Oil and Stock Market in Portugal

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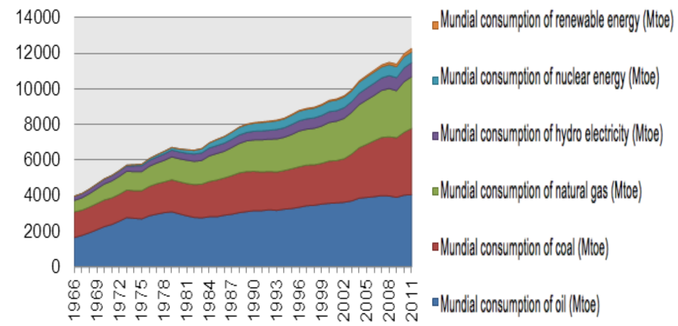
***Abstract*— This paper presents a brief historical description that shows how the fluctuations in oil prices are closely linked to some of the most important events in world history. The importance of oil prices fluctuations on the economy in general and on the stock market in particular is analyzed. Regarding the last point, and although there are strong beliefs that there exists a relationship between these aspects, some clear divergences are registered concerning the way and intensity with which this influence is exerted. A model is estimated with the objective of understanding the existing relationship between oil price fluctuations and the returns of Portuguese stock markets. To estimate the model, the methodology used by Kilian & Park (2009) is essayed, adapting the VAR model and the four time series used by the authors to the Portuguese reality. The model seems to demonstrate that none of the three oil price shocks studied affect the Portuguese stock market. Therefore, and since there exists the possibility of an important stock market influencing the PSI, it could be interesting to elaborate a model including this parameter, in a future study.**

***Keywords* — Oil Shocks; Stock Markets; Stock Returns; VAR; Portugal.**

1. INTRODUCTION

According to Amador (2010) energy is one of the most important factors for every economy. Since long ago, oil has become one of the most important energetic sources and, despite the decrease of importance over the last few years when compared with other kinds of energy, in 2012 it totalized more than 33% [1] of the energy consumed in the world, being the most used form of energy. For this reason, it is legitimate to think that a fluctuation in the price of oil could provoke effects in the economy, which in last instance could affect the stock market.

Although some studies can be found about the importance and relationship between oil and the economy, those who are developed around the repercussion of oil shocks are still scarce, especially when it comes to the Portuguese stock market. It is in this context that the Master's Dissertation in Industrial Engineering and Management that led to this paper arises.



Graph 1- Historical consumption by kind of energy

The main objective of this work is to identify the possible relationship between oil price and Portuguese stock market returns. To do so, a VAR model with four variables was used. The variables are: oil global production, real global activity, oil price and Portuguese stock market returns.

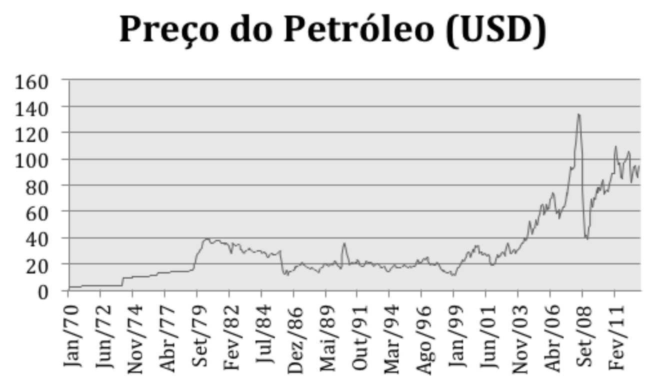
The remainder of this paper is organized as follows: Next section presents the bibliographic review that allows a better perception of the motivations of this work; in the third section, an explanation of the VAR model and a justification of its usage will be provided, as well as some results. Finally, section four will present the main conclusions obtained.

[1] Data found in the institutional BP website. http://www.bp.com/sectionbodycopy.do?categoryId=9037132&contentId=7069049#/Primary-Energy/Primary-energy-data-fueltype/?chartType=area&chartView=chart&regionID=none&countryID=none

2. BIBLIOGRAPHIC REVIEW

2.1. Great Oil Shocks and the Economy

In the 70's, the two first great oil shocks took place. The first one occurred between 1973 and 1974 during the war of Yom Kippur, with the oil barrel rising from 3.5 USD per barrel to 11.5 USD (Blanchard & Galí (2008). The second shock happened between 1978 and 1980, chronologically coinciding with the outbreak of the Iranian revolution and the war between Iran and Iraq (Baumeister & Peersman, 2008). During this shock the oil barrel reached 39.5 USD. The third great shock, in the 90's, occurred between 1999 and 2001, related to the OPEC countries' reduction of "production shares", having the barrel rise from 11.2 USD to 33,9 USD (Esteves & Neves, 2004). The fourth shock, and the longest one, took place between 2002, with a price per barrel of 19.7 USD, and 2006, when the price reached 74.4 USD per barrel. Once again, this shock also occurred in a period of disturbances marked by the war in Iraq and perturbations felt in the Middle East. According to Filis et al. (2011) this shock could also had counted with the impact of a strike in Petróleos de Venezuela S.A. (PDVSA).



Graph 2- Price in USD (1970 - 2013). From: Economic Research Federal Reserve Bank of St. Louis

The fifth and last shock took place between 2007 and 2008. This shock was specifically studied by Hamilton (2009). The oil price reached its historical maximum in June 2008: nominal price of 145 USD per barrel.

This fifth shock happened due to the great expansion of China and India. However, the speed and magnitude of the oil price adjustment may not be exclusively explained by this factor, which opens doors to the possibility of interference from the investors' speculative effect.

According to Filis et al. (2011) it seems to exist a narrow relationship between the great increases of oil prices and significant events in world history. According to Kilian & Park (2009) the fluctuations of oil price are due, essentially, to three types of structural shocks: global supply shock (GSS), global demand shock for all industrial commodities (GDS) and precautionary demand shocks (PDS).

Therefore, in their study Filis et al. (2011) organized, in a table, the main events that led to relevant oil price shocks, associating the type of oil shock that caused them.

Event	Year	Kind of shock
Iraq invasion in Kuwait	1990	PDS
First war in Iraq	1991	PDS
Collapse of the Soviet Union	1991	PDS
Asian economic crisis	1997	GDS
Oil products cuts by OPEC	1998-99	GSS
Housing market boom	2001	GDS
9/11 terrorist attack	2001	PDS
PDVSA worker's strike	2002	GSS
Second war in Iraq	2003	PDS
Chinese economic growing	2006-07	GDS
Global financial crisis	2008	GDS

Table 1 - Events were tied up to specific oil price shocks

After identifying the existing shock types, it is now important to understand each one's impact in the behaviour of oil price. *Ceteris paribus*, if the oil supply contracts, price rises. On the other hand, every time demand expands price also rises. Summarizing, the occurrence of at least one of these shocks is enough to make oil price rise.

According to Kilian & Park (2009) an unexpected increase in oil demand for precautionary motives provokes an immediate, and more lasting, increase of oil price, followed by a gradual decay once the fear that caused the precaution has blurred. On the other hand, an unforeseen increase of the global demand of industrial commodities origins a sustained increase of oil price, though this happens with a certain delay. At last, an eventual rupture of oil production instigates a transitory rise in price, within the period of a year.

According to Blanchard & Galí (2008), the perception of oil price in economy increased during the two first oil shocks, through episodes of low growth, unemployment rise and great inflation.

Having chronologically analysed the recession periods of the American economy, Hamilton (2008) claims that, after the World War II, nine out of ten American recessions were preceded by peaks in oil price quotes, excluding the possibility of this being a mere statistical coincidence. Likewise, in Europe, there exists the same kind of evidence. In the year that followed the 70’s two oil shocks, the OECD countries reached maximum levels of inflation, while their Gross National Product markedly decreased (Esteves & Neves, 2004).

According to Hahn & Mestre (2011), throughout time the great oil shocks had been composed by combinations of diverse importance of each type of shock studied (GSS, GDS and PDS). Different authors identify different weights to each one of the shocks.

Furthermore, there is a perception that macroeconomic effects of oil price shocks have become minor throughout time (Blanchard & Galí (2008). According to Barsky & Kilian (2001) this perception can be justified through the decrease of real rigidity, the change in monetary policies and by the decrease of energetic dependence on oil. Baumeister & Peersman (2008) identified the existence of reasons to believe that the global oil market has, itself, suffered changes throughout time, such as, for instance, the transition from an administrative regulated price regime to a free regulation regime.

In order to study the importance of monetary policies, Peersman & Robays (2009) made the comparison between Europe and United States behaviour during the increase of oil barrel in 1999 to 2008, identifying that the European Central Bank and the Federal Reserve monetary policies were different. These different options did not contribute to the magnitude of oil shocks in Europe and USA to be significantly different. However, the velocity and transmission mechanisms were completely uneven.

Their study provided the perception that, even within Europe, there are some differences between the various countries, due, essentially, to the work market dynamics and the monetary policies transmission mechanisms.

2.2 The Economy and the Stock Market.

As we could previously see, many authors highlight the importance of oil and its price fluctuations in the economy. Therefore, it is expected that this importance can also reflect in the stock market and consequently in the variation of stock prices. During his study, Huang, et al. (1996) detected that oil has an unquestionable relevance to the economy in general, with effects on the CPI and GNP particularly. These effects reflect on companies’ profit, since, directly or indirectly, oil price is added to their operational costs. For that reason, it is expected that an increase in oil prices could provoke a decrease of profit, which will lead to an immediate decrease of stock prices, if the market is efficient.

In his paper, Huang, et al. (1996) also describes the theoretical link between oil and the stock prices. Stock price is equal to the deducted value of future cash flows of the company, i.e.

$$p = \frac{E(c)}{E(r)} \tag{1}$$

where p represents the stock price and E(c) and E(r) are, respectively, the cash flow expectation and the actualization rate.

Therefore, the stock return, r, can be expressed, approximately, as:

$$r = \frac{d(E(c))}{E(c)} - \frac{d\big(E(r)\big)}{E(r)} \tag{2}$$

From equation (2) it is possible to conclude that an alteration in oil price can affect the return of stocks in two ways. On the one hand, through the modification of cash flows, like it has been mentioned before, since this has in account the inflation and, on the other, through the expected interest rate. These two variables depend on expected oil prices.

2.3. – Relationship Between Oil and the Stock Market

Although it is referred in many papers that the alteration in oil price is one of the main factors in understanding the oscillating movements inherent to the stock market, there does not exist consensus about the way in which both relate.

In a slightly different approach from the other authors, Kilian & Park (2009) conclude, through the utilization of a VAR model, that not only are the oil shocks that influence economy, but that the economy can also influence the oil price. Besides that, they identify that the type of effect that oil shocks provoke in the stock market depends on the shock's nature.

Another important aspect is the perception of the possible difference of reaction between importing and exporting economies. Yang, et al (2012) identified the existence of clear differences between the behaviours of stock markets in importing and exporting economies when it came to the fluctuations of this commodity's price. Like Yang et al (2012), a considerable part of the scientific community defends that oil shocks effects to importing and exporting economies are very uneven, being, then, important to analyse which are those differences. However, this opinion is not consensual. For example, Filis et al. (2011) found evidence that the correlation between oil and stock prices does not differ between importing and exporting economies.

3. Development, Testing and Validation of the Model

During this chapter the model will be estimated, with the objective of understanding how the Portuguese stock market reacts to variations in oil price, verifying if its behavior is similar to the one described in the bibliographic review for other countries. The development of the model will be based in the study conducted by Kilian & Park (2009) once it has similar objectives (made for the US). In this article, a structural VAR model was used as a way to overcome two limitations found in previous works. The first of these limitations lays in the fact of oil being treated as an exogenous element to the economy, departing from the wrong premise that price variation occurs with the other variables remaining constant. The second limitation comes from the different behavior of the stock market regarding the type of shock occurred, since the largest shocks in history had been caused by the combination of demand and supply shocks, being this combination changeable from shock to shock .

The model used will relate the variables of the Portuguese stock market with the fluctuations of oil price caused by demand and supply shocks in the global oil market.

The model will be estimated with monthly data (1988-2012) related to the variation in the world oil production, to the variation of real activity of industrial commodities global markets, the variation of oil price and the return on the Portuguese stock market.

3.1 – Model Choice

It is important to understand which reasons lead to the choice of a VAR model. The choice of the adequate econometric model is influenced by diverse factors, among which it can be referred the temporal horizon that is pretended to foresee, the behavior of the series, its stationarity, as well as the number of series involved in the modeling. Therefore, the choice of the VAR model – Vector Auto Regressive – lays in the fact that most phenomenon do not occur in separate, but simultaneously, so there is a need of using a multivariate model, consistent with this reality. VAR allows the evaluation of the trajectory of the variables throughout time and the determination of the causality between them. Moreover, it allows obtaining a matrix of residual correlations which relates those variables and the strength of those relationships. According to Enders (1995), when there is no confidence in the exogenous component of the variables, the solution is to treat them symmetrically. Looking at a case with two variables in which the temporal sequence of the yt variable is influenced by the past of the temporal sequence of zt and vice-versa, the following system with two variables is obtained:

$$y_t = b_{10} - b_{12} z_t + \gamma_{11} y_{t-1} + \gamma_{12} z_{t-1} + \epsilon_{yt} \quad (3)$$

$$z_t = b_{20} - b_{21} y_t + \gamma_{21} y_{t-1} + \gamma_{22} z_{t-1} + \epsilon_{zt} \quad (4)$$

This simple model with only two variables is useful to understanding the more complex model that will be developed. However, in case the reader pretends a more profound development about this subject, Enders (1995) can be consulted.

The structure of the system automatically incorporates the feedback of one variable to the other, as can be seen in equations 3 and 4. A way of making this system easier to solve is displaying it in a matrix form.

$$\begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix} \begin{bmatrix} y_t \\ z_t \end{bmatrix} = \begin{bmatrix} b_{10} \\ b_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} \epsilon_{yt} \\ \epsilon_{zt} \end{bmatrix} \quad (5)$$

This means:

$$B x_t = \Gamma_0 + \Gamma_1 x_{t-1} + \epsilon_t \quad (6)$$

Pre- multiplying both sides by B-1 de standard form of the VAR model is obtained.

$$x_t = A_0 + A_1 x_{t-1} + e_t \quad (7)$$

3.2 – Model Estimation

The estimation of the model will be made with the help of the J-Multi software, which allows obtaining the main results (graphs and indicators). To complete the analysis, a second software will be used, the SVAR, which permits making the historical decomposition of the model.

To ease the perception not only of the model, but also of the results obtained during the Dissertation that led to this article, the model was estimated in two phases. In the first phase, a simplified estimation was done, using only the two most important variables (see equation (3) from Killian and Park, 2009). This option was taken to make the model simpler and easier to understand. Because these two are the most important variables, it is possible to comprehend the impact of each one of them on the other more directly. So, the matrix equation is:

$$e_t = \begin{pmatrix} e_{1t}^{\text{preço do petroleo}} \\ e_{2t}^{\text{retornos mercado bolsista português}} \end{pmatrix} = \begin{bmatrix} a_{11} & 0 \\ a_{21} & a_{22} \end{bmatrix} \begin{pmatrix} \varepsilon_{3t}^{\text{Choque do preço}} \\ \varepsilon_{4t}^{\text{Outro choques[3]}} \end{pmatrix} \quad (8)$$

In the second phase, the model was estimated with four variables, which matrix equation is as follows:

$$e_t = \begin{pmatrix} e_{1t}^{\text{produção global petróleo}} \\ e_{2t}^{\text{atividade global real}} \\ e_{3t}^{\text{preço do petroleo}} \\ e_{4t}^{\text{retornos mercado bolsista português}} \end{pmatrix} = \begin{bmatrix} a_{11} & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} \end{bmatrix} \begin{pmatrix} \varepsilon_{1t}^{COG} \\ \varepsilon_{2t}^{CPG} \\ \varepsilon_{3t}^{CPPP} \\ \varepsilon_{4t}^{\text{Outros choques[4]}} \end{pmatrix} \quad (9)$$

Through the matrix equation (9) it is possible to conclude that the variation in oil production is only affected by supply shocks. Regarding global activity, it is affected either by supply shocks or by demand shocks. Additionally, the global demand shock is, by definition, narrowly related with the increase of global activity. As for the oil price, as it has been said before, it is affected by all three types of shocks. Finally, $\varepsilon_{4t}^{Outros\ choques}$ was added so the alterations in returns caused by factors not directly related to oil shocks remain safeguarded.

In the following sections two models (Model A and Model B) will be analysed, and some conclusions will be drawn at the end.

3.2.1 Model A

After the introduction of data and the determination, through software, of the optimal number of lags (10 lags) it is essential to guarantee the stationarity of the series, since this is one of the conditions that led to the choice of the VAR model. In this way, and in view of the fact that graphical analysis was clear enough, we abstained from performing the DF and ADF stationarity tests.

Subsequently, it was possible to proceed with the parameter interpretation of the results obtained (matrix equation below):

$$\begin{bmatrix} dprice(t) \\ dlnpsi(t) \end{bmatrix} = \begin{bmatrix} 0.545 & 9.811 \\ 0 & 0.185 \end{bmatrix} \begin{bmatrix} dprice(t-1) \\ dlnpsi(t-1) \end{bmatrix} + \begin{bmatrix} -0.135 & 0 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} dprice(t-6) \\ dlnpsi(t-6) \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ -0.002 & 0 \end{bmatrix} \begin{bmatrix} dprice(t-7) \\ dlnpsi(t-7) \end{bmatrix}$$
$$+ \begin{bmatrix} 0 & -6.609 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} dprice(t-8) \\ dlnpsi(t-8) \end{bmatrix} + \begin{bmatrix} -0.117 & 11.438 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} dprice(t-9) \\ dlnpsi(t-9) \end{bmatrix}$$
$$+ \begin{bmatrix} 0 & 1.907 & 0 & 0 \\ 0{,}02 & 0 & -0.033 & -0{,}034 \end{bmatrix} \begin{bmatrix} Const \\ S3(t) \\ S6(t) \\ S9(t) \end{bmatrix} + \begin{bmatrix} u1(t) \\ u2(t) \end{bmatrix} \quad (10)$$

Residuals passed stationarity testing.

Equation (10) shows the existence of a small relationship between oil price and Portuguese stock market returns. The model seems to detect the existence of an impact only in the seventh period, i.e. we are driven to admit that a rise of one dollar in the oil barrel price leads to a decrease of 0.2% in the stock market returns seven months later (semi-elasticity).

The results of the estimation also point out that the oil price is essentially influenced by the previous months' oil price. In this aspect, oil price seems too evidence larger persistence (0.545) than stock market returns (0.185).

However, the interpretation of autoregressive parameter as multipliers can lead to mistakes. For that reason, Granger causality tests were performed to perceive if there really was a causality relationship between the analysed variables.

Considering the question that this paper intends to answer, the relationship between oil price and psi return will be tested, formulating the initial hypothesis:

H_0: price does not affect psi return

pval-F(l; 10, 514) = 0.2110

Assuming a significance level of 0.05, a p-value of 0.2110 means that the null hypothesis is not rejected, implying that oil price does not affect the psi return.

3.2.2 Model B

As well as in Model A, data was introduced to determine the optimum number of lags, which is, again, 10. Also, the process of guarantying the stationarity of the series was similar. Once again, we abstained from performing the DF and ADF stationarity tests, because graphical inspection left no doubts.

Admitting a significance level of 10%, the estimation results are as follows:

$$\begin{bmatrix} dprod(t) \\ ractiv(t) \\ dprice(t) \\ dlnpsi(t) \end{bmatrix} = \begin{bmatrix} -0.190 & 11.253 & 0 & 0 \\ 0 & 1.374 & 0.289 & 13.775 \\ 0 & 0.067 & \boxed{0.553} & 8.903 \\ 0 & 0 & 0 & \boxed{0.191} \end{bmatrix} \begin{bmatrix} dprod(t-1) \\ ractiv(t-1) \\ dprice(t-1) \\ dlnpsi(t-1) \end{bmatrix} + \begin{bmatrix} -0.153 & 0 & 0 & 0 \\ 0 & -0.616 & 0.366 & 0 \\ 0 & -0.127 & 0 & 0 \\ 0 & \boxed{0.002} & 0 & 0 \end{bmatrix} \begin{bmatrix} dprod(t-2) \\ ractiv(t-2) \\ dprice(t-2) \\ dlnpsi(t-2) \end{bmatrix}$$

$$+ \begin{bmatrix} -0.183 & 0 & 0 & 0 \\ 0 & 0.240 & -0.329 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} dprod(t-3) \\ ractiv(t-3) \\ dprice(t-3) \\ dlnpsi(t-3) \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & -0.344 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & -0.002 & 0 \end{bmatrix} \begin{bmatrix} dprod(t-4) \\ ractiv(t-4) \\ dprice(t-4) \\ dlnpsi(t-4) \end{bmatrix}$$

$$+ \begin{bmatrix} -0.156 & 0 & 0 & 0 \\ -0.001 & 0 & 0 & 17.560 \\ 0 & -0.142 & 0 & 0 \\ 0 & \boxed{-0.002} & 0 & 0 \end{bmatrix} \begin{bmatrix} dprod(t-5) \\ ractiv(t-5) \\ dprice(t-5) \\ dlnpsi(t-5) \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 & 0 \\ -0.002 & 0 & -0.282 & 0 \\ 0 & 0.124 & -0.184 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} dprod(t-6) \\ ractiv(t-6) \\ dprice(t-6) \\ dlnpsi(t-6) \end{bmatrix}$$

$$+ \begin{bmatrix} 0 & 0 & 0 & 1446.5 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & \boxed{-0.002} & 0 \end{bmatrix} \begin{bmatrix} dprod(t-7) \\ ractiv(t-7) \\ dprice(t-7) \\ dlnpsi(t-7) \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & -0.312 & 0.32 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} dprod(t-8) \\ ractiv(t-8) \\ dprice(t-8) \\ dlnpsi(t-8) \end{bmatrix}$$

$$+ \begin{bmatrix} 0 & -20.679 & 0 & 0 \\ 0 & 0.508 & -0.256 & 12.736 \\ 0 & 0 & -0.183 & 10.569 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} dprod(t-9) \\ ractiv(t-9) \\ dprice(t-9) \\ dlnpsi(t-9) \end{bmatrix}$$

$$+ \begin{bmatrix} 0 & 0 & 0 & 0 \\ -0.001 & -0.259 & 0 & 0 \\ 0 & 0 & 0.127 & -6.224 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} dprod(t-10) \\ ractiv(t-10) \\ dprice(t-10) \\ dlnpsi(t-10) \end{bmatrix}$$

$$+ \begin{bmatrix} 254.302 & 0 & -396.620 & -497.233 & -563.689 & -547.624 & 0 & 0 \\ 0 & 4.322 & 0 & 3.894 & 0 & 0 & 3.053 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -2.342 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} Const \\ S3(t) \\ S4(t) \\ S5(t) \\ S6(t) \\ S8(t) \\ S10(t) \\ S11(t) \end{bmatrix}$$

$$+ \begin{bmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \end{bmatrix} \qquad (11)$$

Before proceeding to the interpretation of the parameters, analysing the residuals became necessary and, once again, stationarity was verified.

Then, through matrix equation (11) it was possible to conclude, just as in Model A, that it seems to exist a faint relationship between the oil price and the Portuguese stock market returns. It is also possible to verify that the return of the Portuguese stock market seems to establish similar relationships with the two recently introduced series: the level of economic activity seems to have a positive influence two periods after (0.002), but surprisingly negative and of the same magnitude five periods after; as for the level of oil production, it is not possible to establish any type of influence.

Curiously, the same value is obtained for the semi-elasticity of the stock market returns to the oil barrel price (-0.2%), and with the same temporal lag (seven periods) as in Model A, which seems to indicate some robustness in this result.

Regarding persistence, Model A conclusions are confirmed, with values very close to those obtained in that estimation: higher persistence of oil price (0.553) than of stock market returns (0.191).

However, the interpretation of autoregressive parameters as multipliers can lead to mistakes. For that reason, Granger causality tests were performed to perceive if there really is a causality relationship between the analysed variables.

H_0: world oil production does not affect world activity, oil price and the stock market returns.

pval-F(l; 30, 948) = 0.1575

H_0: world activity does not affect world oil production, oil price and the PSI return.

pval-F(l; 30, 948) = 0.0601

H_0: oil price does not affect the world oil production, world activity and PSI return.

pval-F(l; 30, 948) = 0.0000

H_0: World oil production, world activity and oil price do not affect PSI returns.

pval-F(l; 30, 948) = 0.1872

Through this test, and admitting a significance level of 0.05, the following conclusions were obtained:

- World oil production has no interference in any of the other three variables.
- As in the case of production, world activity has no causality relationship with neither of the remaining variables.
- Oil price seems to have a causality relationship with the other variables.
- This result is in accordance with the bibliographical review; however it contradicts the remaining results of the model. Nevertheless, as it was referred, the analysis of parameters as multipliers can lead to interpretation mistakes. Another hypothesis that arouse is the possibility of existing a real relationship between oil prices, its production and world activity and that relationship may lead by drawling the returns of the stock market.
- This result could indicate that the application of the model lacks some variable, a variable that can indeed influence all four variable analysed. This variable might eventually be an important stock index as the NYSE or the Dow Jones. This subject could be an interesting future study.
- The last causality test seems to show that the production, the activity and the price of oil do not affect the Portuguese stock market returns.
- By last, a historical decomposition was also made. Through this decomposition it is possible to conclude that the most contributing factor to the fluctuation of PSI returns are the very own returns, while the remaining variables (world oil production, world activity and oil price) do not seem to have a significant weight in the variation of returns.

3. CONCLUSION

Given the importance of oil in everyday life, it is interesting to analyse its influence in the Portuguese stock market. To do so, two models were implemented, following the guidelines of Killian & Park (2009).

Despite the complexity differences between the models used, both results were very similar. In a primary phase, and after all the conditions regarding the use of VAR models are verified, it is possible to conclude, through parameters analysis, that there does not seem to be a direct influence in the returns of the Portuguese stock market from any of the other variables.

However, since the analysis of autoregressive parameters as multipliers might lead to mistakes, causality tests were performed in order to confirm the inexistence of a causal relationship between the studied variables.

The most important conclusions from the two models are very alike, partially because they are also complementary. This methodology allows a better perception of the events.

On one hand, Model A rejects the possibility of the Portuguese stock market returns being affected by the oil price. On the other hand, Model B says that the price of oil affects the oil market as a whole, but excludes the stock market. This premise is confirmed by the last causality test (oil production, oil price and real activity together do not affect stock market returns). Summarizing, the model seems to demonstrate that none of the three kinds of oil price shocks affect the return of the Portuguese stock market.

Therefore, and since there exists the possibility of an important stock market limiting, through a global demand shock, the oil price, and given that the PSI is very influenced by these markets, it is likely that the model does not have the capability of detecting this difference, transferring this influential international stock markets power to the Portuguese stock market.

Thus, it would be interesting that in the future a similar study would be conducted, in which a market index with international relevance, such as the Dow Jones or the NYSE, might be included, with the purpose of further clarifying this question. Such study would allow understanding if this problem can be caused by the dependence of Portuguese stock market on the main international stock markets.

To conclude, we would like this paper to be another impulse to the study of oil relevance in the Portuguese economy in general, and in the Portuguese stock market in particular.

4. BIBLIOGRAPHY

Amador, J. (2010). Energy Prodution And Consumption In Portugal: Stylized Facts. Banco de Portugal, Economics and Research Department in its journal Economic Bulletin, 69–83.

Barsky, R. B., & Kilian, L. (2001). Do We Really Khow That Oil Caused The Great Stagflation? A Monetary Alternative. NBER Macroeconomics Annual, 16(734), 137–183.

Baumeister, C., & Peersman, G. (2008). Time-Varying Effects of Oil Supply Shocks on the US Economy. Ghent. - Working Paper - (Ghent University 08/515)

Blanchard, O. J., & Galí, J. (2008). The Macroeconomic Effects of Oil Price Shocks: Why are the 2000s so different from the 1970s? International Dimensions of Monetary Policy, 373–421.

Enders, W. (1995). Applied Econometric Time Series (1st ed., pp. 294–305). Wiley.

Esteves, P. S., & Neves, P. D. (2004). Oil Prices and the Economy. Economic Bulletin, Banco de Portugal. Working Paper - (Banco de Portugal, Economic Bulletin December 2004)

Filis, G., Degiannakis, S., & Floros, C. (2011). Dynamic correlation between stock market and oil prices: The case of oil-importing and oil-exporting countries. International Review of Financial Analysis, 20(3), 152–164.

Hahn, E., & Mestre, R. (2011). The Role Of Oil Prices In The Euro Area Economy Since The 1970s. Working Paper - (Working Paper Series Nº1356)

Hamilton, J. D. (2008). Oil and the Macroeconomy. (Palgrave Macmillan, Ed.) (Second Edi.). The New Palgraver Dictionary of Economics.

Hamilton, J. D. (2009). Causes and Consequences of the Oil Shock of 2007–08. Brookings Papers on Economic Activity, 2009(1), 215–261.

Huang, R. D., Masulis, R. W., & Stoll, H. R. (1996). Energy Shocks and Financial Markets. Journal of Futures Market, 16(1), 1–36.

Kilian, L., & Park, C. (2009). the Impact of Oil Price Shocks on the U.S. Stock Market. International Economic Review, 50(4), 1267–1287.

Peersman, G., & Robays, I. Van. (2009). Oil and the Euro Area Economy. Ghent. Working Paper - (Ghent University 09/852)

Yang, L., Wang, Y., & Wu, C. (2012). Oil Price Shocks and Stock Market Returns: Evidence from Oil-Importing and Oil-Exporting Countries. SSRN Electronic Journal.