



ASSOCIAÇÃO DE POLITÉCNICOS DO NORTE (APNOR)
INSTITUTO POLITÉCNICO DE BRAGANÇA

**The Impact of Oil shocks on Macroeconomic indicators: Evidence
from Belarus and Portugal**

Volha Pleskatsevich

Final Dissertation submitted to *Instituto Politécnico de Bragança*

To obtain the Master Degree in Management, Specialisation in Business
Management

Supervisors:

Nuno Filipe Lopes Moutinho

Andrei Chaplianski

Bragança, June, 2018.



ASSOCIAÇÃO DE POLITÉCNICOS DO NORTE (APNOR)
INSTITUTO POLITÉCNICO DE BRAGANÇA

**The Impact of Oil shocks on Macroeconomic indicators: Evidence
from Belarus and Portugal**

Volha Pleskatsevich

Supervisors:

Nuno Filipe Lopes Moutinho

Andrei Chaplianski

Bragança, June, 2018.

Abstract

Nowadays oil have a significant impact in our daily life and the fluctuations in oil price are extremely worrisome for both country producers and country consumers, and also significantly affect both. Due to the fact that not only a decrease, but also an increase in oil prices leads to significant macroeconomic changes, the contemporary situation on the world markets can lead to a lot of tangible consequences both at the global, regional and country levels. Here we want to understand the dependence of the main macroeconomic indicators of two non-producer's countries on the world oil prices. Because Belarus and Portugal have different macroeconomic backgrounds, it is supposed that a change in oil prices will have different effects in the economy of each country. The aim of this study is to analyse the relationship between oil prices and main macroeconomic indicators of Belarus and Portugal. In this thesis we use vector autoregressive models to study the direction and strength of the relationship between these factors.

we show that the change in oil prices has a tangible impact on the economic development of Portugal and Belarus. we have perceived a negative impact in macroeconomic indicators related with a rising in oil prices. In this study we find that oil price shocks have a deeper effect on the Portuguese economy than on the Belarusian economy. The oil prices have a negative impact on the macroeconomic indicators of both countries, but they are deeper in Portugal. On average, there is a more negative impact in short time, which weaken over the years.

Keywords: Oil price, Macroeconomic indicators, VAR model, Portuguese economy, Belarus economy.

Resumo

Hoje em dia o petróleo tem um impacto significativo na vida diária e as flutuações no preço do petróleo são extremamente preocupantes quer para países produtores como para países consumidores, pois afeta significativamente ambos. Devido ao fato de que não apenas uma redução, mas também um aumento nos preços do petróleo induzir mudanças macroeconómicas significativas, a situação contemporânea nos mercados mundiais pode levar a muitas consequências tangíveis tanto a nível global, regional e nacional. Neste trabalho pretendo perceber a dependência dos principais indicadores macroeconómicos de dois países não produtores face aos preços mundiais do petróleo. Dado que a Bielorrússia e Portugal têm origens macroeconómicas diferentes, supõe-se que uma alteração nos preços do petróleo terá efeitos diferentes na economia de cada país. O objetivo deste estudo é analisar a relação entre os preços do petróleo e os principais indicadores macroeconómicos da Bielorrússia e de Portugal. Nesta tese, são utilizados modelos vetoriais autoregressivos para estudar a direção e a força da relação entre esses fatores.

Neste sentido, apresento evidência de que a mudança nos preços do petróleo tem um impacto tangível no desenvolvimento económico de Portugal e da Bielorrússia. Também foi percebido um impacto negativo nos indicadores macroeconómicos relacionados com o aumento dos preços do petróleo. Neste estudo, considero que os choques nos preços do petróleo têm um efeito mais profundo na economia portuguesa do que na economia bielorrussa. Os preços do petróleo têm um impacto negativo nos indicadores macroeconómicos dos dois países, mas são mais profundos em Portugal. Em média, há um impacto mais negativo no curto prazo, que enfraquece com o decorrer dos anos.

Palavras-chave: Preço do petróleo, Indicadores macroeconómicos, Modelo VAR, Economia Portuguesa, Economia da Bielorrússia.

Реферат

В настоящее время нефть оказывает значительное влияние на нашу повседневную жизнь, а колебания цен на нефть являются чрезвычайно тревожными как для стран-производителей, так и для стран-потребителей, а также существенно влияют и на тех, и на других. В связи с тем, что падение цен на нефть, как и их рост, приводит к значительным макроэкономическим изменениям, нынешняя ситуация на мировом рынке неизбежно приведет к ряду ощутимых последствий как на глобальном, так и на региональном уровнях. В работе мы проанализировали зависимость основных макроэкономических показателей двух стран-импортеров нефти от мировых цен на нефть. Поскольку у Беларуси и Португалии разные макроэкономические фоны, смею предположить, что изменение цен на нефть будет иметь разные последствия для экономики каждой страны. Целью данного исследования является анализ взаимосвязи между ценами на нефть и основными макроэкономическими показателями Беларуси и Португалии. В данной диссертации я использую модели векторной авторегрессии для изучения направления и силы взаимосвязи между этими факторами.

Мы показали, что изменение цен на нефть, несомненно, оказывает ощутимое влияние на экономическое развитие Португалии и Беларуси. Мы также выявили, что скачки цен на нефть оказывают более глубокое влияние на португальскую экономику, чем на экономику Беларуси. Цены на нефть отрицательно сказываются на макроэкономических показателях обеих стран, но в Португалии они более ощутимы. В среднем за короткое время наблюдается более негативное влияние, которое ослабевает в течение времени. Эта ситуация может быть связана с большей открытостью португальской экономики к международной торговле и ее большей зависимостью от цен на нефть, торгуемых на международных рынках.

Ключевые слова: цены на нефть, экономический рост, VAR-модель, экономика Португалии, экономика Беларуси.

Acknowledgements

I would like to express my sincere thanks to IPB for my education and to the professors of this institute for a permission to define the thesis. The knowledge and the skills that we acquired throughout the whole period of education are an indispensable component of my future career.

Especially thanks to my supervisors, professor Nuno Filipe Lopes Moutinho and professor Andrei Chapliansky, for their support, companionship, calmness, professionalism, and competence during my work. They shared their experience with me and we have learned a lot of new things. Also, deep gratitude to the staff of IPB, mainly professor Paula Odete Fernandes and the program coordinator from BSEU, professor Olga Morozevich, for their support, kindness and help in different situations.

Special thanks to international relation office in IPB, whose employees showed their professionalism and responsiveness to me during the period of education.

My best wishes for all who supported and motivated me for writing my dissertation.

Abbreviations and Acronyms

ADF - Augmented Dickey-Fuller unit root test

AIC - Akaike information criterion

Chi-sq - Chi-squared test

CPI - Consumer price index

EXP - Exports of goods and services

FDI - Foreign direct investment

FPE - Final prediction error

GDP - Gross Domestic Product rate

HQ - Hannan-Quinn information criterion

IEA - International Energy Agency

INF - Inflation rate

IRF - Impulse Response Function

JB - Jarque-Bera test

LR - Likelihood-ratio test statistic

OIL - Crude oil price in international market

OPEC - the Organization of the Petroleum Exporting Countries

PP - Phillips and Perron unit root test

Prob - Probability

SC - Schwarz information criterion

UNEMP - Unemployment rate

VAR - Vector Autoregression model

VD - Variance Decomposition

Table of contents

1. Literature review.....	4
1.1. Oil Price and some Historical Evidence.....	4
1.2. Oil Shocks and the Labour Market.....	8
1.3. Oil shocks and the stock market.....	9
1.4. Oil shocks and Inflation.....	10
2. Research Methodology.....	12
2.1. Objective of the study and Research Hypotheses.....	12
2.2. Description of Data Analysis.....	12
2.3. Description of Data Collection.....	13
3. Empirical Results Analysis.....	16
3.1. Sample Characterisation.....	16
3.2. Stationarity test.....	20
3.3. Number of Lags.....	21
3.4. Analysis of Data Quality.....	22
3.4.1. Normality Test.....	22
3.4.2. Autocorrelation Test.....	22
3.4.3. Heteroscedasticity Test.....	23
3.5. Granger Causality Test.....	24
3.6. VAR Analysis.....	25
3.6.1. Variance Decomposition.....	25
3.6.2. Impulse Response Function.....	27
Conclusions, Limitations and Future Research Lines.....	30
References.....	32
Appendix.....	37
Appendix 1: Macroeconomic Indicators.....	37
Appendix 2: Variance Decomposition.....	38
Appendix 3: Impulse Response Function.....	41
Appendix 4: VAR estimation.....	43

List of Figures

Figure 1. Oil prices changes and US recessions, 1947-75.....	5
Figure 2. Evolution of Macroeconomic variables in Belarus	17
Figure 3. Evolution of Macroeconomic variables in Portugal	18
Figure 4. Oil price between 1960 and 2016	19
Figure 5. Response of Belarus macroeconomic variables to oil price impulse.....	27
Figure 6. Response of Portuguese macroeconomic variables to oil price impulse	28

List of Tables

Table 1. Descriptive Statistics	17
Table 2. Correlation Matrix	19
Table 3. Stationarity tests.....	20
Table 4. Lag selection criteria	21
Table 5. Normality test	22
Table 6. Autocorrelation Tests	23
Table 7. Heteroscedasticity Tests	23
Table 8. Granger Causality Test	24
Table 9. Variance Decomposition	26

Introduction

Nowadays oil is a key energy factor in the global economy. Despite the noticeable growth in the popularity of alternative renewable natural sources, such as wind, water, nuclear and solar energy, oil still holds a dominant position in the global energy balance. According to the Statistical Review of World Energy 2017 (BP, 2017), oil was the most important type of energy consumed since the middle of the 20th century until now.

As this product plays an important role in the world economy, the level of prices for it is an important reference point for all countries of the world. Theoretically, low world oil prices are beneficial for oil-importing countries: the lower the price of oil, the cheaper the production, the higher the consumer activity, and, finally, the faster the rate of economic growth. On the contrary, high world oil prices are beneficial to oil-exporting countries: the higher the price of oil, the greater the income from exports, the higher the investment in infrastructure and the higher the welfare of the population of these states.

The mechanism of world oil prices has undergone significant changes over the years. For a long time, pricing in this market was oligopolistic, but since 1986 oil price is based on a stock exchange market. In this market oil prices experience daily fluctuations and are formed under the influence of a wide range of fundamental, geopolitical, financial and other factors. Slight fluctuations in prices do not have a significant impact on the economies of oil-exporting countries, while sharp fluctuations in world oil prices can destabilize national economies.

In order to study the impact of changes in oil prices on the economies of Portugal and Belarus, one must understand that these two countries are developing in completely different economic conditions.

Belarus is the only country from the former Soviet republics, which in part retain its reliance on Soviet economic methods. Belarus imports oil. However, oil in the country exists. Its reserves are very scarce and do not provide for the state's needs in full. All extracted oil is used and processed in Belarus, in addition, most of the oil is exported from Russia and Venezuela. It should be noted that the oil refining industry in Belarus is well developed and often oil is brought to the country for processing. Belarus is too much connected with Russia, and its economy is almost entirely on oil reserves. Due to the peculiarities of geographical location and weather conditions, alternative energy sources in Belarus are poorly developed. We can assume that the change in oil prices will really affect the Belarusian economy.

Portugal is an industrial-agrarian country, after the accession to the EU, Portugal's economy becomes more diversified and service-oriented. Like Belarus, Portugal is an importer of oil, but it should be noted that the structure of the energy industry in Portugal is different from the Belorussian one. First, alternative sources of energy are widely used in Portugal, and their use is growing every year. We are talking about hydroelectric plants (arranged on the reservoirs of dams), as well as wind, solar power stations and working on biomass. Among the renewable sources of electricity production

in Portugal, the leading ones were hydraulic - 42% of the total production, wind energy (27%), biomass (3%) and solar energy (1%). Secondly, oil import in the country is much more diversified. According to International Energy Agency, the main oil exporters for Portugal in 2016 were Russia, Angola, Saudi Arabia, Algeria. This makes this country more independent of oil than Belarus. Therefore, it can be assumed that oil prices have less influence on its economic development.

As for oil prices themselves, as is known, they change quite a lot in the last period: in December 2017, for the first time in 2.5 years, they reached the level of \$ 66 per barrel of Brent brand, having overcome the shock drop of 2014-2015. In the modern era of the globalization of economic relations, many factors influence the world prices of energy carriers and especially oil: global and local economic crises, the growth rates of large countries' GDP, the revolutionary changes in oil production technology, as well as the fact that significant impact on the formation of world prices are made by OPEC and IEA decisions, political and military events, embargoes, etc. In these conditions, the forecasting of world oil prices on the basis of statistical data is practically not feasible, because qualitative factors largely determine the fluctuations and sharp leaps in the energy market.

Therefore, at a given time, when all the indicators change quickly and, often, unexpectedly, it is very important to be ready for change and to know what they can lead the economies of the countries. This is what determines the importance and relevance of my research.

The object of this study became the economies of Portugal and Belarus in the light of the main macroeconomic indicators and the impact of the fluctuations in world oil prices.

As a method of research, we use the Vector Autoregression (VAR) model. It is one of the most popular methods of analysing various economic impacts in empirical literature. VAR allows to evaluate several variables at once and takes into account their interaction. The popularity of this method is explained by the relative simplicity of use, as well as by the ability to determine the channels for spreading various shocks in the country's economy by means of impulse response functions and obtain an economic interpretation of the evaluation results.

Based on the information on the peculiarities of the economies of Belarus and Portugal, as well as previous studies on this issue by other scientists, we set for myself the main task of investigation the existence of oil price influence on the main macroeconomic indicators of Belarus and Portugal, and through them on the economic growth of these countries. It is also important to know the level of this influence, as well as the similarities and differences in the influence of this factor between the two countries.

In order to achieve the goal, we analyze if changes in oil prices significantly affect GDP, inflation, foreign direct investment, the level of investment and the unemployment rate of Belarus and Portugal. We also would like to analyze if the impact of oil prices in Belarus and Portugal is not the same due to the difference in economics.

In the first section, we review the literature, taking into account the opinions of different authors on this topic and various methods of research of this issue in different countries. In this topic we also analyse some literature about oil prices impact on various macroeconomic indicators. In the second

section, we describe the methodology that we use in the work, explaining the model and tests that are relevant. We also present the variables and data that we manage. The following section is devoted to the empirical analysis. Here we describe step-by-step the econometric model and the statistical tests. Then we show the results and we get the main findings. Then, in the last section, we summed up the whole work, we explain the main limitations and we make some suggestions for future research.

1. Literature review

1.1. Oil Price and some Historical Evidence

Today there is large number of studies about interconnection between the oil price and the economic growth of countries. Hamilton's work from 1983 is considered as a fundamental work about this issue and still very important for analysis of oil prices and their macroeconomic impact. In the paper, the author tried to prove the serious decline in the US economy after the Second World War with a sharp rise in oil prices. The economic depression of that time was expressed in the following: a sharp decline in the growth rate of real GNP (by 1.6 percentage points); increased more than twice the average rate of inflation; the highest unemployment rate for the last thirty years. Hamilton determined, that the US economic downturns appeared 3-4 quarters after the rise in oil prices, after what, 6-7 quarters later it is possible to observe recovery.

However, the author did not dare to say that the cause of all economic downturns after the Second World War were the jumps in oil prices. In the search for answers, Hamilton study the following: *Hypothesis 1*: Correlation is a historical coincidence. *Hypothesis 2*: Correlation is the result of the influence of third endogenous factors, which, presumably, could affect both the economic development of the country and the price of oil. *Hypothesis 3*: At least some factors of the US economic recession are caused by exogenous factors of rising oil prices.

On the Figure 1 we can see the changes in crude oil prices and US recessions, 1947-1975. Hypothesis 1 was eliminated almost immediately. Author safely connects the following historical events with the facts of the economic downturn in the United States: 1951-1952 - the Iranian nationalism; 1956-1957 - the Suez Crisis; 1969 - secular decline in US reserves; 1970 - the trans-Arabian pipeline; 1973 - the OPEC embargo; 1980 - beginning of Iran-Iraq war. These events can be safely considered the causes of depressive results in the US economy.

Working on Hypothesis 2, the author used Granger-Causality test. Here he examined the casual relationship oil and following variables: employment, GNP, price levels, wages, money growth rates and import prices. In this case, if hypothesis 2 is correct, if the third factor influences both oil prices and the economy, then it must be possible to identify unusual behaviour in some of the key macro

series in evidence prior to the oil price increases. As a result, evidence, that the above series carry reliable information about the increase in oil prices, were not found. Testing the hypothesis 3 showed that the timing, magnitude as well duration of the economical decreases after 1973 were more discernible with oil prices.

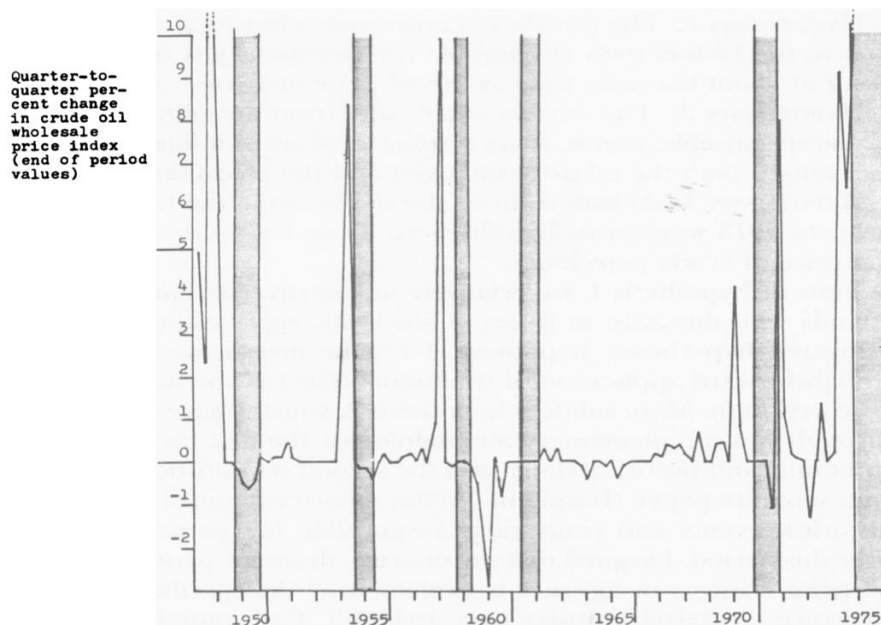


Figure 1. Oil prices changes and US recessions, 1947-75

Source: Hamilton (1983, p.229).

Based on the work of Hamilton, Mork (1989) added data after the 1980s, which significantly reduced the impact of oil prices on the country's economic development. He also changed the research model somewhat, which more suited the selected data.

As a result, Mork came to the conclusion that, with an increase in oil prices, the model showed significantly different coefficients than when they were going down. The VAR was structurally stable across that breakpoint, and price increases Granger-caused output changes while price decreases did not (p-values of .001 and .152).

So, he came up with the asymmetric effects of oil prices changes, that he left without any advance in theoretical explanation of this fact. He also proved that oil prices downturn does not have statistical significance for the economy of the USA.

Jones, Leiby and Paik (2003) distinguished five directions of research when estimating the state of knowledge on the impact of oil price fluctuations on economic growth. *The first* of these was the mechanism for transferring the effects of a change in the level of oil prices to the economy at the micro-level (the use of disaggregated data at the firm level, theoretical models for different market set-ups, etc.). *The second* branch is connected with the fact that oil shocks often led to interference in monetary policy - a kind of indemnity issue. A number of authors believed that it was precisely

changes in monetary policy that led to stagflation, rather than shocks of oil prices (Hooker, 2002); Bernanke, Gertler and Watson (1997, pp 135) also attributed the deepening of stagflation to monetary policy, they argued that "the Federal Reserve policy is largely endogenous due to the its commitment to macroeconomic stabilization". *The third* prospect expresses a detection stability of relations between GDP and oil prices over time. This idea was supported by many authors. Among others, Rotemberg and Woodford (1996) claimed that in the 1980s the nature of the relationships of oil prices and GDP changed. They relate this to the fact that it was at the beginning of this period (early 1980s) that OPEC lost control over the nominal price of oil and could no longer sustain its stability, which led to a momentary reaction of the nominal price of oil. In this regard, they decided that one of two options is correct: either oil prices ceased to Granger-cause GDP or the relations between them have become much more complicated (in comparison with the earlier linear dependence). The empirical studies of asymmetry in the oil-GDP relationship (Mork, 1989) are also related to this question. *The fourth* branch is linked to the so-called magnitude of the oil price-GDP relationship. As for the US economy, the empirical tests provide the negative relationship, as it as expected. *The fifth* area pays attention to the relationships of oil prices and stock market performance.

Olivier and Galí (2008) evaluated a hypothesis that results of the oil prices up goings were similar in 1970s as well as in 2000s, but the differences in the effects could be caused by faced the shocks of different format, like other raw materials prices in the 1970s and increase in productivity and world demand in the 2000s. This fact could noticeably misrepresent an assessment of influence of oil price shocks based on a simple examination of the movements in aggregate variables around each period.

The scientists used structural VAR technics to evaluate this assumption identifying and estimating the effects of the price of oil: they needed to insulate the element of macroeconomic fluctuations connected with exogenous modifications in oil prices.

As a result, it was proved that, firstly, the consequences of sharp changes in oil prices also coincided with other significant shocks, which caused a difference in the results. Secondly, the impact of the oil prices themselves has changed over time: the influence on wages, prices, the volume of production and the level of unemployment has slowed.

The reasons for these changes were also revealed. One of them is real wage stiffness, 'such rigidities are needed to generate the type of large stagflation in response to adverse supply'. It turned out that over time, consumption wages became more sensitive to the marginal rates of substitution (and hence to employment). In addition, increased confidence in monetary policy has also become the reason for measuring the reaction of the economy to oil price shocks. This could be proved by a simple formalization of the absence of a power of attorney and its influence on the boundary of volatility: the reaction of expected inflation to oil prices changes significantly decreased. The third identified cause was a significant reduction in the use of oil in production and in consumption. This decline was strong enough to reduce the merger of the change in oil prices.

Lee, Ni, and Ratti (1995) claimed that oil shocks have much more economical influence in the conditions when the oil prices are stable rather than in the situation when they are changeable and

erratic.

A number of scientists have faced the fact that the impact of world oil prices differs significantly from country to country. Burbidge and Harrison (1984) demonstrated that industrial production in the United States and Great Britain became subject to a significant impact of oil shocks, while for Japan, Germany and Canada, it is relatively small. Bjørnland (2000) study Norway, Germany, Great Britain, USA and Canada data and found that the effect of oil prices was positive only for Norway. Chuku et al. (2010) found that changes in oil prices are not determinative for the macroeconomic activity of the Nigerian economy. Cunado et al. (2015) note the impact of sharp fluctuations in oil prices on the economies of Asian countries (Japan, Korea, India and Indonesia) from 1974 to 2013. The results show that the economies of these countries are very sensitive to a sharp change in oil prices. Rautava (2002), Ito (2008) and Melnikov (2010) report on the positive impact of global oil price shocks in Russia. In the work of Sarzaeem (2005), it was shown that a sharp rise in oil prices leads to an increase in inflation and liquidity in Iran. In the works of Farzanegan and Markvard (2009) and Samadi et al. (2009), the negative impact of oil sharp fluctuations on Iran's economic growth was found. In work Mahregan and Salmani (2014) analysed the impact of sharp fluctuations in oil prices on Iran's economic growth with the help of the Markov model from 1987 to 2011. Their results show that the positive impact of a sharp rise in oil prices on Iran's economic growth is less than the negative impact of a sharp drop in oil prices on Iran's economic growth.

Usman et al. (2011) and Rafay and Farid (2015) in their works found negative reaction of such variables as employment and output on the raise of oil prices in Pakistan. It was also found that the short-term impact is significantly greater, than the long-term one.

Studying the economy of China, Shuping et al. (2012) not only discovered the effect of the volatility of oil prices on production, but also revealed the reasons for this influence. The first is the psychological expectation of economic growth by buyers, the second is the impact on monetary policy.

Some works (Mehrara and Oskoui, 2007; El-Anshasy and Bradley, 2012; Iwayemi and Fowowe, 2011) provide more specific information about oil price caused instability in oil-exporting countries. Mehrara and Oskoui (2007) and El-Anshasy and Bradley (2012) show that oil price shocks are the main cause of output fluctuations. On the contrary, Iwayemi and Fowowe (2011) and Isah et al. (2015) show that the impact of oil price shocks on Nigerian (a purely oil-exporting country) macroeconomic variables is low. However, Isah et al. (2015) proved the oil price impact on external reserves.

Also Korhonen and Ledyeva (2009) split the impact of oil prices fluctuation on the for oil consuming countries and for oil producing countries. In the end they show that the influence is different: such countries as Russia and Canada - oil producers - gain profit from positive changes of oil price, while countries consumers, such as Switzerland, Japan, Germany and UK incur losses.

Robalo and Salvado (2008) studied the impact of oil price shocks on the Portuguese aggregate economic activity, industrial production and price level. Investigating the stability and magnitude of

these relationships, scientists used the multivariate methodology of VAR. They singled out two time intervals for comparing the strength of the influence of the factors 1968-1985 and 1986-2005. As variables, average oil price, real Gross Domestic Product, Industrial Production Index, total employment, unemployment rate and the CPI-based inflation rate were chosen. As a result, they showed that the fluctuation in oil prices had a pronounced effect on the level of inflation in the country throughout the entire examined period and the unemployment rate in the interval from 1968 to 1985. The impulse response functions were extremely useful in analysing the adjustment and the initial impact of the variations in the price of oil. They also found that oil prices induce persistent effects on unemployment and inflation rates, and not so persistent effects on total employment and GDP. Robalo and Salvado noted the ambiguity of the reaction of industrial production. In general, this method supported the idea previously mentioned in the literature: there is a weakening of the reaction of economic factors to oil shocks after 1985, and the adjustment becomes more rapid.

1.2. Oil Shocks and the Labour Market

Different ideas about the interrelation between oil price shocks and unemployment were put forward. But the most common was the theory about the supply-side effect: when the price of oil is going up, the availability of oil as basic input in production is decreasing (Brown and Yücel, 1999). As a result, the growth of output is slowing down, real wage growth also decreases, as well as unemployment. Brown and Yücel (1999) describe this effect in the following way: the oil price jump reflects in slowing down of GDP growth, that leads to an upward trend in unemployment, which in turn drives to a further reduction in GDP growth. It continues unless unexpected inflation increases as much as GDP growth falls. The first reduction in GDP growth always comes together with a fall in labour productivity. And if the real wages do not fall as much as the reduction in labour productivity, companies will have to dismiss workers, that will lead to prolongation of GDP losses and unemployment growth. Brown and Yücel (2002) highlight only one situation, when a reduction in wages can help stabilize the situation on the labour market in this case - when unexpected inflation that is at least as great as the reduction in GDP growth.

Kilian (2009) also examined the behaviour of the labour market in context of energy prices. He separated demand- and supply-side oil price shocks to measure their influence on inflation and GDP growth using Vector Autoregression for testing relations between these variables. Although, Granger and Teräsvirta (1993) doubted usage of linear models in accounting for macroeconomic asymmetries. In addition, linear models miss the impact of such non-linear effects as, for example, policy changes, capacity limitations and adjustment costs that undoubtedly affect labour and oil markets. Therefore, Mork (1989) got a greater support in this matter, he first confirmed the asymmetry of the impact of the oil prices on other economic indicators. It was Papapetreo (2001) who applied this in relation to the labour market, proving in his work the non-linear dependence of the labour market on oil shocks.

Ordóñez et al. (2010) considered actual shocks in real oil prices and investigate their cyclical effects on the US unemployment rate through their impact on the job finding and job separation rates. In their work, they showed several significant results: real shocks in oil prices have a significant impact

on the change in the level of unemployment; the transmission mechanism of such shocks is the job finding rate; oil price shocks are complementary to the standard technological shocks and provide a new amplification mechanism of business cycle fluctuations in the context of the Pissarides' model.

Van Wijnbergen (1985) came up with the idea that oil price shocks have different impact on the labour market behaviour in different countries. Similarly, Dogrul and Soytaş (2010), who examined relationship between oil prices, interest rate, and unemployment, doubted if the results of their studies can be implemented for other developing countries. Fawad Ahmad (2013) using the Toda-Yamamoto causality test was studying the dependence of the labour market on the oil price shocks and real interest rate in Pakistan. While he did not find a significant association between the labour market state and real interest rate, the dependence on the oil price was found. This evidence shows the possibility of application of the previous researches regarding the relationship of these variables to developing countries.

1.3. Oil shocks and the stock market

There are not many researches about the correlation between the price of oil and the stock market fluctuations. Jones and Kaul (1996) examined if current and future changes in real cash flows and changes in expected returns can explain the reaction of the international stock market to the oil price changes. Studying the post-war period, they proved that oil shocks have a direct impact on the financial markets of Canada and the United States, but does not have such a strong influence on the stock market of the United Kingdom and Japan.

Huang, Masulis and Stoll (1996) tested the link between daily oil future returns and daily United States returns. Their results suggested that oil returns do lead some individual oil company stock returns, but oil future returns do not have much impact on general market indices.

Having selected for his study the period 1947-1996, Sadorsky (1999) demonstrated that the real profitability of shares is subject to great influence from the price of oil and its volatility. Notably, oil price fluctuations after the middle of 1980s justified a large fraction of the forecast error variance in real stock returns than was received from the interest rates. Papapetrou (2001) using a VAR approach was testing the impact of oil shocks on different economic indicators in Greece and proved that oil prices have significant influence on employment rate, real economic activities and also the stock market.

More specifically, the relevant literature generates mixed views regarding the effect of such oil-price shocks on asset prices, such as stock prices. Kaul and Seyhun (1990) announced that correlation between oil-price volatility and stock prices is negative (Hong et al., 2002; Sadorsky, 1999; O'Neil et al., 2008; Park and Ratti, 2008). Papapetrou (2001) associates this negative effect with the impact of the negative impact of oil shocks on employment and production growth.

However, Sadorsky (2001) shows a positive relationship between oil prices and stock returns from oil and gas companies, using a multifactorial model. In this multifactorial model of the market, he takes into account the factors of exchange rate and interest, as well as the presence of several risk

premiums as the main determinants of oil and gas stock returns. He was supported by Gogineni (2007) and Yurtsever and Zahor (2007). One of the hypotheses they proved was the one that states that the change in oil prices positively affects the prices in the stock market, if oil price shocks reflect changes in aggregate demand, but negatively associate with stock price, if they reflect changes in supply. They also demonstrated an asymmetry in the relationship of these indicators: an increase in the price of oil leads to a decline in prices in the stock market, but the decline in oil prices is not associated with a decline in the stock market prices. Wei (2003) stated that it was not the oil prices increase in the USA (1973-1974), that explained the US stock market prices fall.

Kilian (2009) did not support all the above scientists and argued that oil price shocks are an exogenous factor. Other scientists have stated that oil prices react to other factors that also affect the stock market (Barsky and Kilian, 2002, 2004; Hamilton, 2005; Kilian, 2008).

Economists must decompose aggregate oil price shocks into the structural factors that reflect the endogenous character of such shocks. This solves two problems at once, such as a lack of research on this issue, as well as a lack of existing studies to determine the impact of these shocks on the asset rate.. Kilian and Park (2008) demonstrated that the impact that have oil price fluctuations driven by global oil-specific demand shocks differs from the one that have oil price fluctuations caused by global supply shocks in the crude oil market.

1.4. Oil shocks and Inflation

LeBlanc and Chinn (2004) studied the impact of oil shocks on inflation between 1980 and 2001 in countries such as the United States, France, Germany, the United Kingdom and Japan. Their main conclusions were that an increase in the price of oil by 10% leads on average to an increase in inflation by 0.1-0.8 percentage points. At the same time, scientists did not notice a significant difference between the results obtained in the US and the EU.

There are several explanations for reducing oil price shocks after the 1980s. Blanchard and Gali (2007) suggested that such changes as decline in real wage rigidities, the higher credibility of monetary policy and the decrease in the share of oil consumption and in production could reduce oil shocks impact; Peersman (2009) linked it with the change in the oil price shocks (decrease in oil demand elasticity over time); higher energy efficiency of production processes, the price setting due to globalization and also the better conduct of monetary policy that help to reduce the impact of oil price shocks were suggested by Alvarez et al. (2009).

Choi et al. (2017) studied the economies of 72 developed and developing countries between 1970 and 2015. They found that the reaction of the inflation behaviour to oil price changes between advanced and developing countries: 10 percent increase in oil prices brings 0.4 percentage points increase in inflation rate on average; this effect comes to naught in after two years. They also confirmed several statements: oil price impact has asymmetric nature (positive oil price shocks have greater influence than negative ones); the impact of oil price fluctuations has weakened with time because of better conduct of monetary policy. After studying the last 15 years of the period (2000-

2015), scientists concluded the share of transport in the CPI basket and energy subsidies are the most robust factors in explaining cross-country variations in the effects of oil price shocks during this period.

When studying the impact of oil shocks on the economies of MENA-6 countries, it was proved that, both for oil importing countries (Tunisia, Morocco) and for oil exporting countries (Bahrain, Saudi Arabia), an increase in oil prices leads to depreciation currency, but only in the short term, the inflation situation has stabilized for six months already (Brini, Jemmali and Farroukh, 2016).

Using the data of 50 countries and the period of 2007-08 Habermeier et al. (2009) found high role on the monetary policy in defining the scale of pass-through of oil price fluctuation. They stated that two factors can lead to lower pass-through of a country: high independence of central bank and inflation targeting regime. De Gregorio et al. (2007) attributed pass-through decreasing to declining in oil intensity and the exchange rate pass-through degree. They found that advanced countries achieve is lower than in developing economies. Conversely, Álvarez et al. (2011) stated that with time oil price shocks have bigger effect on the EU countries, attributing this change to the higher expenditure share of households on refined oil products, whereas their indirect and second-round effects have decreased.

Zoli (2009) and Caceres et al. (2012), using Vector Autoregressions, affirmed that reaction of domestic inflation rate to a global change in oil prices in developing countries can be influenced by specific factors of the region. These authors examined the economies of the countries of Emerging Europe and Central Africa and found that while in Emerging Europe countries the global oil price is a significant factor in explaining the inflation fluctuations, in Central Africa the prices are mostly controlled.

In one of the most recent works on (this topic, presented by Gelos and Ustyugova (2017), data of advanced and developing countries is examined by country-by-country augmented Phillips curves for the period 2000-2010. Differently from other studies, their analysis determines the only that high fuel intensities and pre-existing inflation levels are the only significant factors explaining cross-country differences in the effects of food and oil price shocks. The conduct of monetary policy, including the existence of inflation targeting regimes, does not seem to be a major determinant of the degree of pass-through.

Other studies have focused on changing the impact of oil prices on the macroeconomy over time. A number of scientists, for instance, have proved that oil shocks have different effects on inflation and real GDP, regardless of whether they are caused by negative supply shocks (such as exogenous shortfalls in oil production in 1970s) or positive demand shocks (shifts in the demand for crude oil in 1999) (Kilian, 2009; Peersman and Van Robays, 2012; Baumeister and Peersman, 2013).

2. Research Methodology

2.1. Objective of the study and Research Hypotheses

This thesis studies the key macroeconomic indicators of Belarus and Portugal and their evolution over the last decades. Whereas the economic growth and population well-being have been influenced by international factors that both countries do not control, it is proposed to analyze how the price of oil has affected the economies of both countries.

The main purpose of my work is to investigate the relationship between the main macroeconomic indicators and also oil prices in two countries: Belarus and Portugal. It is also important to know the level of this influence, as well as the similarities and differences in the influence of this factor between the two countries.

The main hypothesis we propose is that changes in oil prices significantly affect GDP, inflation, foreign direct investment, the level of investment and the unemployment rate of Belarus and Portugal. It would also be interesting to verify if the impact of oil prices in Belarus and Portugal is not the same due to the difference in economics.

2.2. Description of Data Analysis

As a method of research, we use the Vector Autoregression (VAR) model, which is one of the most popular methods of analysing many economic impacts in empirical literature. VAR method allows to evaluate several variables at once and takes into account their interaction. The popularity of this method is explained by the relative simplicity of use, as well as by the ability to determine the channels for spreading various shocks in the country's economy by means of impulse response functions and obtain an economic interpretation of the evaluation results. Also Isah, Dikko and Chinyere (2015), Shuping, Aimei and Zhenxin (2012), Rafay and Farid (2015) and Usman, Nawaz and Qayyum (2011) use VAR model like in this study. All calculations using the vector autoregressive method were carried out in the EViews software.

The basic VAR model that we used to analyse the effect of oil prices on the main economic indicators, was as follows:

$$Y_{it} = A_1 Y_{it-1} + A_2 X_{t-1} + v_t \quad (1)$$

Where:

Y_{it} : is the vector of endogenous variables for country i in period t ;

X_{t-1} : is the vector of exogenous variables in period $t-1$;

v_t : is the error vector under normal distribution.

In order to study the data, it is important to investigate some descriptive statistics and the correlation matrix and to verify the evolution of macroeconomic variables. The next step is the determination of the number of lags that it will be used. The lagging length will be chosen according to the Akaike Information Criteria. Then, in VAR model there are some assumptions that will be analyzed, such as the stationarity of the series, the absence of autocorrelation, the lack of heteroscedasticity, and the normality of the residues. There are some tests that can be performed to analyse these assumptions: Augmented Dickey–Fuller and Phillips and Perron unit root tests are performed to test the stationarity; the Jarque-Bera residual normality test is performed to test the normality; Breusch Godfrey test is performed to test the autocorrelation; White test is performed to test the heteroscedasticity.

After this analysis we will check the Granger Causality Test to study the cause-effect relationship between time series. Finally, in the analysis of the VAR model, we will examine the Impulse Response Function (IRF) to describe the impact of a dynamic series in response to some external shocks and the Variance Decomposition (VD) to determine how much of the variance of the predicted error of each variable can be attributed to exogenous shocks for other variables.

2.3. Description of Data Collection

In this thesis we choose to study the macroeconomic consequences of the oil price changes using VAR method in the Republic of Belarus and in Portugal. For the first country, we examine the data from 1991 until now since there is no data available before that period, because the country was not independent and was a former member of the Soviet Union. For the second, we examine data from 1970, near 4 years before a political revolution from a dictatorship regime to a political democratic regime. We only use annual data because it is not possible to use quarterly or monthly data to Belarus. So, it is used crude oil price and macroeconomic data from Belarus and Portugal. The variables used are the following:

- **GDP_{it}**: GDP growth (annual %) for country i in period t - Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included

in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Source: World Bank national accounts data, and OECD National Accounts data files.

- **UNEMP_t**: Unemployment rate, is the total (% of total labour force) (national estimate) for country i in period t - Unemployment refers to the share of the labour force that is without work but available for and seeking employment. Source: International Labour Organization, ILOSTAT database.
- **INF_t**: Inflation, consumer prices (annual %) for country i in period t - Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. Source: International Monetary Fund, International Financial Statistics and data files.
- **EXP_t**: Exports of goods and services (annual % growth) for country i in period t - Annual growth rate of exports of goods and services based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments. Source: World Bank national accounts data, and OECD National Accounts data files.
- **FDI_t**: Foreign direct investment, net inflows (% of GDP) for country i in period t - Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP. Source: International Monetary Fund, International Financial Statistics and Balance of Payments databases, World Bank, International Debt Statistics, and World Bank and OECD GDP estimates.
- **OIL_t**: Price of oil in period t – Oil price is the Crude oil, average spot price of Brent, Dubai and West Texas Intermediate, equally weighed. Source: World Bank.

Since my main goal is to study the impact of oil prices on real output and price level, as one of the most important indicators of economic growth, we include variables such as GDP and inflation in the VAR model. The unemployment rate is a condition for the growth of production, the emergence of new enterprises, affects the expansion of reproduction, purchasing and investment demand, and a reduction in the savings of the population. Therefore, we could not ignore this factor in our VAR model. The export of goods and services is introduced as a variable, as it promotes production growth in most industries, and also affects the growth of investment and consumer demand, which

stimulates the development of domestic production. Speaking of foreign direct investments, we took this factor as important, because it is a significant factor in the growth of national economies, an important source of capital investment in the national production of goods and services.

3. Empirical Results Analysis

In order to achieve the objectives of the thesis, we will have to use the VAR-model, which requires several conditions to be fulfilled by the variables. First, the data must be stationary, and secondly, the conditions of normality, heteroscedasticity and absence of autocorrelation must be met. But above all, we must choose the optimal lag length.

3.1. Sample Characterisation

In this study we will use the crude oil price in international market (OIL) some of the most relevant macroeconomic factors in a country, like Gross Domestic Product growth rate (GDP), Unemployment rate (UNEMP), Exports of goods and services growth rate (EXP), Inflation (INF), and Foreign direct investment (FDI). Their values can be seen in Appendix 1.

A brief analysis of the descriptive statistics of the variables for each of the countries, presented in Panel A and Panel B of Table 1, allows one to perceive the macroeconomic behaviour of each of the countries.

From Panel A we can verify a mean of GDP growth of 3,34% in Belarus from 1991 to 2016, with a standard deviation of 6,61%. In this country the minimum is about -11,7% and the maximum is about 11% in GDP growth. The unemployment is 2,11%, which is a very low value, but Belarus has a high inflation rate. The exports had growth of 4.9% in the period and the Foreign direct investment is 2,04% of the national GDP. In Panel B we present the descriptive values of Portugal between 1961 and 2016, where we observe a GDP growth of 2,72%, with a standard deviation of 3,56%, and a minimum GDP growth of -4,35% and a maximum of 12,61%. The unemployment rate is 7,09% and the inflation rate has a mean of 9,41%. The exportation of goods and services is 5,19% and the Foreign direct investment is 2,17% of the GDP.

Table 1. Descriptive Statistics

Panel A: Descriptive Analysis in Belarus

	EXP	FDI	GDP	INF	UNEMP	OIL
Mean	4,19	2,04	3,34	214,92	2,11	51,49
Median	6,30	1,96	4,89	35,47	2,00	44,95
Maximum	33,90	6,48	11,45	2221,02	6,10	95,27
Minimum	-22,40	0,07	-11,70	7,03	0,50	15,90
Std. Dev.	13,32	1,56	6,61	505,86	1,52	28,74
Skewness	-0,01	0,89	-0,86	3,09	1,28	0,32
Kurtosis	3,49	3,72	2,89	11,91	4,18	1,61
Observations	24	24	24	24	24	24

Panel B: Descriptive Analysis in Portugal

	EXP	FDI	GDP	INF	UNEMP	OIL
Mean	5,19	2,17	2,72	9,41	7,09	40,69
Median	5,90	1,27	2,14	5,21	7,19	31,80
Maximum	32,97	10,16	12,61	28,78	16,18	95,27
Minimum	-15,71	0,27	-4,35	-0,84	1,40	5,21
Std. Dev.	7,84	2,16	3,56	8,80	3,38	25,72
Skewness	0,07	1,60	0,41	0,85	0,73	0,80
Kurtosis	6,45	5,50	3,44	2,38	3,49	2,62
Observations	47	47	47	47	47	47

Source: Authors's own-elaboration

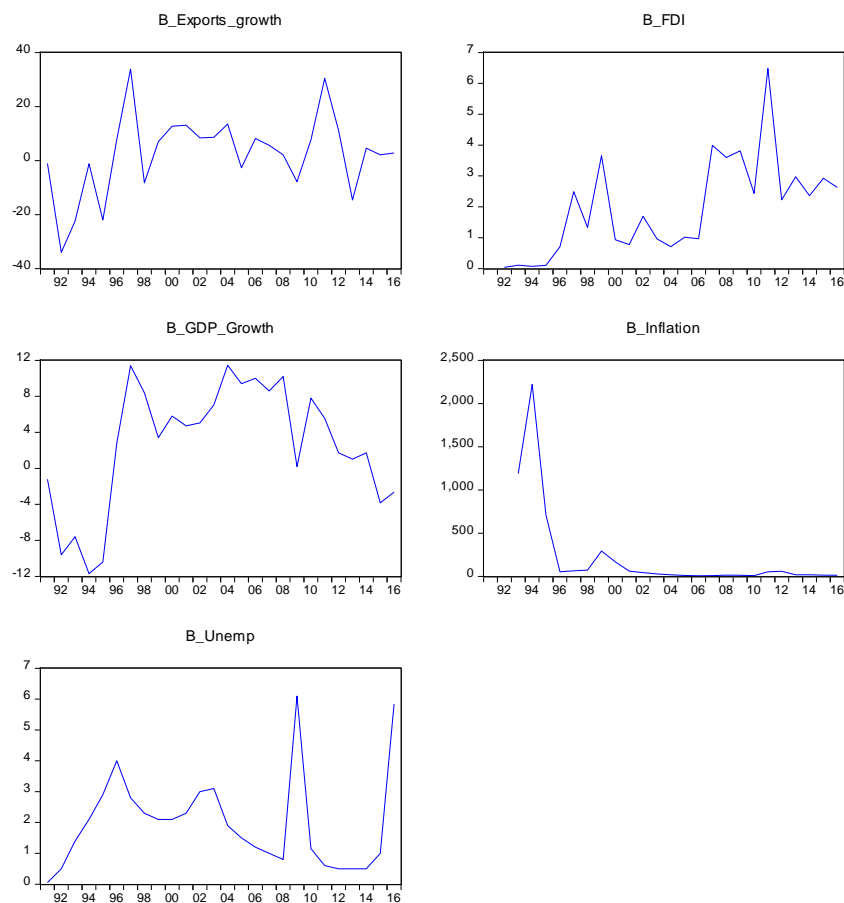


Figure 2. Evolution of Macroeconomic variables in Belarus

Source: Authors's own-elaboration

Figure 2 above shows the evolution of Belarus indicators. we can observe the decline in the level of inflation rates in recent times, as well as a slow decrease in the country's GDP growth after 2004. Exports and FDI are steadily growing. The evolution of the Portuguese macroeconomic variables can be verified in Figure 3. As we can see from the graphs, almost all the macroeconomic indicators of Portugal have a lot of fluctuation.

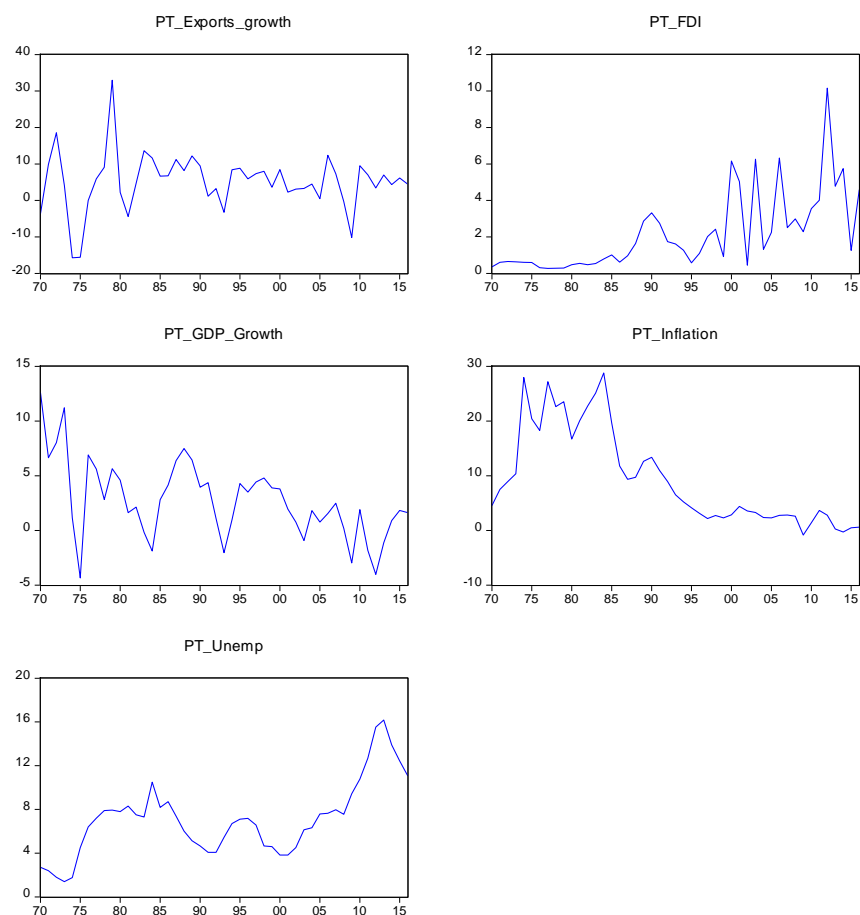


Figure 3. Evolution of Macroeconomic variables in Portugal

Source: Author's own-elaboration

It is also relevant to show the evolution of oil price in the period of the analysis. From Figure 4 we can verify the evolution of the crude oil prices and show the increase of their prices in the oil crises in the beginnings of 1980s and after 2005. From Panel A in Table 1, relative to the period between 1991 and 2016, we verify the mean oil price of 51,49 USD, with a fluctuation between 15,90 USD and 95,27 USD. Between 1960 and 2016 Panel B of Table 1 shows a mean price of oil of 40,69 USD. The mean oil price is lower in the second period (1960-2016) because at the beginning the price was lower, as we can observe in the following figure.

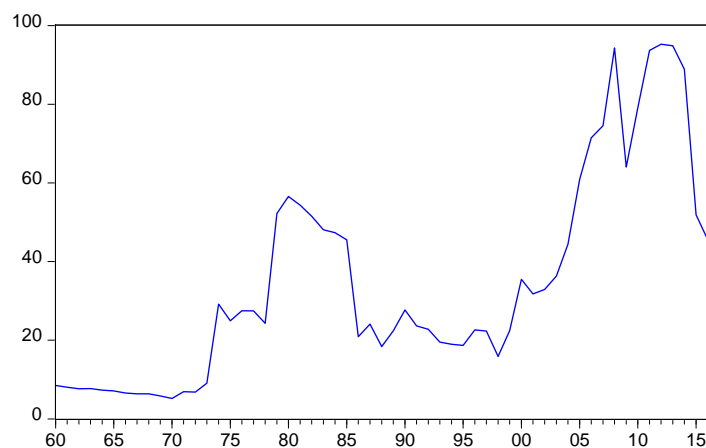


Figure 4. Oil price between 1960 and 2016

Source: Author`s own-elaboration

Table 2 shows the correlation matrix between the variables for both countries. From the correlation analysis, it can be seen that in both countries the time series of oil prices are correlated with macroeconomic indicators. The oil price is positively correlated with Belarus GDP growth, but negatively correlated with Portuguese GDP growth. Inflation rate is negatively related with oil price and foreign direct investment is positively correlated with oil price in both countries. Other correlations are presented in the table.

Table 2. Correlation Matrix

Panel A: Correlation Matrix in Belarus

	EXP	FDI	GDP	INF	UNEMP	OIL
EXP	1	0,37	0,58	-0,36	-0,09	0,15
FDI	0,37	1	0,25	-0,42	-0,14	0,61
GDP	0,58	0,25	1	-0,71	-0,19	0,29
INFLATION	-0,36	-0,42	-0,71	1	-0,02	-0,44
UNEMP	-0,09	-0,14	-0,19	-0,02	1	-0,48
OIL	0,15	0,61	0,29	-0,44	-0,48	1

Panel B: Correlation Matrix in Portugal

	EXP	FDI	GDP	INF	UNEMP	OIL
EXP	1	0,02	0,32	0,03	0,13	<0,01
FDI	0,02	1	-0,40	-0,52	0,44	0,55
GDP	0,32	-0,40	1	0,08	-0,52	-0,59
INFLATION	0,03	-0,52	0,08	1	-0,20	-0,23
UNEMP	0,13	0,44	-0,52	-0,20	1	0,79
OIL	<0,01	0,55	-0,59	-0,23	0,79	1,00

Source: Authors`s own-elaboration

Having conducted a basic analysis of variables for Belarus and Portugal, we can conclude that there are differences in the behaviour of macroeconomic indicators in these countries. However, general

trends can be observed, such as a general increase or decrease in indicators over time and a correlation with the oil prices.

3.2. Stationarity test

Before further research, we first check the time series for stationarity. Thus, to confirm if the series used are stationary, tests are performed to the unit roots in order to measure the degree of integration of the series. It is important to note that a typical VAR model can only be constructed if the time series is stationary.

To check the stationarity, we conducted two tests: Augmented Dickey-Fuller (ADF, Dickey and Fuller, 1981) and Phillips and Perron (PP, Phillips and Perron, 1988) unit root tests. Their main difference is that PP does not require to select the level of serial correlation as in ADF, it takes the same estimation scheme as in ADF test, but corrects the statistic to conduct for autocorrelations and heteroscedasticity.

Table 3. Stationarity tests

Panel A: Stationary tests in Belarus						
	EXP	FDI	GDP	INF	UNEMP	OIL
ADF test						
Level	-3,92 (0,01)	-1,86 (0,34)	-1,85 (0,35)	-8,19 (<0,01)	-3,48 (0,02)	-1,22 (0,65)
1st difference	-3,46 (0,02)	-9,08 (<0,01)	-5,29 (<0,01)	-3,23 (0,03)	-5,13 (<0,01)	-4,84 (<0,01)
PP test						
Level	-3,76 (0,01)	-3,08 (0,04)	-1,85 (0,35)	-3,03 (0,05)	-3,39 (0,02)	-1,25 (0,64)
1st difference	-10,45 (<0,01)	-9,91 (<0,01)	-5,41 (<0,01)	-6,08 (<0,01)	-5,59 (<0,01)	-4,84 (<0,01)
Panel B: Stationary tests in Portugal						
	EXP	FDI	GDP	INF	UNEMP	OIL
ADF test						
Level	-5,66 (<0,01)	-2,43 (0,14)	-4,47 (<0,01)	-1,12 (0,70)	-1,34 (0,60)	-1,84 (0,36)
1st difference	-6,22 (<0,01)	-5,11 (<0,01)	-5,51 (<0,01)	-3,91 (<0,01)	-4,77 (<0,01)	-6,58 (<0,01)
PP test						
Level	-5,32 (<0,01)	-4,47 (<0,01)	-4,49 (<0,01)	-1,42 (0,56)	-1,63 (0,46)	-1,88 (0,34)
1st difference	-20,73 (<0,01)	-18,47 (<0,01)	-8,80 (<0,01)	-7,54 (<0,01)	-4,74 (<0,01)	-6,58 (<0,01)

Source: Authors's own-elaboration

The Dickey–Fuller test involves fitting the regression model.

$$\Delta y_t = \rho y_{t-1} + (\text{constant, time trend}) + u_t \quad (2)$$

The Phillips–Perron test involves fitting (2), and the results are used to calculate the test statistics. They estimate not (2) but:

$$y_t = \pi y_{t-1} + (\text{constant, time trend}) + u_t \quad (3)$$

The main hypothesis is the presence of a unit root, mathematically it is expressed in equality. If it is rejected, then there are no single roots and time series are stationary.

Table 4 show the results of stationary tests for each of the variables at the initial level and at the first difference. Although there are some variables stationary at the initial level, it can be observe that all variables – oil prices, GDP growth, unemployment, Inflation, exports of goods and services, and foreign direct investment of Portugal and Belarus – are integrated of order one. So, it can be concluded that all variables are stationary in first difference. In this way, we will use all variables as stationary in the first difference.

3.3. Number of Lags

To select the optimal VAR model, we need to determine the optimal number of lags. Since the choice of the optimal number of lags is relevant for the estimation of the VAR model, we use the following criteria: LR test statistic (LR); Final prediction error (FPE); Akaike information criterion (AIC); Schwarz information criterion (SC); Hannan-Quinn information criterion (HQ). If we analyse the data based in the Akaike information criterion, which is the best criteria, we would choose Lag 2 for Belarus and Lag 5 for Portugal. However, if we use other criteria we would get different conclusions, and because of the autocorrelation and heteroscedasticity test in the following section, we will use Lag 1 for Belarus and Lag 3 for Portugal.

Table 4. Lag selection criteria

Panel A: Lag selection criteria in Belarus							
Lag	LogL	LR	FPE	AIC	SC	HQ	
0	-437,08	NA	85500000000	42,20	42,50	42,26	
1	-383,64	71,26*	19000000000	40,54	42,63	40,99	
2	-322,87	46,30	5370000000*	38,18*	42,06*	39,02*	
Panel B: Lag selection criteria in Portugal							
Lag	LogL	LR	FPE	AIC	SC	HQ	
0	-741,89	NA	118000000	35,61	35,86	35,70	
1	-601,51	233,97	834645	30,64	32,38*	31,28	
2	-554,42	65,03	547929	30,12	33,34	31,30	
3	-516,30	41,75	666997	30,01	34,73	31,74	
4	-435,37	65,51*	152266	27,87	34,08	30,15	
5	-347,37	46,10	52541*	25,39*	33,09	28,22*	

Source: Authors` own-elaboration

After the choice of the number of lags, we check the VAR stability condition which confirm that the model is stationary with 1 lag for Belarus and with 3 lags for Portugal.

3.4. Analysis of Data Quality

The appropriate use of the VAR model makes it necessary to comply with some requirements in addition to the stationarity of the series, like the absence of autocorrelation, the absence of heteroscedasticity, and the normality of the residuals. Because of that, we make the analysis of these assumptions in this point.

3.4.1. Normality Test

VAR models use the assumption of the normality of distributions, so specific tests for normality are needed. In this thesis we start doing a histogram method to test the normality of distribution. The histogram divides the series range (the distance between the maximum and minimum values) into a number of equal length intervals or bins and displays a count of the number of observations that fall into each bin. We also use the Jarque-Bera test (JB), that is a statistical test which verifies the observations errors on the normality. The null hypothesis of JB test is the normal distribution.

Table 5. Normality test

Panel A: Normality tests in Belarus							
	EXP	FDI	GDP	INF	UNEMP	OIL	Joint
Jarque-Bera	1,741	7,356	2,382	10,401	1,024	0,370	23,274
Probability	0,42	0,03	0,30	0,01	0,60	0,83	0,03
Panel B: Normality tests in Portugal							
	EXP	FDI	GDP	INF	UNEMP	OIL	Joint
Jarque-Bera	2,519	0,038	0,334	2,851	1,836	0,437	8,015
Probability	0,28	0,98	0,85	0,24	0,40	0,80	0,78

Source: Authors`s own-elaboration

Table 5 show the Jarque-Bera test coefficient and its p-value. If we use a level of significance of 5%, all p-values are greater in Portugal, but FDI and inflation are lower in Belarus. But if we use a level of significance of 1%, all variable will be greater than this level of significance in both countries. This means that for all variables the null hypothesis is not rejected and that all variables satisfy the condition of normal distribution. The problem related with inflation and unemployment in Belarus data at 5% is common in short sample series.

3.4.2. Autocorrelation Test

Another important assumption that we need to verify is the non-presence of autocorrelation in my time series data. To test the hypothesis of autocorrelation of random deviations of the model we use the Breusch-Godfrey test, that allows to verify the autocorrelation of any order. With the goal to

perceive the autocorrelation of the residuals, the test uses the auxiliary regression of the least-squares residuals of the original model for the factors of this model and the lag values of the residues. Further, for this auxiliary regression, the hypothesis of simultaneous equality to zero of all coefficients with lagged residues is verified. The test statistic has an asymptotic distribution. If the value of the statistics exceeds the critical table value, the autocorrelation is recognized as significant, otherwise it is insignificant. The null hypothesis of Breusch-Godfrey test (Autocorrelation LM Test) is the lack of autocorrelation, and the alternative hypothesis is its presence.

Table 6. Autocorrelation Tests

Panel A: Breusch-Godfrey Test in Belarus		
Lags	LM-Stat	Prob
1	49,70	0,06
Panel B: Breusch-Godfrey Test in Portugal		
Lags	LM-Stat	Prob
3	33,37	0,59

Source: Authors` own-elaboration

Table 6 shows the results of autocorrelation tests. After testing the VAR models for Portugal with 3 lags and for Belarus with 1 lag, we find that in both cases the p-value exceeds 5%, which means that we accept the null hypothesis. In turn, this means that both models do not have autocorrelation, and therefore are suitable for further testing.

3.4.3. Heteroscedasticity Test

The analysis of VAR model implies to study the heteroscedasticity. In this way we use White test, that is necessary in order to proceed to hypotheses testing or forecasting. In this test the initial regression equation is evaluated and then an auxiliary equation is constructed for the dependence of the square of the residuals of the original equation on all independent variables, their squares and pairwise products. The null hypothesis of white test is that the residuals are homoscedasticity (or no heteroscedasticity), and the alternative hypothesis is that the residuals are heteroscedasticity.

Table 7. Heteroscedasticity Tests

Panel A: White Test in Belarus		
Lags	Chi-sq	Prob
1	264,00	0,29
Panel B: White Test in Portugal		
Lags	Chi-sq	Prob
3	786,90	0,21

Source: Authors` own-elaboration

After testing the VAR models for Portugal and Belarus we find that the p-value also exceeds 5% in the White test. It means that we accept the null hypothesis: both models do not have heteroscedasticity, and therefore are suitable for hypotheses testing and forecasting.

3.5. Granger Causality Test

Granger's test of causality is a procedure for checking the cause-effect relationship between time series. The idea of the test is that the values (changes) of one-time series, which is the cause of changes in another time series, must precede the changes of this time series, and besides, they should make a significant contribution to the forecast of its values.

Table 8. Granger Causality Test

Panel A: VAR Granger Causality for Belarus				Panel B: VAR Granger Causality for Portugal			
Dependent variable: D(GDP)				Dependent variable: D(GDP)			
Excluded	Chi-sq	df	Prob,	Excluded	Chi-sq	df	Prob,
D(EXP)	0,33	1	0,57	D(EXP)	3,86	3	0,28
D(FDI)	0,03	1	0,86	D(FDI)	2,13	3	0,55
D(INF)	4,83	1	0,03	D(INF)	2,92	3	0,40
D(UNEMP)	2,22	1	0,14	D(UNEMP)	10,21	3	0,02
D(OIL)	0,35	1	0,56	D(OIL)	14,98	3	<0,01
All	15,32	5	0,01	All	40,61	15	<0,01
Dependent variable: D(INF)				Dependent variable: D(INF)			
Excluded	Chi-sq	df	Prob,	Excluded	Chi-sq	df	Prob,
D(EXP)	1,17	1	0,28	D(EXP)	3,39	3	0,34
D(FDI)	0,43	1	0,51	D(FDI)	1,18	3	0,76
D(GDP)	0,53	1	0,46	D(GDP)	18,80	3	<0,01
D(UNEMP)	0,33	1	0,56	D(UNEMP)	2,11	3	0,55
D(OIL)	0,27	1	0,61	OIL	3,40	3	0,33
All	2,01	5	0,85	All	30,68	15	0,01
Dependent variable: D(UNEMP)				Dependent variable: D(UNEMP)			
Excluded	Chi-sq	df	Prob,	Excluded	Chi-sq	df	Prob,
D(EXP)	0,01	1	0,91	D(EXP)	3,60	3	0,31
D(FDI)	<0,01	1	0,96	D(FDI)	1,91	3	0,59
D(GDP)	0,36	1	0,55	D(GDP)	7,27	3	0,06
D(INFLATION)	0,17	1	0,68	D(INF)	0,94	3	0,82
D(OIL)	0,11	1	0,74	OIL)	12,54	3	0,01
All	0,77	5	0,98	All	30,94	15	0,01
Dependent variable: D(OIL)				Dependent variable: D(OIL)			
Excluded	Chi-sq	df	Prob,	Excluded	Chi-sq	df	Prob,
D(EXP)	0,41	1	0,52	D(EXP)	1,30	3	0,73
D(FDI)	0,92	1	0,34	D(FDI)	6,88	3	0,08
D(GDP)	0,04	1	0,84	D(GDP)	4,97	3	0,17
D(INFLATION)	<0,01	1	0,97	D(INF)	8,43	3	0,04
D(UNEMP)	0,12	1	0,73	D(UNEMP)	18,54	3	<0,01
All	1,63	5	0,90	All	37,91	15	<0,01

Source: Authors`s own-elaboration

3.6. VAR Analysis

The VAR coefficients¹ are not interpretable. The influence of one variable on another is not exhausted by the coefficient immediately before it. There is also an indirect influence through other variables. Interpretation of VAR is performed using the analysis of the Impulse Response Function (IRF) and the Variance Dispersion (VD).

3.6.1. Variance Decomposition

It is also important to analyse the Variance Decomposition. It determines how much of the variance of the predicted error of each variable can be attributed to shocks for other variables. In other words, the given analysis will allow to learn, what contribution change of one variable brings in change of another.

The variance decomposition allows one to estimate the contribution of the dispersion of one variable to the variance of the other. It provides information about the relative importance of each random perturbation in affecting the variables in the VAR system. The advantage of using this method of interpreting the results is that these contributions can be compared.

All results are presented in Appendix 2 and Table 9 only show the results of decomposition of the dispersion by the oil price factor. Analysing the data about the first difference, we can say that the impact of oil prices has a significantly different impact on macroeconomic indicators of Portugal and Belarus.

Panel A of Table 9 shows that, in the short run, that is year 2, impulse or innovation or shock to oil prices account 0,10% variation of the fluctuation in Belarus exportation growth, shock to oil prices can cause 1,81% fluctuation in foreign direct investment. Also, a shock of 1% in oil prices can cause 0,40% fluctuation in GDP growth, 0,55% fluctuation in inflation rate and 0,2% fluctuation in unemployment rate.

In the long run, that is year 10, impulse or innovation or shock to oil prices account 0,17% variation of the fluctuation in growth exportations, shock to oil prices can cause 1,51% fluctuation in foreign direct investment. Also, a shock of 1% in oil prices can cause 0,52% fluctuation in GDP growth, 0,56% fluctuation in inflation rate and 0,47% fluctuation in unemployment rate. Although the impact of oil prices in macroeconomic variables seems to be similar between short and long term, it seems to have little impact overall.

When we look into the Portuguese results, we see that the impact of oil prices increases a lot. Based on the Panel B of Table 5, we can say that a change in the variance of oil prices by 1% will lead to an increase 11,63% in the variance of Portugal's GDP in the short term, that is year 2. In the long run, year 10, this influence does not change much, and by the 10th period oil prices have an impact of 11,48%. Also for exportations we can observe a decrease in the influence of the change in oil

¹ We present the VAR model estimation results in the Appendix 4.

prices, since in the long run the percentage of the exponents of the dispersion of the variance decreases: from 14,98% in the short run to 12,11% in the long run.

Table 9. Variance Decomposition

Panel A: Variance Decomposition of Belarus						
Variance Decomposition of:	D(EXP)	D(FDI)	D(GDP)	D(INF)	D(UNEMP)	
Period						
1	<0,01	<0,01	<0,01	<0,01	<0,01	<0,01
2	0,10	1,81	0,40	0,55	0,20	
3	0,16	1,43	0,39	0,55	0,41	
4	0,16	1,43	0,51	0,55	0,46	
5	0,16	1,54	0,51	0,56	0,47	
6	0,16	1,57	0,51	0,56	0,47	
7	0,16	1,58	0,52	0,56	0,47	
8	0,16	1,58	0,52	0,56	0,47	
9	0,17	1,58	0,52	0,56	0,47	
10	0,17	1,58	0,52	0,56	0,47	

Panel B: Variance Decomposition of Portugal						
Variance Decomposition of:	D(EXP)	D(FDI)	D(GDP)	D(INF)	D(UNEMP)	
Period						
1	<0,01	<0,01	<0,01	<0,01	<0,01	
2	14,98	2,96	11,63	0,50	3,46	
3	13,97	2,50	8,73	0,47	3,86	
4	14,37	9,91	8,23	4,68	3,68	
5	12,07	10,20	10,42	4,67	6,16	
6	12,21	10,07	11,01	4,61	8,96	
7	11,92	10,24	10,75	4,40	9,55	
8	11,56	10,67	10,57	4,32	9,79	
9	12,46	10,82	11,78	4,42	9,79	
10	12,11	11,10	11,48	4,71	10,10	

Source: Authors` own-elaboration

In the short run, that is year 2, impulse or innovation or shock to oil prices account 14,98% variation of the fluctuation in growth exportations, shock to oil prices can cause 2,96% fluctuation in foreign direct investment. Also, a shock of 1% in oil prices can cause 11,63% fluctuation in GDP growth, 0,50% fluctuation in inflation rate and 3,46% fluctuation in unemployment rate.

In the long run, that is year 10, impulse or innovation or shock to oil prices account 12,11% variation of the fluctuation in growth exportations, shock to oil prices can cause 11,10% fluctuation in foreign direct investment. Also, a shock of 1% in oil prices can cause 11,48% fluctuation in GDP growth, 4,71% fluctuation in inflation rate and 10,10% fluctuation in unemployment rate.

Although the results of oil prices impact are more relevant in Portugal, they have some more differences between short and long term effects.

In general, it can be said that change in OIL has much more contribution in change of macroeconomic variables in Portugal than in Belarus.

3.6.2. Impulse Response Function

The impulse is a single perturbation, which is attached to one of the parameters. The Impulse Response function describes the response of a dynamic series in response to some external shocks. Shock refers to a one-stage change in exogenous variables, equal to their one standard deviation of the oscillations over the entire observed period. Basically, it shows how an increase in oil prices by 1% will change the macroeconomic indicators of countries. It is used the response to cholesky one standard deviation innovations.

Appendix 3 shows the results of an analysis of the impulse response function of exportations growth, GDP growth, inflation, unemployment and foreign direct investment. we can show that, for example, the change (which is as impulse or a shock) in the GDP growth has response of other variables, that is, if the GDP growth changes the other variables can also change or not change very much and eventually this effect tends to zero. Here we present and discuss the results of the response of macroeconomic variables to oil price changes.

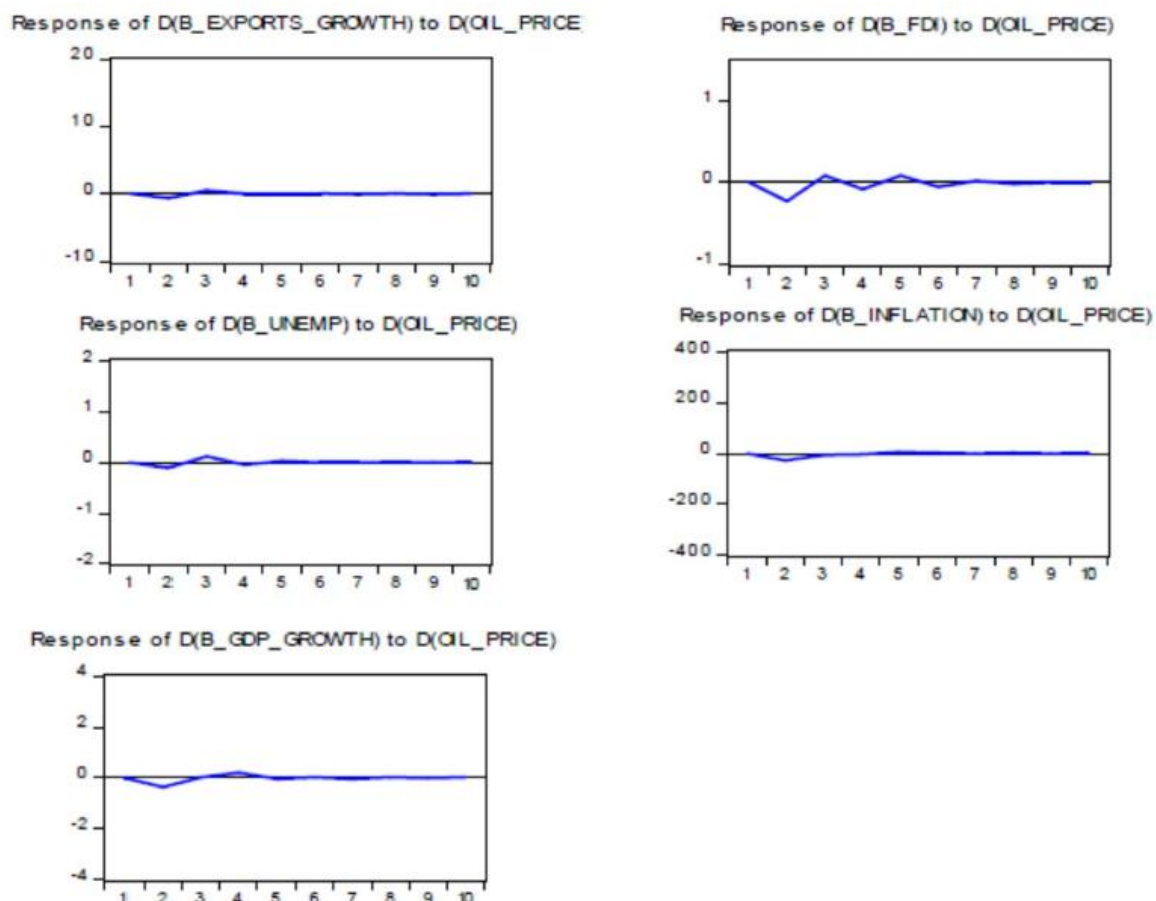


Figure 5. Response of Belarus macroeconomic variables to oil price impulse

Source: Author's own-elaboration

Figure 5 shows the response of Belarusian macroeconomic variables to oil price shocks and we find that all variables have a very slight response. However, in all variables there is a slightly negative

response in the second period and a slightly positive response in the following period. In the long term, the response to the oil price shock is practically non-existent.

In Figure 6 we can analyse Portuguese data and it is noted that a change in the price of oil gives a negative response to the growth rate of GDP and to the growth rate of exports. There is also a positive response in the inflation rate and in the unemployment rate when a shock occurs in oil price. During the period it is showed that there are several fluctuations in the responses of the macroeconomic variables to the oil price shocks.

From this analysis it seems to be concluded that oil price shocks have deeper effects on the Portuguese economy than on the Belarusian economy. Comparing the two countries, Portuguese macroeconomic indicators are more prone responding to oil shocks than Belarus variables. This situation may be related to the greater openness of the Portuguese economy to international trade and its greater dependence on the oil price traded in international markets.

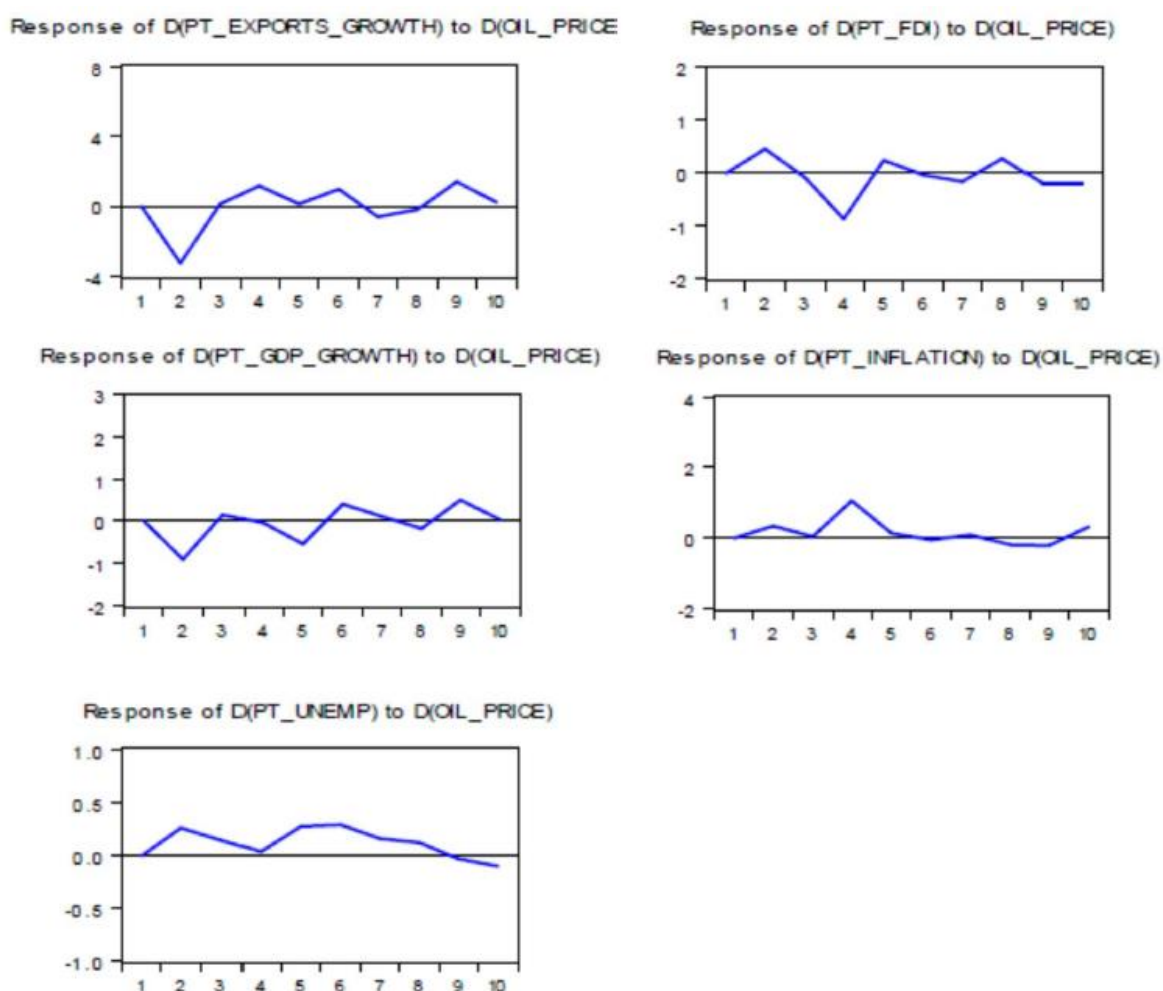


Figure 6. Response of Portuguese macroeconomic variables to oil price impulse

Source: Author's own-elaboration

Considering the impact of oil prices on macroeconomic indicators through the Impulse Response function of the two countries, the oil prices has a negative effect on the macroeconomic indicators of

both countries, but they are deeper in Portugal. On average, in 2-3 years there is a significant negative impact of rising oil prices, which weaken over the years.

Conclusions, Limitations and Future Research Lines

Everyone knows that a varied set of macroeconomic variables are interconnected with each other and are also associated with factors in international markets. Considering the upward trend in oil prices since the mid-2000s and knowing their importance in the development of economies, in this thesis the main goal was to study the impact of oil prices in macroeconomic variables of two different economies, Belarus and Portugal.

Confirming our first hypothesis, we can say that we have showed that the change in oil prices undoubtedly has a tangible impact on the economic development of Portugal and Belarus. It is worth noting the negative impact of rising oil prices due to the fact that both countries are importers of oil.

As for the second assumption that the Belarusian economy is more sensitive to changes in oil prices than the economy of Portugal, we came to the conclusion that the situation is the opposite: in this study we found that oil price shocks have a deeper effect on the Portuguese economy than on the Belarusian economy. The oil prices have a negative impact on the macroeconomic indicators of both countries, but they are deeper in Portugal. On average, there is a more negative impact in short time, which weakens over the years. This situation may be related to the greater openness of the Portuguese economy to international trade and its greater dependence on the oil price traded in international markets.

In view of the conclusions reached, the oil price is much more important for the Portuguese state budget than for Belarusian accounts. In this sense, the macroeconomic policy in Portugal must take into account the oil price in the international market as a major factor for the evolution of economic indicators. However, in Belarus the oil price on the international market does not seem to affect daily life or the economic policy.

Throughout this work we came across several limitations. We have faced with the lack of macroeconomics data, especially in the case of Belarus. Since the country gained its independence only in 1991, it was not possible to find annual data for earlier periods. In order to increase the sample time series, we also failed to obtain monthly or quarterly data, because there are not Belarus available data. Another problem could be that the export factor is included in the calculations of the GDP factor, which means that in calculating the impact of oil prices, this could give rise to inaccuracies.

Oil price seems to be determined in the international market taking into account international factors in which the playmakers are the big world economies (e.g. USA, China, United Kingdom, Germany, ...), and countries like Belarus and Portugal maybe only play takers of the oil price. In this way, it seems to make sense to consider the oil price as an exogenous variable, which would imply the use of an econometric VAR Structural model (SVAR). In order to assess whether the series are

cointegrated, besides being integrated in isolation, to find out if there is a long-term equilibrium relation between them, it can be used the Johansen Cointegration test and it could also be used the Vector Error Correlation model (VECM).

In the light of the results obtained, as well as relying on the latest developments in the oil market, we believe that this issue needs further study. For a more detailed and precise study of the issue, we would suggest introducing other macroeconomic factors into the model, for example, the money supply. Another suggestion may be the study of the influence of supply and demand factors on oil. One can also learn the asymmetry of the influence of growth and fall in oil prices on the economic growth of the countries studied. It could also be important the analysis of other commodities, instead of the oil market, like gold market or other.

References

- Ahmad, F. (2013). *The Effect of Oil Prices on Unemployment: Evidence from Pakistan*. Retrieved from <https://www.berjournal.com/the-effect-of-oil-prices-on-unemployment-evidence-from-pakistan-2>.
- Alvarex, L.J., Hurtado, S., Sanchez, I., & Thomas, C. (2009). The impact of oil Price changes on Spanish and Euro area consumer price inflation. *Banco de Espana*, 23-33.
- Álvarez, L. E. (n.d.). *The impact of oil price changes on Spanish and euro area consumer price inflation*. Retrieved from <https://www.sciencedirect.com/science/article/pii/S0264999310001574>.
- Barsky, R. B., & Kilian, L. (2002). Do We Really Know that Oil Caused the Great Stagflation? A Monetary Alternative. *NBER Macroeconomics Annual 2001*, 137-183.
- Baumeister, C., & Peersman, G. (2013). *Time-Varying Effects of Oil Supply Shocks on the US Economy*. Retrieved 02 27 from <https://pdfs.semanticscholar.org/561f/515dede873ea-b3cecc75cd603234cd6db3fc>.
- Bernanke, B., Gertler, M., & Watson, M. (1997). Systematic Monetary Policy and the Effects of Oil Price Shocks. *Brookings Papers on Economic Activity*, 1, 91-157.
- Bjørnland, H. C. (2000). The dynamic effects of aggregate demand, supply and oil price shocks. A comparative study. *Manchester School* 68(5), 578-607.
- Blanchard, O. J., & Galí J. (2008). *The Macroeconomic Effects of Oil Price Shocks: Why are the 2000s so Different from the 1970s?* Retrieved from <http://www.nber.org/chapters/c0517>.
- Blanchard, O. J., & Gali, J. (2007). *The macroeconomic effects of oil price shocks: why are the 2000s so different from the 1970s?* Retrieved from <http://www.nber.org/papers/w13368>.
- BP. (2017). *BP Statistical Review of World Energy 2017*. Retrieved from BP Statistical Review of World Energy. Retrieved from <https://www.bp.com/content/dam/bp/en/corporate/pdf/en>.
- Brown, S., & Yücel, M.K. (1999). Oil prices and the economy. *Southwest Economy*, 4, 1-6.
- Brown, S.P.A., & Yücel, M.K. (2002). Energy prices and aggregate economic activity: An interpretative study. *Quarterly Review of Economics and Finance*, 42(2), 193-208.
- Burbidge, J., & Harrison A. (1984). Testing for the Effects of Oil-Price Rises Using Vector Autoregression. *International Economic Review*, 25(2), 459-484.

- Caceres, C., Poplawski-Ribeiro, M., & Tartari D. (2012). *Inflation dynamics in the CEMAC region*. Retrieved from <https://academic.oup.com/jae/article-abstract/22/2/239/763803?redirectedFrom=PDF>.
- Chuku, A. C., Effiong E. L., & Sam N. R. (2010). *Oil Price Distortions and Their Short- and Long-Run Impacts on the Nigerian Economy*. Retrieved from <http://mpa.ub.uni-muenchen.de/24434/>
- Cunado, J., Jon S., & Perez de Gracia F. (2015). *Revisiting the macroeconomic impact of oil shocks in Asian economics*. Retrieved from <http://www.bankofcanada.ca/wpcontent/uploads/2015/06/wp2015-23.pdf>
- Doğrul, G. H., & Soytaş, U. (2010). Relationship between oil prices, interest rate, and unemployment: Evidence from an emerging market. *Energy Economics*, 32, 1523-1528.
- El-Anshasy, A.A., & Bradley, M.D. (2012). Oil prices and the fiscal policy response in oil exporting countries. *Journal of Policy Modeling*, 25-30.
- Farzanegan, M.R., & Markwardt, G. (2009). The Effects of Oil Price Shocks on the Iranian Economy. *Energy Economics*, 31(1), 134-151.
- Gelos, G., & Ustyugova, Y. (2017). *Inflation responses to commodity price shocks—How and why do countries differ*. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.367.7104&rep=rep1&type=pdf>.
- Gogineni, S. (2007). *The Stock Market Reaction to Oil Price Changes*. Retrieved from https://www.researchgate.net/publication/266215963_The_Stock_Market_Reaction_to_Oil_Price_Changes.
- Granger, C.W.J., & Teräsvirta, T. (1993). *Modelling Nonlinear Economic Relationships*. Retrieved from <http://onlinelibrary.wiley.com/doi/10.1002/jae.3950090412>.
- Gregorio, J. E. (2007). Another Pass-through Bites the Dust? Oil Prices and Inflation. *Economia*, 7(2), 155-208.
- Habermeier, K. (2009). *Inflation pressures and monetary policy options in emerging and developing countries - A cross regional perspective*. Retrieved from https://www.researchgate.net/profile/Alessandro_Giustiniani2/publication/228304943_Inflation_Pressures_and_Monetary_Policy_Options_in_Emerging_and_Developing_Countries_-_A_Cross_Regional_Perspective/links/00b7d5231b8207bd3d000000/Inflation-Pressures.
- Hamilton, J. (1983). Oil and the Macroeconomy since World War II. *Journal of Political Economy* 91, 228-248.
- Hamilton, J. D. (2005). *Oil and Macroeconomy*. Retrieved from http://econweb.ucsd.edu/~jhamilton/JDH_palgrave_oil.
- Hong, H., Torous, W., & Valkanov, R. (2002). *Do Industries Lead Stock Markets?* Retrieved from <http://pages.stern.nyu.edu/~rengle/Harrison%20Hong>.

- Hooker, M. A. (2002). Are Oil Shocks Inflationary? Asymmetric and Nonlinear Specifications versus Changes in Regime. *Journal of Money*, 540-561.
- Huang, R., Masulis, R., & Stoll H. (1996). Energy Shocks and Financial Markets. *Journal of Futures markets*, 16, 1-27.
- International Labour Organization. (2018). *ILOSTAT database*. Retrieved from http://www.ilo.org/ilostat/faces/wcnav_defaultSelection?_afLoop=2077694249378906&_afWindowMode=0&_afWindowId=null#!%40%40%3F_afWindowId%3Dnull%26_afLoop%3D2077694249378906%26_afWindowMode%3D0%26_adf.ctrlState%3D10j7tbwg8e_86.
- International Monetary Fund. (2018). *International Financial Statistics and data files*. Retrieved from: <https://www.imf.org/en/Data>.
- Isah, A., Dikko, H.G., & Chinyere, E.S. (2015). *Modeling the Impact of Crude Oil Price Shocks on Some Macroeconomic Variables in Nigeria Using Garch and VAR Models*. Retrieved from <http://article.sciencepublishinggroup.com/html/10.11648.j.ajtas.20150405.16.html>.
- Ito, K. (2008). *The impact of oil price volatility on macroeconomic activity in Russia*. Retrieved from http://www.unagaliciamoderna.com/eawp/coldata/upload/impact_oilprice_volatility_russia.
- Jones, C., & Kaul, G. (1996). Oil and Stock Markets. *Journal of Finance*, 51, 463-491.
- Jones, D., Leiby, P., & Paik, I. (2003). Oil Price Shocks and the Macroeconomy: What Has Been Learned since 1996. *The Energy Journal*, 25(2), 34-38.
- Kaul, G., & Seyhun N. (1990). Relative Price Variability, Real Shocks, and the Stock Market. *Journal of Finance*, 45, 479-496.
- Kilian, L. (2008). Exogenous Oil Supply Shocks: How Big Are They and How Much Do They Matter for the U.S. Economy? *Review of Economics and Statistics*, 90(2), 216-240.
- Kilian, L. (2009). *Not all oil price shocks are alike: disentangling demand and supply shocks in the crude oil market*. Retrieved from <https://www.aeaweb.org/articles?id=10.157/aer.99.3.1053>.
- Korhonen, I., & Ledyeva, S. (2010). Trade Linkages and Macroeconomic Effects of the Price of Oil. *Energy Economics*, 32(4), 848-856.
- LeBlanc, M., & Menzie D. Chinn. (2004). Do high oil prices presage inflation? The evidence from G-5 countries. *Business Economics*, 39(2), 38-49.
- Lee, K., Ni, S., & Ratti, R. A. (1995). Oil Shocks and the Macroeconomy The Role of Price Variability. *The Energy Journal*, 16, 39-56.
- Mehrara, M., & Oskoui, K. (2007). The source of macroeconomic fluctuations in oil exporting countries: A comparative study. *Economic Modelling*, 365-379.
- Mehregan, N., & Salmani, Y. (2014). Oil price shocks and economic growth in Iran: Application of Markov-model. *Iran-Energy Economics Journal*, 12, 183-209.

- Melnikov, R. (2010). Influence of oil price dynamics on macroeconomic indicators of the Russian economy. *Applied Econometrics*, 20-29.
- Mork, K. (1989). Oil and the macroeconomy when prices go up and down: an extension of Hamilton's results. *Journal of Political Economy*, 91, 740-744.
- O'Neil, T. J., Penm, J., & Terrell, R.D. (2008). The Role Higher Oil Prices: A Case of Major Developed Countries. *Research in Finance*, 24, 287-299.
- Papapetrou, E. (2001). Oil price shocks stock market, economic activity and employment in Greece. *Energy Economics*, 511-532.
- Park, J., & Ratti, R. A. (2008). Oil Price Shock Markets in the U.S. and 13 European Countries. *Energy Economics*, 30, 2587-2608.
- Peersman, G., & I. van Robays. (2009). Oil and the Euro Area Economy. *Economic Policy*, 603-651.
- Rafay, A., & Farid, S. (2015). *An Analysis of Oil Price Volatility Using VAR: Evidence From Pakistan*. Retrieved from <http://www.lahoreschoolofeconomics.edu.pk/businessjournals/V4issue1/02%20Rafay%20and%20Farid%20FINAL>.
- Rautava, J. (2002). *The Role of Oil Prices and the Real Exchange Rate on Russia's Economy*. Retrieved from http://ideas.repec.org/p/hhs/bofitp/2002_003.html.
- Robaldo, P., & Salvado, J.C. (2008). *Oil price shocks and the Portuguese economy since the 1970s*. Retrieved 02 22, 2018, from https://www.jstor.org/stable/pdf/2229041.pdf?seq=1#page_scan_tab_contents.
- Rotemberg, J. J., & Woodford, M. (1996). Imperfect Competition and the Effects of Energy Price Increases. *Journal of Money, Credit and Banking*, 28 (1), 549-577.
- Sadorsky, P. (1999). Oil Price Shocks and Stock Market Activity. *Energy Economics*, 21, 449-469.
- Sadorsky, P. (2001). Risk Factors in Stock Returns of Canadian Oil and Gas Companies. *Energy Economics*, 23, 17-28.
- Sarzaeem, A. (2005). Investigation of oil price shocks impact on macroeconomic variables through a VAR model. *Quarterly Energy Economics Review*, 27-51.
- Shuping, W., Aimei H., & Zhenxin, W. (2012). *The Impact of Oil Price Volatility on China's Economy: An Empirical Investigation Based on VAR Model*. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.918.8628&rep=rep1&type=pdf>.
- The Organisation for Economic Co-operation and Development (OECD). (2018). *OECD National Accounts data files*. Retrieved from <https://data.oecd.org>.
- Tinbergen, J. (1962). *Shaping the World Economy: Suggestions for an International Economic Policy*. Retrieved from https://www.jstor.org/stable/pdf/2229041?seq=1#page_scan_tab_contents.

- Usman, M., Nawaz, R. M., & Qayyum, M. (2011). *Impact of Oil Price Volatility on Macroeconomic Variables (A Case Study)*. Retrieved from <https://pdfs.semanticscholar.org/85bc/9d10fcb0aa6cf70b6dd44cdf8a0650477654>.
- VanWijnbergen, S. (1985). Oil price shocks, unemployment, investment and the current account: an inter-temporal disequilibrium analysis. *The Review of Economic Studies*, 52(4), 627-645.
- Wei, C. (2003). Energy, the Stock Market, and the Putty-Clay Investment Model. *American Economic Review*, 93, 311-323.
- Yang, J., Askari, H., Forrer, J., & Teegen, H. (2004). U.S. Economic Sanctions: An Empirical study. *The International Trade Journal*, 1, 23-62.
- Yurtsever, C., & Zahor, T. (2007). *Oil Price Shocks and Stock Market in the Netherlands*. Retrieved from https://www.researchgate.net/publication/266455363_oil_price_shocks_and_stock_market_in_the_Netherlands.

Appendix

Appendix 1: Macroeconomic Indicators

Year	Panel A: Belarus data					Panel B: Portuguese data					oil price		
	GDP_Gro wth	Unemp	Inflation	Exports_g rowth	FDI_Growth FDI	GDP_Gro wth	Unemp	Inflation	Exports_g rowth	FDI_Growth FDI	h	Oil	
2016	-2,65	5,84	11,84	2,80	2,63	-0,25	1,62	11,07	0,61	4,43	4,59	2,76	45,53
2015	-3,83	1,00	13,53	2,13	2,93	-0,11	1,82	12,44	0,49	6,14	1,26	-0,81	51,86
2014	1,72	0,50	18,12	4,60	2,36	-0,17	0,89	13,89	-0,28	4,34	5,74	0,22	88,90
2013	1,02	0,50	18,31	-14,60	2,97	0,53	-1,13	16,18	0,27	6,99	4,78	-0,51	94,83
2012	1,73	0,50	59,22	11,20	2,23	-0,63	-4,03	15,53	2,77	3,41	10,16	1,24	95,27
2011	5,54	0,60	53,23	30,40	6,48	1,87	-1,83	12,68	3,65	7,04	4,01	0,16	93,67
2010	7,79	1,15	7,74	7,67	2,44	-0,26	1,90	10,77	1,40	9,52	3,55	0,52	79,04
2009	0,20	6,10	12,95	-7,83	3,81	-0,14	-2,98	9,43	-0,84	-10,21	2,29	-0,29	64,02
2008	10,20	0,80	14,84	2,10	3,60	0,21	0,20	7,55	2,59	-0,32	2,99	0,30	94,32
2007	8,60	1,00	8,42	5,60	3,99	4,06	2,49	7,96	2,81	7,31	2,51	-0,54	74,52
2006	10,00	1,20	7,03	8,17	0,97	0,16	1,55	7,65	2,74	12,37	6,33	1,98	71,49
2005	9,40	1,50	10,34	-2,70	1,01	0,87	0,77	7,58	2,29	0,49	2,24	0,77	60,88
2004	11,45	1,90	18,11	13,50	0,71	-0,05	1,81	6,32	2,36	4,46	1,32	-0,76	44,38
2003	7,04	3,10	28,40	8,59	0,96	-0,30	-0,93	6,13	3,28	3,29	6,27	16,35	36,30
2002	5,05	3,00	42,54	8,41	1,69	1,58	0,77	4,50	3,55	3,08	0,44	-0,90	32,94
2001	4,73	2,30	61,13	13,09	0,78	-0,19	1,94	3,83	4,39	2,25	5,03	-0,16	31,80
2000	5,80	2,10	168,62	12,70	0,93	-0,73	3,79	3,82	2,85	8,44	6,16	5,25	35,48
1999	3,40	2,10	293,68	7,00	3,66	1,19	3,89	4,60	2,30	3,62	0,92	-0,61	22,42
1998	8,40	2,30	72,87	-8,30	1,33	-0,42	4,79	4,65	2,72	8,01	2,42	0,27	15,90
1997	11,40	2,80	63,94	33,90	2,49	2,36	4,43	6,57	2,16	7,35	2,01	0,75	22,31
1996	2,80	4,00	52,71	7,80	0,71	6,11	3,50	7,19	3,12	5,90	1,10	0,97	22,65
1995	-10,40	2,90	709,35	-22,00	0,11	0,40	4,28	7,11	4,12	8,84	0,58	-0,46	18,69
1994	-11,70	2,10	2221,02	-1,20	0,07	-0,40	0,96	6,71	5,21	8,39	1,27	-0,17	18,97
1993	-7,60	1,40	1190,23	-22,40	0,11	1,51	-2,04	5,44	6,50	-3,27	1,61	-0,18	19,51
1992	-9,60	0,50		-34,00	0,04		1,09	4,08	8,94	3,24	1,74	-0,23	22,79
1991	-1,20	0,05		-1,10			4,37	4,07	10,93	1,16	2,74	-0,06	23,65
1990							3,95	4,65	13,37	9,49	3,32	0,50	27,67
1989							6,44	5,13	12,62	12,20	2,87	0,88	22,40
1988							7,49	6,01	9,70	8,18	1,64	0,98	18,37
1987							6,38	7,38	9,34	11,21	0,97	0,96	24,12
1986							4,14	8,70	11,76	6,76	0,61	-0,13	20,90
1985							2,81	8,18	19,65	6,67	1,01	0,38	45,54
1984							-1,88	10,50	28,78	11,64	0,79	0,35	47,35
1983							-0,17	7,30	25,11	13,61	0,54	0,02	48,09
1982							2,14	7,50	22,73	4,67	0,47	-0,17	51,53
1981							1,62	8,30	20,04	-4,44	0,55	0,11	54,34
1980							4,59	7,80	16,69	2,22	0,48	1,00	56,53
1979							5,64	7,94	23,54	32,97	0,29	0,19	52,22
1978							2,82	7,89	22,64	9,09	0,28	0,14	24,30
1977							5,60	7,20	27,19	5,90	0,27	-0,08	27,47
1976							6,90	6,40	18,25	0,00	0,31	-0,45	27,48
1975							-4,35	4,50	20,41	-15,59	0,60	0,09	24,96
1974							1,14	1,77	27,97	-15,71	0,61	0,12	29,16
1973							11,20	1,40	10,36	4,18	0,63	0,30	9,09
1972							8,02	1,80	8,94	18,55	0,65	0,30	6,83
1971							6,63	2,40	7,50	9,88	0,61	0,94	6,92
1970							12,61	2,70	4,53	-3,67	0,36		5,21
1969							2,12	2,60	7,40	2,89			5,82
1968							8,88	3,10	6,07	-3,39			6,37
1967							7,54	2,50	5,52	3,58			6,36
1966							4,08	1,80	5,05	16,32			6,57
1965							7,47	2,60	3,48	11,06			7,11
1964							6,31	3,40	3,40	40,38			7,33
1963							5,87	3,30	2,02	0,60			7,69
1962							6,61	3,20	2,66	19,15			7,65
1961							5,53	3,00	1,55	-2,08			8,05
1960									3,02				8,51

Appendix 2: Variance Decomposition

Panel A: Variance decomposition in Belarus							
Variance Decomposition of D(EXP):							
Period	S.E.	D(EXP)	D(FDI)	D(GDP)	D(INFL)	D(UNEMP)	D(OIL)
1	17,29	100,00	<0,01	<0,01	<0,01	<0,01	<0,01
2	19,35	84,32	0,41	3,31	11,74	0,12	0,10
3	19,70	82,63	0,82	4,40	11,64	0,35	0,16
4	19,79	82,00	1,15	4,48	11,53	0,69	0,16
5	19,83	81,68	1,30	4,46	11,70	0,68	0,16
6	19,85	81,53	1,38	4,45	11,78	0,70	0,16
7	19,86	81,47	1,41	4,45	11,79	0,72	0,16
8	19,86	81,44	1,42	4,45	11,79	0,74	0,16
9	19,86	81,42	1,42	4,45	11,79	0,76	0,17
10	19,86	81,41	1,42	4,45	11,79	0,76	0,17
Variance Decomposition of D(FDI):							
Period	S.E.	D(EXP)	D(FDI)	D(GDP)	D(INFL)	D(UNEMP)	D(OIL)
1	1,37	21,99	78,01	<0,01	<0,01	<0,01	<0,01
2	1,70	17,86	67,01	7,28	0,68	5,36	1,81
3	2,05	13,67	48,77	7,57	9,32	19,24	1,43
4	2,15	12,46	44,39	7,41	9,20	25,11	1,43
5	2,19	12,11	43,01	7,45	8,92	26,96	1,54
6	2,20	11,99	42,50	7,47	8,80	27,67	1,57
7	2,21	11,94	42,40	7,46	8,79	27,83	1,58
8	2,21	11,92	42,40	7,45	8,83	27,82	1,58
9	2,21	11,91	42,41	7,45	8,86	27,80	1,58
10	2,21	11,91	42,42	7,44	8,87	27,79	1,58
Variance Decomposition of D(GDP):							
Period	S.E.	D(EXP)	D(FDI)	D(GDP)	D(INF)	D(UNEMP)	D(OIL)
1	4,18	17,09	0,43	82,48	<0,01	<0,01	<0,01
2	5,85	8,73	0,87	42,19	35,83	11,99	0,40
3	5,92	8,99	1,27	41,39	35,03	12,93	0,39
4	5,94	8,96	1,38	41,19	35,04	12,93	0,51
5	5,95	8,93	1,38	40,99	35,01	13,18	0,51
6	5,96	8,92	1,38	40,93	34,96	13,30	0,51
7	5,96	8,91	1,38	40,92	34,96	13,32	0,52
8	5,96	8,91	1,38	40,91	34,96	13,32	0,52
9	5,96	8,91	1,38	40,91	34,96	13,32	0,52
10	5,96	8,91	1,39	40,91	34,96	13,32	0,52
Variance Decomposition of D(INF):							
Period	S.E.	D(EXP)	D(FDI)	D(GDP)	D(INF)	D(UNEMP)	D(OIL)
1	379,21	0,13	1,48	30,52	67,87	<0,01	<0,01
2	396,50	2,23	1,93	31,47	62,09	1,73	0,55
3	406,30	2,38	2,51	30,17	59,95	4,43	0,55
4	408,79	2,36	2,80	29,80	60,07	4,41	0,55
5	409,84	2,35	2,96	29,65	60,06	4,42	0,56
6	410,10	2,35	3,05	29,62	60,00	4,43	0,56
7	410,31	2,35	3,07	29,59	59,97	4,46	0,56
8	410,43	2,35	3,08	29,57	59,95	4,49	0,56
9	410,48	2,34	3,08	29,57	59,94	4,51	0,56
10	410,50	2,34	3,08	29,57	59,93	4,52	0,56

Variance Decomposition of D(UNEMP):								
Period	S.E.	D(EXP)	D(FDI)	D(GDP)	D(INFL)	D(UNEMP)	D(OIL)	
1	2,18	5,97	0,16	12,18	23,15	58,54	<0,01	
2	2,38	5,40	0,15	10,21	20,95	63,08	0,20	
3	2,42	5,27	0,23	9,94	20,59	63,55	0,41	
4	2,43	5,23	0,44	9,89	20,48	63,50	0,46	
5	2,44	5,21	0,63	9,85	20,46	63,38	0,47	
6	2,44	5,20	0,74	9,83	20,51	63,25	0,47	
7	2,44	5,19	0,79	9,82	20,54	63,19	0,47	
8	2,44	5,19	0,80	9,82	20,54	63,18	0,47	
9	2,44	5,19	0,81	9,82	20,54	63,18	0,47	
10	2,44	5,19	0,81	9,82	20,54	63,18	0,47	

Variance Decomposition of D(OIL):								
Period	S.E.	D(EXP)	D(FDI)	D(GDP)	D(INF)	D(UNEMP)	D(OIL)	
1	15,36	5,48	0,48	48,33	18,26	4,60	22,84	
2	15,76	6,02	2,95	45,94	17,83	5,54	21,72	
3	15,99	5,86	3,92	44,69	18,90	5,51	21,12	
4	16,13	5,75	4,23	43,88	19,41	6,00	20,74	
5	16,17	5,72	4,34	43,69	19,37	6,23	20,65	
6	16,19	5,71	4,35	43,59	19,34	6,40	20,61	
7	16,20	5,71	4,35	43,54	19,32	6,50	20,58	
8	16,21	5,70	4,35	43,53	19,31	6,54	20,57	
9	16,21	5,70	4,35	43,52	19,31	6,55	20,57	
10	16,21	5,70	4,35	43,52	19,31	6,55	20,57	

Panel B: Variance decomposition in Portugal								
Variance Decomposition of D(EXP):								
Period	S.E.	D(EXP)	D(FDI)	D(GDP)	D(INF)	D(UNEMP)	D(OIL)	
1	6,63	100,00	<0,01	<0,01	<0,01	<0,01	<0,01	
2	8,41	72,72	0,52	0,20	0,16	11,42	14,98	
3	8,71	70,89	0,63	3,48	0,15	10,87	13,97	
4	9,12	68,18	1,55	4,49	0,47	10,94	14,37	
5	9,96	66,31	1,32	9,90	0,91	9,48	12,07	
6	10,30	61,93	2,03	10,67	3,44	9,71	12,21	
7	10,58	58,80	2,53	13,43	4,07	9,25	11,92	
8	10,75	57,28	2,52	14,53	3,94	10,16	11,56	
9	11,09	54,26	3,51	14,40	4,16	11,22	12,46	
10	11,27	52,58	5,65	14,19	4,52	10,94	12,11	

Variance Decomposition of D(FDI):								
Period	S.E.	D(EXP)	D(FDI)	D(GDP)	D(INF)	D(UNEMP)	D(OIL)	
1	1,73	4,21	95,79	<0,01	<0,01	<0,01	<0,01	
2	2,65	3,18	77,86	0,18	0,09	15,73	2,96	
3	2,93	6,38	72,05	0,27	0,14	18,65	2,50	
4	3,13	5,60	66,38	1,56	0,15	16,41	9,91	
5	3,18	6,34	64,52	1,86	0,21	16,87	10,20	
6	3,20	6,37	64,53	1,84	0,39	16,81	10,07	
7	3,21	6,41	64,32	1,83	0,45	16,76	10,24	
8	3,26	6,38	63,78	1,80	0,47	16,89	10,67	
9	3,28	6,73	63,35	1,88	0,50	16,73	10,82	
10	3,29	6,70	63,11	1,90	0,51	16,68	11,10	

Variance Decomposition of D(GDP):							
Period	S.E.	D(EXP)	D(FDI)	D(GDP)	D(INF)	D(UNEMP)	D(OIL)
1	2,14	0,01	13,32	86,67	<0,01	<0,01	<0,01
2	2,67	0,15	10,03	56,26	12,74	9,19	11,63
3	3,12	1,60	8,40	63,85	10,68	6,74	8,73
4	3,22	2,31	8,49	61,14	11,50	8,32	8,23
5	3,31	3,34	8,02	57,87	10,88	9,48	10,42
6	3,45	3,22	7,91	57,32	11,75	8,80	11,01
7	3,51	4,14	9,13	55,65	11,68	8,64	10,75
8	3,58	4,22	8,80	56,30	11,22	8,90	10,57
9	3,69	4,37	10,61	53,20	10,74	9,29	11,78
10	3,74	4,34	11,95	52,26	10,89	9,08	11,48

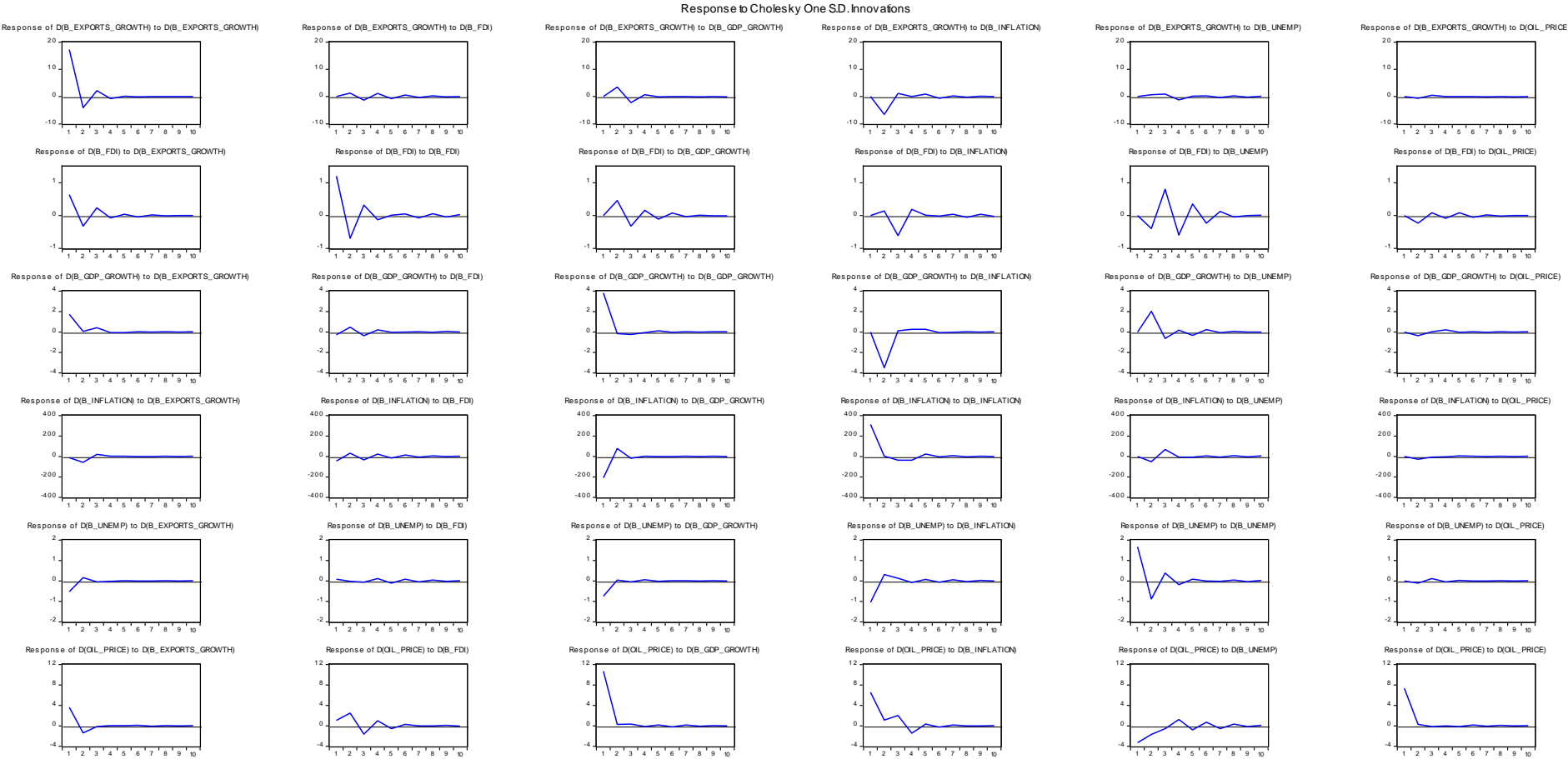
Variance Decomposition of D(INFLATION):							
Period	S.E.	D(EXP)	D(FDI)	D(GDP)	D(INF)	D(UNEMP)	D(OIL)
1	4,33	5,50	9,20	17,98	67,32	<0,01	<0,01
2	4,73	5,87	7,70	27,30	58,09	0,54	0,50
3	4,90	6,10	11,08	25,51	54,17	2,67	0,47
4	5,10	6,57	10,94	25,07	50,27	2,47	4,68
5	5,14	7,44	10,83	24,72	49,88	2,46	4,67
6	5,18	7,61	10,79	25,37	49,14	2,47	4,61
7	5,31	7,54	13,02	24,42	46,77	3,85	4,40
8	5,43	8,67	14,65	23,43	44,76	4,17	4,32
9	5,47	8,62	15,08	23,30	44,15	4,42	4,42
10	5,49	8,56	14,98	23,44	43,84	4,46	4,71

Variance Decomposition of D(UNEMP):							
Period	S.E.	D(EXP)	D(FDI)	D(GDP)	D(INF)	D(UNEMP)	D(OIL)
1	1,21	6,65	3,31	26,89	0,06	63,08	<0,01
2	1,38	5,67	3,60	37,55	1,44	48,27	3,46
3	1,50	5,15	3,10	33,70	12,71	41,48	3,86
4	1,55	4,84	2,99	31,80	14,60	42,08	3,68
5	1,63	5,02	2,78	28,85	16,88	40,32	6,16
6	1,66	5,05	2,68	28,13	16,21	38,97	8,96
7	1,68	5,91	2,84	27,35	16,39	37,96	9,55
8	1,71	5,89	3,41	26,61	16,10	38,20	9,79
9	1,71	5,89	3,40	26,52	16,32	38,09	9,79
10	1,71	5,92	3,39	26,41	16,26	37,93	10,10

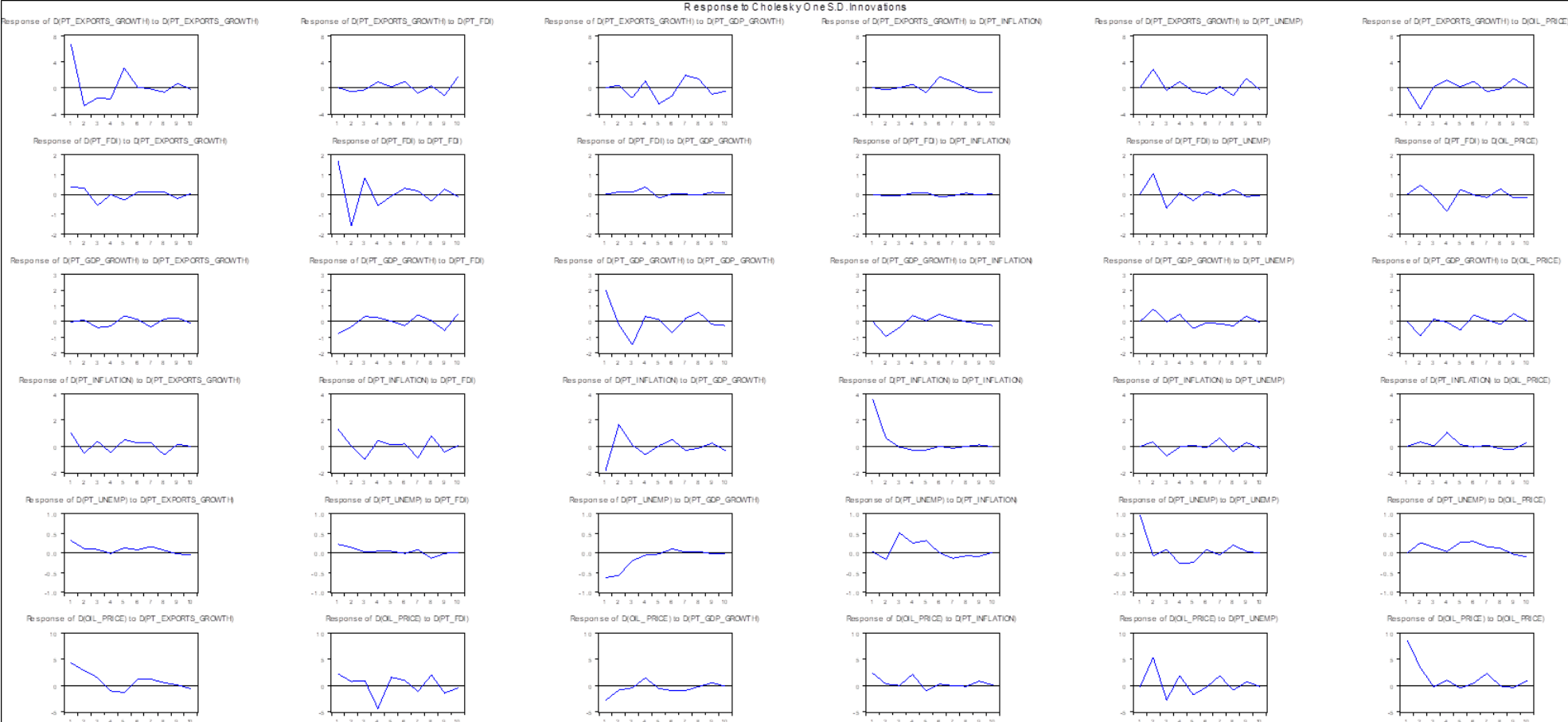
Variance Decomposition of D(OIL):							
Period	S.E.	D(EXP)	D(FDI)	D(GDP)	D(INF)	D(UNEMP)	D(OIL)
1	10,61	16,78	4,41	7,19	4,70	0,08	66,84
2	12,77	16,46	3,41	5,38	3,30	18,00	53,44
3	13,20	16,69	3,72	5,16	3,09	21,29	50,05
4	14,36	14,65	12,43	5,43	4,87	19,76	42,87
5	14,67	14,89	13,05	5,35	5,15	20,37	41,19
6	14,79	15,26	13,26	5,69	5,11	20,08	40,61
7	15,21	15,07	13,10	5,77	4,83	20,49	40,74
8	15,38	14,86	14,52	5,67	4,73	20,40	39,83
9	15,50	14,64	15,13	5,70	4,94	20,29	39,29
10	15,55	14,73	15,12	5,67	4,92	20,19	39,37

Appendix 3: Impulse Response Function

Panel A: Impulse Response Function in Belarus



Panel B: Impulse Response Function in Portugal



Appendix 4: VAR estimation

Panel A: VAR estimation for Belarus						
	D(EXP)	D(FDI)	D(GDP)	D(INF)	D(UNEMP)	D(OIL)
D(EXP(-1))	-0,26 0,30 (-0,869)	-0,02 0,02 (-0,798)	0,04 0,07 (0,572)	-7,09 6,56 (-1,079)	<0,01 0,04 (0,113)	-0,17 0,27 (-0,639)
D(FDI(-1))	0,41 2,38 (0,171)	-0,49 0,19 (-2,596)	0,10 0,58 (0,177)	34,42 52,19 (0,659)	-0,01 0,30 (-0,048)	2,03 2,11 (0,961)
D(GDP(-1))	0,19 1,29 (0,143)	0,15 0,10 (1,516)	-0,03 0,31 (-0,099)	20,72 28,34 (0,731)	-0,10 0,16 (-0,602)	-0,24 1,15 (-0,208)
D(INFL(-1))	-0,02 0,01 (-1,545)	<0,01 <0,01 (0,110)	-0,01 <0,01 (-2,198)	-0,04 0,26 (-0,163)	<0,01 <0,01 (-0,416)	<0,01 0,01 (-0,036)
D(UNEMP(-1))	0,24 3,10 (0,078)	-0,30 0,24 (-1,217)	1,12 0,75 (1,489)	-39,25 67,94 (-0,577)	-0,57 0,39 (-1,448)	-0,96 2,75 (-0,347)
D(OIL(-1))	-0,08 0,35 (-0,238)	-0,03 0,03 (-1,113)	-0,05 0,09 (-0,588)	-4,01 7,78 (-0,515)	-0,01 0,04 (-0,325)	0,03 0,32 (0,106)
C	-0,48 3,79 (-0,12661)	0,22 0,30 (0,73354)	0,11 0,92 (0,11951)	-97,61 83,07 (-1,17500)	0,16 0,48 (0,33780)	1,09 3,36 (0,323)
R-squared	0,34	0,58	0,51	0,16	0,13	0,10
Adj. R-squared	0,07	0,41	0,31	-0,17	-0,22	-0,26
Sum sq. resid	4 485,64	27,99	262,11	052,05	71,18	3 538,73
S.E. equation	17,29	1,37	4,18	379,21	2,18	15,36
F-statistic	1,27	3,39	2,56	0,48	0,37	0,27
Log likelihood	-89,71	-33,87	-58,47	-157,64	-44,13	-87,10
Akaike AIC	8,79	3,72	5,95	14,97	4,65	8,55
Schwarz SC	9,14	4,06	6,30	15,31	5,00	8,90
Mean dependent	0,18	0,12	0,41	-100,42	0,17	1,21
S.D. dependent	17,94	1,77	5,02	350,19	1,97	13,67
Determinant resid covariance (dof adj.)		91 693 466 276,16				
Determinant resid covariance		9 211 913 685,36				
Log likelihood			-439,68			
Akaike information criterion			43,79			
Schwarz criterion			45,87			

Panel B: VAR estimation for Portugal

	D(EXP)	D(FDI)	D(GDP)	D(INF)	D(UNEMP)	D(OIL)
D(EXP(-1))	-0,32 0,19 (-1,670)	0,02 0,05 (0,433)	0,08 0,06 (1,337)	-0,16 0,12 (-1,300)	0,01 0,03 (0,326)	-0,08 0,30 (-0,252)
D(EXP(-2))	-0,39 0,19 (-2,085)	-0,10 0,05 (-2,048)	-0,05 0,06 (-0,903)	-0,01 0,12 (-0,050)	0,01 0,03 (0,170)	0,11 0,30 (0,374)
D(EXP(-3))	-0,46 0,16 (-2,909)	-0,03 0,04 (-0,632)	-0,03 0,05 (-0,570)	-0,03 0,10 (-0,336)	-0,01 0,03 (-0,357)	-0,04 0,25 (-0,158)
D(FDI(-1))	-0,03 0,66 (-0,039)	-0,92 0,17 (-5,372)	-0,08 0,21 (-0,374)	0,33 0,43 (0,764)	-0,05 0,12 (-0,378)	0,17 1,06 (0,161)
D(FDI(-2))	-0,40 0,75 (-0,536)	-0,24 0,20 (-1,200)	-0,09 0,24 (-0,368)	-0,21 0,49 (-0,416)	-0,14 0,14 (-1,015)	0,99 1,21 (0,817)
D(FDI(-3))	0,77 0,73 (1,060)	0,14 0,19 (0,737)	0,21 0,23 (0,915)	-0,32 0,47 (-0,666)	-0,22 0,13 (-1,669)	-1,77 1,16 (-1,525)
D(GDP(-1))	0,66 0,77 (0,865)	0,42 0,20 (2,101)	-0,18 0,25 (-0,723)	1,14 0,50 (2,279)	-0,32 0,14 (-2,324)	1,76 1,23 (1,432)
D(GDP(-2))	0,86 0,86 (1,005)	0,59 0,22 (2,651)	-0,20 0,28 (-0,717)	-0,13 0,56 (-0,228)	0,03 0,16 (0,195)	0,57 1,37 (0,413)
D(GDP(-3))	1,68 0,60 (2,808)	0,25 0,16 (1,595)	0,38 0,19 (1,971)	-0,26 0,39 (-0,661)	-0,20 0,11 (-1,868)	0,36 0,96 (0,374)
D(INF(-1))	0,13 0,38 (0,331)	-0,07 0,10 (-0,669)	-0,21 0,12 (-1,688)	0,15 0,25 (0,601)	-0,06 0,07 (-0,937)	-0,22 0,61 (-0,363)
D(INF(-2))	0,25 0,39 (0,633)	0,11 0,10 (1,049)	-0,11 0,13 (-0,825)	0,28 0,26 (1,080)	0,07 0,07 (1,002)	0,92 0,63 (1,460)
D(INF(-3))	0,08 0,40 (0,204)	0,06 0,11 (0,568)	0,02 0,13 (0,132)	-0,27 0,26 (-1,027)	0,04 0,07 (0,494)	-0,48 0,65 (-0,743)
D(UNEMP(-1))	2,84 1,18 (2,412)	1,11 0,31 (3,620)	0,81 0,38 (2,130)	0,37 0,77 (0,487)	-0,07 0,21 (-0,303)	5,76 1,89 (3,054)
D(UNEMP(-2))	2,25	-0,32	0,72	-1,84	0,23	-6,14

	1,29	0,34	0,42	0,85	0,24	2,07
	(1,737)	(-0,933)	(1,718)	(-2,176)	(0,953)	(-2,966)
D(UNEMP(-3))	0,33	-0,83	0,07	0,39	-0,07	1,17
	1,57	0,41	0,51	1,03	0,29	2,51
	(0,211)	(-2,030)	(0,143)	(0,384)	(-0,229)	(0,466)
D(OIL(-1))	-0,38	0,05	-0,11	0,04	0,03	0,40
	0,14	0,04	0,04	0,09	0,03	0,22
	(-2,711)	(1,458)	(-2,349)	(0,426)	(1,178)	(1,798)
D(OIL(-2))	0,03	0,04	0,06	0,02	-0,02	-0,21
	0,18	0,05	0,06	0,12	0,03	0,29
	(0,152)	(0,834)	(0,984)	(0,127)	(-0,553)	(-0,705)
D(OIL(-3))	-0,05	-0,11	-0,10	0,14	0,02	0,30
	0,16	0,04	0,05	0,10	0,03	0,25
	(-0,341)	(-2,599)	(-1,899)	(1,325)	(0,768)	(1,185)
C	-0,18	0,51	-0,41	-0,17	0,10	0,64
	1,17	0,31	0,38	0,76	0,21	1,87
	(-0,156)	(1,668)	(-1,094)	(-0,224)	(0,480)	(0,340)
R-squared	0,71	0,71	0,76	0,42	0,51	0,54
Adj. R-squared	0,49	0,50	0,58	-0,02	0,15	0,20
Sum sq. resids	1 055,11	71,75	110,42	449,73	35,03	2 700,39
S.E. equation	6,63	1,73	2,14	4,33	1,21	10,61
F-statistic	3,22	3,30	4,23	0,96	1,41	1,58
Log likelihood	-129,82	-72,02	-81,29	-111,48	-56,61	-150,02
Akaike AIC	6,92	4,23	4,66	6,07	3,52	7,86
Schwarz SC	7,70	5,01	5,44	6,85	4,29	8,64
Mean dependent	0,01	0,09	-0,22	-0,23	0,22	0,85
S.D. dependent	9,27	2,44	3,31	4,29	1,31	11,86
		438				
Determinant resid covariance (dof adj.)		546,07				
Determinant resid covariance		13				
Log likelihood		257,81				
Akaike information criterion		-570,17				
Schwarz criterion		31,82				
		36,49				