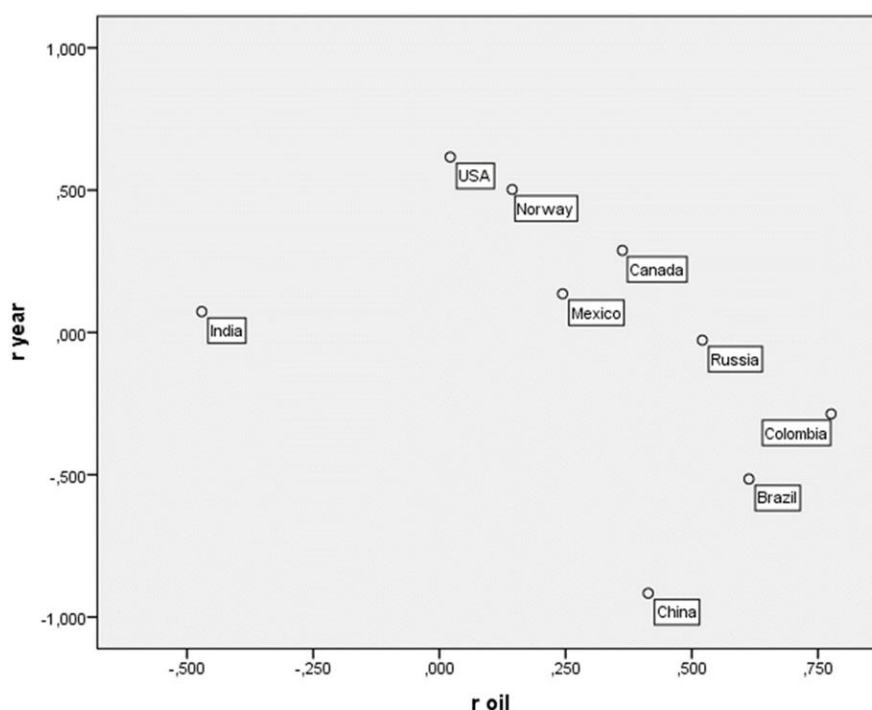
Based on this, I came to the conclusion that there is a weak relationship, but this cannot be considered a linear change in the price of oil and CO2 emissions. I think it is likely that other factors also have an impact on CO2 emissions, such as compliance with climate agreements, the market and the production of large consumers, factories or the activities of other actors in the economy. As a result of this I rejected this hypothesis.

### **3.5. The analysis of the relationship between oil price and GDP growth**

**H5/A/: There is a positive linear relationship between oil prices and the GDP growth of oil exporting and OPEC countries.**

**H5/B/: There is a negative linear relationship between oil prices and the GDP growth of major EU countries**

In Figure 3 we can see the impact of annual GDP growth and oil price changes in relation to oil exporting non OPEC countries. In the case of India and China, changes in oil prices have a different effect than in other countries. While in the case of India, the annual GDP growth has a more significant impact as it is closer to the y-axis on which I plotted the change of annual GDP growth. And in the case of China, oil price change has a more significant impact than the change in annual GDP growth. The other countries are located along a perpendicular descending diagonal, the highest values belong to the U.S. and Norway, and the lowest to the x-axis are Brazil and Colombia.



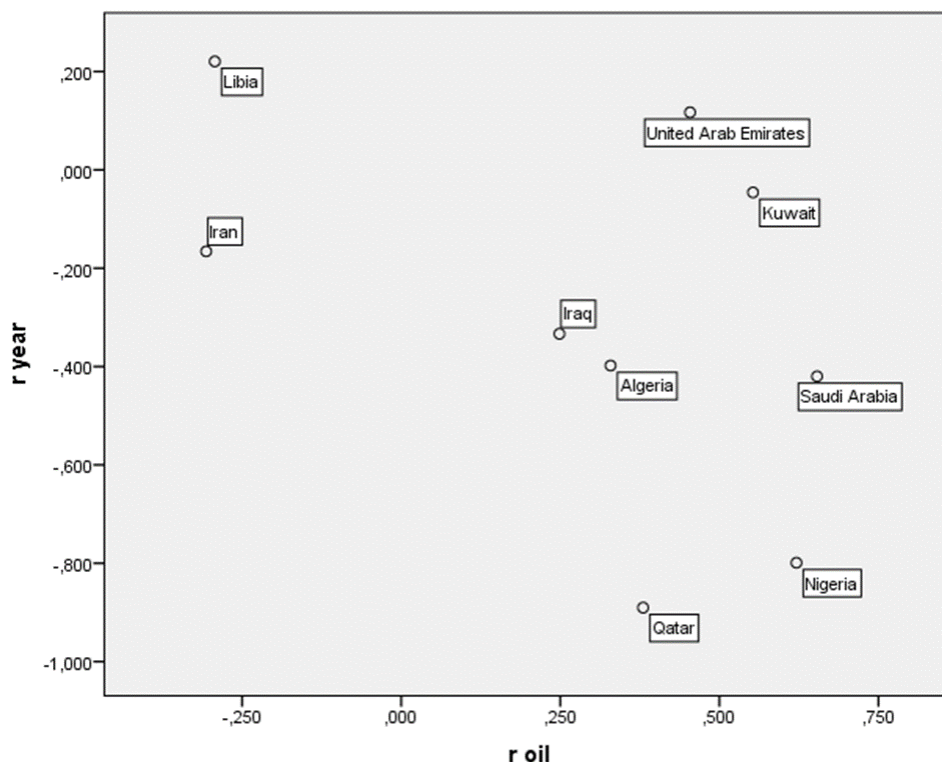
**Figure 3: Scatterplot on the impact of annual GDP growth and oil price change of oil exporting countries**

**Source: Author's own editing based SPSS calculations of data from WDI**

I concluded my analysis for OPEC countries with the scatter plot, I wanted to know which countries move together. Figure 4 shows that my analysis above was partially confirmed and I was able to form three groups during

the analysis. The first group included Libya and Iran, which responded relatively more significantly to the annual change in their GDP growth than to changes in oil prices. The next group is Qatar and Nigeria, which have been more sensitive to changes in oil prices than other countries. The third and final group is characterized by the fact that the change in the price of oil is a more important factor (the values are positive here) than the changes in the period (here most of them have a negative sign). The United Arab Emirates is the only country that has achieved the highest value, but does not form an independent group in itself. .

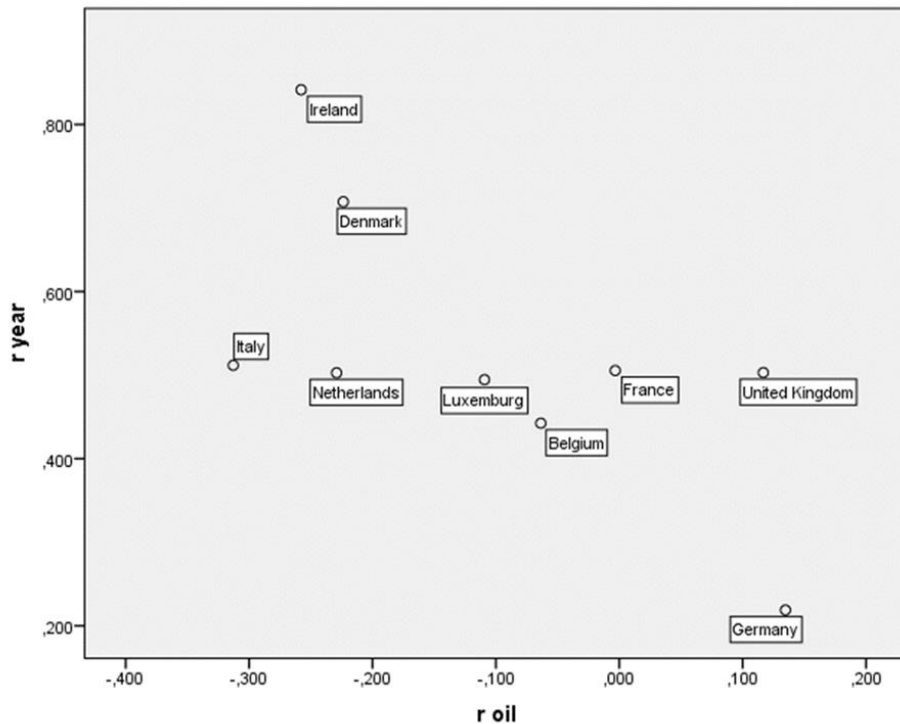
In summary, there are countries which GDP growth is affected by oil price fluctuations, but not all OPEC countries are equally affected.



**Figure 4: Scatterplot on the impact of annual GDP growth and oil price change of oil OPEC countries based on SPSS calculations of data from WDI**

**Source: Author's own editing**

I concluded my study by drawing the scatterplot diagram for these countries as well. Figure 5 shows that we can create three large groups from the countries. In the first group, I put Ireland and Denmark because they have been given a higher value for annual GDP growth change. For the other group, I marked Germany alone because this country is particularly responsive to changes in oil prices. Italy, Netherlands, Luxemburg, Belgium, France and the UK are the countries which are less dependent on changes in oil prices to varying extent.



**Figure 5: Scatterplot on the impact of annual GDP growth and oil price change of oil EU countries**

**Source: Author's own editing based on SPSS calculations of data from WDI**

Summarizing the above research results, I have found that oil-exporting countries react to oil price rises with an increase in their GDP growth. Similar conclusion can be drawn in the case of OPEC countries. Correlation analysis used for the significance of the relationship have shown that these relationships are not valid in all cases and countries, there are countries that

respond more intensively to oil prices, and there are some that respond later.

In the case of the EU countries, I have observed that their trend line is opposite, that is, if the price of oil rises, their GDP growth will fall, and although this relationship is not so significant, it can still be demonstrated. Based on this, I confirmed my hypothesis.

### **3.6. The analysis of the strength of the link between oil price and key macroeconomic indicators**

In my research, I sought the answer to what kind of relationship I can show between inflation, unemployment, household consumption, CO<sub>2</sub>, and annual GDP growth. After analysing my hypotheses I examined that I was able to detect a change in the development of each factor.

Based on Table 5 I can conclude that the relationship between oil price and key macroeconomic indicators weakened in the examined time period. In the case of household consumption expenditure I was not able to justify this, I could show a higher linear correlation over time.

**Table 5: Pearson’s correlation between oil price and the key indicators between 2008 and 2013/ 2014 and 2019 key data**

indicator	All	2008-2013	2014-2019
infl_oilexport	0,263	0,049	-0,260
infl_OPEC	0,608	0,487	0,093
infl_EU	0,643	0,699	0,115
Hhexp_EU	0,656	-0,893	0,671
Hhexp_opec	-0,927	-0,895	-0,927
Hhexp_oilexp	-0,847	-0,568	-0,939
Unempl_EU	0,430	0,237	0,243
Unemp_opec	-0,571	0,048	-0,227
Unempl_oilexp	-0,366	-0,924	-0,899
CO2_oilexp	-0,171	0,789	0,362
CO2_OPEC	-0,433	0,697	-0,275
CO2_EU	0,222	0,043	-0,642
AnGPD_oilexp	0,526	0,587	0,722
ANGPD_OPEC	0,343	0,414	-0,735
ANGDP_EU	-0,142	0,567	0,201

**Source: Author’s own editing based on SPSS calculations of data from WDI**

## 4. CONCLUSIONS AND RECOMMENDATIONS

### 4.1. Conclusions

Research Question 1 and the connecting hypothesis were as follows:

#### **1. What is the relationship between oil price and inflation rate in oil exporting countries, OPEC countries and major EU countries?**

The relationship between oil price and inflation rate is positive and linear in oil exporting countries, OPEC countries and major EU countries. The strength of the relationship differs in each examined country groups.

**Hypothesis 1: There is a positive linear relationship between oil price and inflation rate. Falling oil prices decrease inflation rate in oil exporting countries, OPEC countries and major EU countries.**

I confirmed my hypothesis that there is a positive linear relationship between oil price and inflation rate in each examined country types. Falling oil prices decrease inflation rate in oil exporting countries, OPEC countries and major EU countries. The relationship is present on a different level, the most significant in the case of OPEC ( $r = 0.608$ ) ( $p = 0.05$ ) countries and EU countries, ( $r = 0.643$ ) ( $p = 0.05$ ) in the case of major oil exporting countries the relationship is not significant ( $r = 0.263$ ,  $p = 0.05$ ). In the case of oil exporting countries that inflation rate loosely follows the movement of oil prices. The average inflation rate in each country reacts loosely and inversely to oil prices. This phenomenon is detectable in the period of 2009-2016. After 2016 we can see a more linear relationship. The trend in both cases is decreasing and parallel to each other.

In general we can say that falling oil prices can help to reduce the cost of living. Products and services related to oil will fall, resulting lower cost of living and lower inflation rate. Central Banks are in better position with lower oil prices. They can keep interest rates lower without the risk of inflation. Falling oil prices is one of the reasons why inflation is relatively low in Western Europe at the moment of writing this dissertation.

A drop in oil prices may help to bring inflation closer to the governments' target, but with inflation already close to zero, falling oil prices do not help to reduce excess inflation – they are in danger of causing deflation. Deflation can cause serious macroeconomic problem, e.g. debt inflation, rising interest rates and rising real wages.

Research Question 2.and the connecting hypothesis were as follows:

## **2. What is the relationship between oil price and unemployment rate in oil exporting countries, OPEC countries and major EU countries?**

The relationship between oil price and unemployment rate is linear and negative in oil exporting and OPEC countries. The relationship is linear and positive in selected EU countries. The strength of the relationship does not significantly differ in the examined country groups.

**Hypothesis 2/A/: There is a negative linear relationship between oil price and unemployment rate in oil exporting and OPEC countries.**

**Hypothesis 2 /B/: There is a positive linear relationship between oil price and unemployment rate in major EU countries.**

Examining my second hypothesis, I found that changes in oil prices can have an impact on the unemployment rate of either oil exporting or oil importing countries, but to varying degrees. My hypothesis consisted of two parts, the first is that as a result of rising oil prices, the unemployment rate will decrease in oil exporting and OPEC countries as they can employ more people. This statement was substantiated because both the correlation diagrams and the correlation table showed that there is an opposite relationship between them. In the case of oil exporting countries  $r = -0,366$  ( $p = 0.05$ ), for OPEC countries  $r = -0,571$  ( $p = 0.05$ ). The correlation is opposite, if oil prices fall, the unemployment rate in these oil exporting countries will rise.

The other part of the hypothesis is that in the case of non-oil producing countries in the EU, the price of oil should move in parallel with the unemployment rate. I was able to show positive relationship between them,  $r = 0,430$  ( $p = 0.05$ ).

Research Question 3.and the connecting hypothesis were as follows:



### **3. What is the relationship between oil price and household final consumption expenditure in oil exporting countries, OPEC countries and major EU countries?**

The relationship between oil price and household final consumption is linear and negative in oil exporting and OPEC countries. The relationship is linear and positive in selected EU countries. The strength of the relationship is significant in oil exporting and OPEC countries.

**Hypothesis 3: There is a negative linear relationship between oil price and the final consumption expenditure of households in oil exporting, OPEC and EU countries.**

My third hypothesis that there is a negative linear relationship between oil price and the final consumption expenditure of households in oil exporting, OPEC and EU countries I was able to confirm only partially. There is a significant negative linear relationship between oil price changes and households final consumption expenditure in the case of oil exporting,  $r=-0,847$  ( $p=0.01$ ) and OPEC  $r=-0,927$  ( $p=0.01$ ) countries, however this relationship is positively linear and weaker in the case of selected EU countries,  $r=0,656$  ( $p=0.05$ ).

If real wages remain constant, falling oil price generate more discretionary income for consumers. It can be interpreted as a free tax cut with the same effect as expansionary fiscal policy. In theory, the fall in oil price has an increasing effect on the consumption of goods and services adding more value to real GDP. The synergy of lower prices, more purchasing power and lower cost of living can intensify economic growth.

Research Question 4.and the connecting hypothesis were as follows:

### **4. What is the relationship between oil price and CO2 emission in oil exporting countries, OPEC countries and major EU countries?**

There is no definite positive or negative linear relationship between oil price and CO2 emissions in the examined country groups.

**Hypothesis 4: There is a negative linear relationship between oil price and CO2 emission in oil exporting, OPEC and major EU countries.**

My fourth hypothesis of my research was that there is a negative linear relationship between oil price change and CO<sub>2</sub> emissions for each country type. I used linear regression method in several ways. I examined the average of each country type and looking at the trends, I found that the linear trend chart is increasing for oil producing and OPEC countries and decreasing slightly for EU countries.

Based on the descriptive statistical indicators, I found that the CO<sub>2</sub> emissions of each country vary widely, the averages and the degree of variance are different, but the most significant was in different EU countries.

Correlation studies have shown that OPEC and oil exporting countries have a more significant negative relationship, whereas this is not obvious and is not true for all countries. The relationship was more positive in the EU countries, but no significant relationship could be established here either.

The linear regression calculations supported this assumption, as I could not show a significant and close relationship between CO<sub>2</sub> emissions and oil price changes in either the ANOVA or Coefficients calculations.

Based on this, I came to the conclusion that there is a weak relationship, but this cannot be considered a linear change in the price of oil and CO<sub>2</sub> emissions. I think it is likely that other factors also have an impact on CO<sub>2</sub> emissions, such as compliance with climate agreements, the market and the production of large consumers, factories or the activities of other actors in the economy. As a result of this I rejected this hypothesis.

Research Question 5 and the connecting hypothesis were as follows:

### **5. What is the relationship between oil price and GDP growth in oil exporting countries, OPEC countries and major EU countries?**

The relationship between oil price and GDP growth is linear and positive in most of the examined oil exporting and OPEC countries. The relationship between oil price and GDP growth is linear and negative in major EU countries.

**Hypothesis 5/A/: There is a positive linear relationship between oil prices and the GDP growth of oil exporting and OPEC countries.**

### **Hypothesis 5/B/: There is a negative linear relationship between oil prices and the GDP growth of major EU countries**

In my fifth hypothesis I have found that oil-exporting countries react to oil price rises with an increase in their GDP growth. Similar conclusion can be drawn in the case of OPEC countries. Correlation analysis used for the significance of the relationship have shown that these relationships are not valid in all cases and countries, there are countries that respond more intensively to oil prices, and there are some that respond later.

In the case of the EU countries, I have observed that their trend line is opposite, that is, if the price of oil rises, their GDP growth will fall, and although this relationship is not so significant, it can still be demonstrated. Based on this, I confirmed my hypothesis.

Research Question 6.was as follows:

### **6. Do oil price fluctuations have a different impact on the economy of oil exporting and oil importing countries?**

Yes, they do. Oil price fluctuations have a different impact on the economy of oil exporting and oil importing countries.

We can deduct from the results of the testing of my hypotheses that the changes in the oil price have a different impact on the economy of various countries. The impact will be different in oil exporting countries from oil importing ones. The impact depends on the direction of the price trend.

Oil importers will benefit from a falling oil price as their oil imports ' value will decrease. This will reduce oil importers ' current account deficit; this is essential for a country like India that imports 75% of oil consumption and currently has a significant current account deficit. A falling oil price, however, will do the opposite for oil exporters to reduce the value of their exports and result in lower trade surpluses.

Recently prices have dropped to such a degree that oil companies are quitting business. Regions like North Sea Oil, Arctic oil extraction sites and other high-cost regions are no longer commercial to operate. Industries have no choice but to cut demand and lay off workers.

With oil companies going bankrupt, we can experience a negative impact on the global financial system. Banks that have lent money to invest in oil can lose money, contributing to a tightening of global credit.

Dropping oil prices can cause reduced efficiency for alternative sources of energy. OPEC nations like Saudi Arabia want to protect their oil markets and not lose market share. Declining oil prices could slow investment in alternative forms of 'greener' energy, such as electric cars.

Falling oil price can change the recent decline in car use, it can lead to an increase in traffic congestion and can cause environmental problems.

Examining the macro economic problems rising oil prices can cause, we can state that the rise in the oil price has a positive impact on the oil importers, they will see an increase in their revenue. A rising oil price is able to shift economic and political power from oil importers top oil exporters.

Higher oil prices would result in an increase in the role of oil exporters such as OPEC countries in their current account. It will lead to a decline in the role of oil importers in the current account (e.g. Germany, China). Oil exporters will see a rise in deposits of foreign currency that they can use to buy foreign assets.

Consumers may see a decline in discretionary income. They face higher rates of travel, but they have no allowance for rising incomes. Higher oil prices will lead to slower economic growth, particularly if consumer spending is small.

Cost-push inflation from rising oil prices provides policymakers with a challenge. Higher inflation typically requires higher interest rates to maintain target inflation. Demand for oil is inelastic in the short term. It means that a price rise triggers only a marginal drop in demand. Demand is invaluable since customers prefer goods based on oil, e.g. their vehicle just runs on fuel. Nevertheless, higher oil prices would enable customers to diversify consumption in the long term (e.g. purchase hydrogen-powered cars, etc.), and demand can become more price stable in the long run.

Research Question 7.was as follows:

**7. Did the link between oil prices and key macroeconomic indicators deteriorate over the last decade?**

Based on my research I can conclude that the relationship between oil prices and the macro economy weakened in the examined period. The reasons for this can be the underlying shock driving oil prices. Another explanation for the weakening relationship lies in changes in the transmission of shocks. The transmission of oil price shocks can change with the structure of the economy and policy framework. Energy efficiency can be the third factor. When energy efficiency leads to lower consumption, prices can fall. This is especially true if energy efficiency activities are widespread and on a large enough scale, such as fuel economy standards for vehicles. Some energy sources are global commodities; changes in demand in a single region may have little impact on energy prices. Local supply constraints, on the other hand, may translate into changes in energy prices locally if energy efficiency measures free up the supply of energy sources and lead to improved energy supply security.

## **4.2. Recommendations**

Energy prices account for a sizable portion of our domestic expenditures, have a significant impact on industrial competitiveness, and influence energy consumption patterns. End-use prices are influenced by commodity market movements as well as policy decisions. Monitoring energy end-use prices around the world has become increasingly important for analysts and policymakers as countries move away from regulated pricing in energy markets. Based on the above I would like to recommend my dissertation to managers in the corporate sector and policy makers in the governmental sector.

Government policy, in the form of taxes and/or subsidies, has a significant impact on how gasoline prices vary around the world. For example, European consumers pay the highest gasoline prices, owing to high fuel taxes. On the other end of the spectrum, countries that subsidize liquid fuels have the lowest prices. In recent years, the prices of automotive diesel and gasoline have tracked the movements of crude oil prices. Not surprisingly, global pump prices are significantly higher on average than underlying crude spot prices because they include transformation, transportation, and marketing costs, as well as taxes levied on fuel sales. While the global gasoline price follows crude spot trends, regional dynamics differ. Significant changes have occurred in the MENA region in recent years as

a result of both policy developments and economic effects (exchange rates and inflation).

Because of the role of policy, prices in Algeria and Saudi Arabia had little correlation with crude price movements until recent increases due to reductions in fuel subsidies and the implementation of value-added taxes in Saudi Arabia. Despite these trends, these two countries' prices remained among the lowest in the world in 2019. Egypt has gradually increased the fixed pump price to reduce the burden on the country's budget; however, the price expressed in 2015 US dollars decreased significantly due to the combined effect of inflation and currency depreciation.

Geographical variations in transportation fuel prices exist within a country due to a variety of factors such as pricing framework, sub-national taxes, distribution costs (consumer proximity to suppliers), marketing costs (retail competition and margins), and refining costs (different environmental regulations).

Sub-national gasoline prices in China, for example, are more homogeneous due to national price regulations than those in Brazil, where prices are market-based and heavily influenced by local taxes.

Taxation is a major source of revenue for governments, and it is used to fund the general budget or to internalize the external costs associated with the use of a given commodity. A growing number of countries have begun earmarking taxation in order to more clearly demonstrate the purpose of single excise taxes. Environmental taxes (either based on sulphur or carbon content); energy security taxes; or social taxation to subsidize access to energy for all are examples.

Governments use a variety of regulations and approaches to strike a balance between affordability, environmental concerns, and other policy goals. A significant number of countries, for example, fix the price to encourage greater access for the population, effectively subsidizing consumption. In other countries, where affordability is less of an issue and energy spending accounts for a smaller proportion of household expenditure, markets are more liberalized, with interventions limited to taxation. In a third group of countries, governments use an intermediate scheme to limit fluctuations in the end-use price linked to the crude spot market by partially controlling the end-use price (e.g., through a price cap). In liberalized markets, post-tax prices are generally higher.

I would suggest the introduction of a gasoline tax (in countries where it is not yet available) may be actual, although it will lead to an increase in gasoline prices. This will allow consumers and manufacturers to adapt to the new legislation and change their habits.

Alternatively, tax on crude oil can also be a solution. Special tax could be introduced. For example, if the oil price over \$90, the tax rate will be 8 %. If the price is under \$90 the tax rate will be 13%. Such a strategy would keep high rates and provide the same level of tax revenue for countries.

Vehicle manufacturers should pay more attention to fuel efficiency of engines in the future. Because car manufacturers have long product development cycles, they prefer uniform and predictable regulations on fuel efficiency and emissions standards.

The volatility in oil price intensifies uncertainty and can lead to cash flow management problems. Primarily governments and policy makers have to face these problems and they have to take steps to stabilize the situation.

Regulation on reducing import costs such as hedging will help mitigate the adverse effect of rising oil prices. Private oil companies that are multinational companies' branches will buy petroleum products using futures contracts if it is expected that rates will rise in the future. This can help for governments to maintain a steady price for customers. To reduce heavy dependence on oil, governments should diversify into non-petroleum energy sources. Natural gas, coal, and renewable energy sources such as solar, geothermal, wind, and hydro are the most important non-petroleum sources governments should focus in the future.

In the future policy makers cannot ignore the fact that burning oil is one of the largest sources of greenhouse gas emissions and thus a major contributor to climate change, which, if unchecked, could have serious global security implications and other consequences.

## 5. NEW SCIENTIFIC RESULTS

1. I have statistically proven that the relationship between oil price and inflation rate is positive and linear in oil exporting countries, OPEC countries and major EU countries. Falling oil prices decrease inflation rate in oil exporting countries, OPEC countries and in major EU countries. The relationship is present on a different level, the most significant in the case of OPEC countries and EU countries, in the case of major oil exporting countries the relationship is not significant. Falling oil prices decrease inflation resulting growth in the economy of both oil exporting and oil importing countries.

2. I have statistically proven that the relationship between oil price and unemployment rate is linear and negative in oil exporting and OPEC countries. The relationship is linear and positive in major EU countries. The strength of the relationship does not significantly differ in the examined country groups. This statement has been substantiated because the research showed that there is an opposite relationship between the indicators. If oil prices fall, the unemployment rate in oil exporting countries will rise. In the case of major EU countries, the price of oil moves in parallel with the unemployment rate. Positive relationship has been verified between the indicators.

3. I have statistically proven that the relationship between oil price and household final consumption is linear and negative in oil exporting and OPEC countries. The relationship is linear and positive in major EU countries. The strength of the relationship is significant in oil exporting and OPEC countries. Falling oil prices generate larger consumption in oil-exporting countries but decreases consumption in oil-importing countries.

4. I have statistically proven that there is no definite positive or negative linear relationship between oil price and CO<sub>2</sub> emissions in the examined country groups. There is a weak relationship, but this cannot be considered as a negative linear relationship.

5. I have statistically proven that. The relationship between oil price and GDP growth is linear and positive in most of the examined oil exporting and OPEC countries. The relationship between oil price and GDP growth is linear and negative in major EU countries. Oil exporting countries react to oil price rises with an increase in their GDP growth. In the case of the



EU countries the relationship is opposite, if the price of oil rises, their GDP growth will fall. This relationship is not significant, but can be proven statistically.

6. During my research I came to the conclusion that oil price fluctuations have a different impact on the economy of oil exporting and oil importing countries. We can deduct from the results of the testing of my hypotheses that the changes in the oil price have a different impact on the economy of various countries. The impact will be different in oil exporting countries from oil importing ones. The impact depends on the direction of the price trend.

7. I have statistically proven that the relationship between oil prices and key macroeconomic indicators weakened in the period of 2008-2019.

## 6. SUMMARY

Crude oil prices, like most other commodities in the market, have routinely experienced wild price swings alternating between periods of great scarcity, high demand, and high prices and periods of oversupply, low demand, and depressed prices. These so-called crude oil “Price Cycles” can last several years, depending on factors such as oil demand, the volume of oil drilled, processed, and sold by the major producers, and so on. These price swings have been triggered by economic and political events, technological advancements and changes within the petroleum industry, and continue to influence prices in the present day.

The objective of the dissertation was to answer my 7 research questions and examine oil price changes and their effect on economic development in the world. It analysed the relationship between oil prices changes and inflation rate, unemployment rate, household final consumption expenditure, CO2 emission and GDP growth in different country groups. It was assumed that oil prices strongly influence the economy of net oil exporting countries while little or no influence can be detected on the economy of net oil importing countries. In order I could answer my research questions I formulated 5 hypotheses. In the research, I primarily tested my hypotheses by analysing them with different statistical methods.

Firstly I analysed the relationship between oil price fluctuation and inflation rate of non OPEC oil-exporting, OPEC and oil importing EU countries. I confirmed my hypothesis that there is a linear relationship between oil price and inflation rate.

Examining my second hypothesis, I found that changes in oil prices can have an impact on the unemployment rate of either oil exporting or oil importing countries, but to varying degrees. My hypothesis consisted of two parts, the first is that as a result of rising oil prices, the unemployment rate will decrease in oil exporting and OPEC countries as they can employ more people. This statement was substantiated because both the correlation diagrams and the correlation table showed that there is an opposite relationship between them. The correlation is opposite, if oil prices fall, the unemployment rate in these oil exporting countries will rise. The other part of the hypothesis is that in the case of non-oil producing countries in the EU, the price of oil should move in parallel with the unemployment rate. I was able to show positive relationship between them.

My third hypothesis that there is a negative linear relationship between oil price and the final consumption expenditure of households in oil exporting, OPEC and EU countries I was able to confirm only partially. There is a significant non-linear relationship between oil price changes and households final consumption expenditure in the case of oil exporting and OPEC countries, however this relationship is linear and weaker in the case of selected EU countries.

My fourth hypothesis of my research was that there is a negative linear relationship between oil price change and CO<sub>2</sub> emissions for each country type I could not show a significant and close relationship between CO<sub>2</sub> emissions and oil price changes in either the ANOVA or Coefficients calculations.

In my fifth hypothesis I have found that oil-exporting countries react to oil price rises with an increase in their GDP growth. Similar conclusion can be drawn in the case of OPEC countries. Correlation analysis used for the significance of the relationship have shown that these relationships are not valid in all cases and countries, there are countries that respond more intensively to oil prices, and there are some that respond later.

In the case of the EU countries, I have observed that their trend line is opposite, that is, if the price of oil rises, their GDP growth will fall, and although this relationship is not so significant, it can still be demonstrated. Based on this, I confirmed my hypothesis. Based on my hypotheses I concluded that oil price fluctuations have a different impact on the economy of oil exporting and oil importing countries, and the link between oil prices and key macroeconomic indicators weakened in the last decade.

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